Vertica® Analytic Database 4.1, Revision 1

SQL Reference Manual

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Contents

Technical Support

To submit problem reports, questions, comments, and suggestions, use the Technical Support page on the Vertica Systems, Inc., Web site.

Note: You must be a registered user in order to access the support page.

1. Go to http://www.vertica.com/support (***http://www.vertica.com/support***).
2. Click **My Support**.

You can also email verticahelp@vertica.com.

Before you report a problem, run the Diagnostics Utility described in the Troubleshooting Guide and attach the resulting `.zip` file to your ticket.

About the Documentation

This section describes how to access and print Vertica documentation. It also includes ***suggested reading paths*** (page 4).

Where to Find the Vertica Documentation

You can read or download the Vertica documentation for the current release of Vertica® Analytic Database from the ***Product Documentation Page http://www.vertica.com/v-zone/product_documentation***. You must be a registered user to access this page.

The documentation is available as a compressed tarball (`.tar`) or a zip archive (`.zip`) file. When you extract the file on the database server system or locally on the client, contents are placed in a `/vertica41_doc/` directory.

Note: The documentation on the Vertica Systems, Inc., Web site is updated each time a new release is issued. If you are using an older version of the software, refer to the documentation on your database server or client systems.

See Installing Vertica Documentation in the Installation Guide.

Reading the Online Documentation

Reading the HTML documentation files

The Vertica documentation files are provided in HTML browser format for platform independence. The HTML files require only a browser that displays frames properly with JavaScript enabled. The HTML files do not require a Web (HTTP) server.

The Vertica documentation is supported on the following browsers:

- Mozilla FireFox
- Internet Explorer
- Apple Safari
- Opera
- Google Chrome (server-side installations only)

The instructions that follow assume you have installed the documentation on a client or server machine.

Mozilla Firefox

1. Open a browser window.
2. Choose one of the following methods to access the documentation:
   - Select **File** > **Open File**, navigate to `..\HTML-WEBHELP\index.htm`, and click **Open**.
   - OR drag and drop `index.htm` into a browser window.

- OR press **CTRL+O**, navigate to `index.htm`, and click **Open**.

Internet Explorer

Use one of the following methods:

1. Open a browser window.
2. Choose one of the following methods to access the documentation:
   - Select **File** > **Open** > **Browse**, navigate to `..\HTML-WEBHELP\index.htm`, click **Open**, and click **OK**.
   - OR drag and drop `index.htm` into the browser window.
   - OR press **CTRL+O**, Browse to the file, click **Open**, and click **OK**.

Note: If a message warns you that Internet Explorer has restricted the web page from running scripts or ActiveX controls, right-click anywhere within the message and select **Allow Blocked Content**.

Apple Safari

1. Open a browser window.
2. Choose one of the following methods to access the documentation:
   - Select **File** > **Open File**, navigate to `..\HTML-WEBHELP\index.htm`, and click Open.
   - OR drag and drop `index.htm` into the browser window.
   - OR press **CTRL+O**, navigate to `index.htm`, and click **Open**.

Opera

1. Open a browser window.
2. Position your cursor in the title bar and right click > **Customize** > **Appearance**, click the **Toolbar** tab and select **Main Bar**.
3. Choose one of the following methods to access the documentation:
   - Open a browser window and click Open, navigate to `..\HTML-WEBHELP\index.htm`, and click **Open**.
   - OR drag and drop `index.htm` into the browser window.
   - OR press **CTRL+O**, navigate to `index.htm`, and click **Open**.

Google Chrome

Google does not support access to client-side installations of the documentation. You'll have to point to the documentation installed on a server system.

1. Open a browser window.
2. Choose one of the following methods to access the documentation:

   In the address bar, type the location of the `index.htm` file on the server. For example: `file://<servername>//vertica41_doc//HTML/Master/index.htm`
   - OR drag and drop `index.htm` into the browser window.
   - OR press **CTRL+O**, navigate to `index.htm`, and click **Open**.

Notes

The `.tar` or `.zip` file you download contains a complete documentation set.

The documentation page of the ***Downloads Web site http://www.vertica.com/v-zone/download_vertica*** is updated as new versions of Vertica are released. When the version you download is no longer the most recent release, refer only to the documentation included in your RPM.

The Vertica documentation contains links to Web sites of other companies or organizations that Vertica does not own or control. If you find broken links, please let us know.

Report any script, image rendering, or text formatting problems to ***Technical Support*** (on page 1).

Printing Full Books

Vertica also publishes books as Adobe Acrobat™ PDF. The books are designed to be printed on standard 8½ x 11 paper using full duplex (two-sided) printing.

Note: Vertica manuals are topic driven and not meant to be read in a linear fashion. Therefore, the PDFs do not resemble the format of typical books. Each topic starts a new page, so some of the pages are very short, and there are blank pages between each topic.

Open and print the PDF documents using Acrobat Acrobat Reader. You can download the latest version of the free Reader from the ***Adobe Web site*** (***http://www.adobe.com/products/acrobat/readstep2.html***).

The following list provides links to the PDFs.

- Release Notes
- Concepts Guide
- Installation Guide
- Getting Started Guide
- Administrator's Guide
- Programmer's Guide
- SQL Reference Manual
- Troubleshooting Guide

Suggested Reading Paths

This section provides a suggested reading path for various users. Vertica recommends that you read the manuals listed under All Users first.

All Users

- Release Notes — Release-specific information, including new features and behavior changes to the product and documentation
- Concepts Guide — Basic concepts critical to understanding Vertica

- Getting Started Guide — A tutorial that takes you through the process of configuring a Vertica database and running example queries
- Troubleshooting Guide — General troubleshooting information

System Administrators

- Installation Guide — Platform configuration and software installation
- Release Notes — Release-specific information, including new features and behavior changes to the product and documentation

Database Administrators

- Installation Guide — Platform configuration and software installation
- Administrator's Guide — Database configuration, loading, security, and maintenance

Application Developers

- Programmer's Guide — Connecting to a database, queries, transactions, and so on
- SQL Reference Manual — SQL and Vertica-specific language information

Where to Find Additional Information

Visit the ***Vertica Systems, Inc. Web site*** (***http://www.vertica.com***) to keep up to date with:

- Downloads
- Frequently Asked Questions (FAQs)
- Discussion forums
- News, tips, and techniques
- Training

Typographical Conventions

The following are the typographical and syntax conventions used in the Vertica documentation.

Typographical Convention	Description
Bold	Indicates areas of emphasis, such as a special menu command.
Button	Indicates the word is a button on the window or screen.
`Code`	SQL and program code displays in a monospaced (fixed-width) font.
`Database objects`	Names of database objects, such as tables, are shown in san-serif type.
Emphasis	Indicates emphasis and the titles of other documents or system files.
`monospace`	Indicates literal interactive or programmatic input/output.
`monospace italics`	Indicates user-supplied information in interactive or programmatic input/output.
`UPPERCASE`	Indicates the name of a SQL command or keyword. SQL keywords are case insensitive; `SELECT` is the same as `Select`, which is the same as `select`.
`User input`	Text entered by the user is shown in bold san serif type.
↵	indicates the Return/Enter key; implicit on all user input that includes text
Right-angle bracket >	Indicates a flow of events, usually from a drop-down menu.
Click	Indicates that the reader clicks options, such as menu command buttons, radio buttons, and mouse selections; for example, "Click OK to proceed."
Press	Indicates that the reader perform some action on the keyboard; for example, "Press Enter."

Syntax Convention	Description
`Text without brackets/braces`	Indicates content you type as shown.
`< Text inside angle brackets >`	Placeholder for which you must supply a value. The variable is usually shown in italics. See Placeholders below.
`[ Text inside brackets ]`	Indicates optional items; for example, CREATE TABLE [*schema_name*.]*table_name* The brackets indicate that the *schema_name* is optional. Do not type the square brackets.
`{ Text inside braces }`	Indicates a set of options from which you choose one; for example: `QUOTES { ON | OFF }` indicates that exactly one of ON or OFF must

	be provided.You do not type the braces: `QUOTES ON`
Backslash `\`	Continuation character used to indicate text that is too long to fit on a single line.
Ellipses `...`	Indicate a repetition of the previous parameter. For example, `option[,...]` means that you can enter multiple, comma-separated options. Note: Showing an ellipses in code examples might also mean that part of the text has been omitted for readability, such as in multi-row result sets.
`Indentation`	Is an attempt to maximize readability; SQL is a free-form language.
`Placeholders`	Items that must be replaced with appropriate identifiers or expressions are shown in italics.
Vertical bar `|`	Is a separator for mutually exclusive items. For example: `[ASC | DESC]` Choose one or neither. You do not type the square brackets.

Preface

This guide provides a reference description of the Vertica SQL database language.

Audience

This document is intended for anyone who uses Vertica. It assumes that you are familiar with the basic concepts and terminology of the SQL language and relational database management systems.

SQL Overview

An abbreviation for Structured Query Language, SQL is a widely-used, industry standard data definition and data manipulation language for relational databases.

Note: In Vertica, use a semicolon to end a statement or to combine multiple statements on one line.

Vertica Support for ANSI SQL Standards

Vertica SQL supports a subset of ANSI SQL-99.

See ***BNF Grammar for SQL-99*** (***http://savage.net.au/SQL/sql-99.bnf.html***)

Support for Historical Queries

Unlike most databases, the ***DELETE*** (page 580) command in Vertica does not delete data; it marks records as deleted. The ***UPDATE*** (page 656) command performs an INSERT and a DELETE. This behavior is necessary for historical queries. See Historical (Snapshot) Queries in the Programmer's Guide.

Joins

Vertica supports typical data warehousing query joins. For details, see Joins in the Programmer's Guide.

Transactions

Session-scoped isolation levels determine transaction characteristics for transactions within a specific user session. You set them through the ***SET SESSION CHARACTERISTICS*** (page 641) command. Specifically, they determine what data a transaction can access when other transactions are running concurrently. See Transactions in the Concepts Guide.

System Limits

This section describes system limits on the size and number of objects in a Vertica database. In most cases, computer memory and disk drive are the limiting factors.

Item	Limit
Database size	Approximates the number of files times the file size on a platform, depending on the maximum disk configuration.
Table size	2^64 rows per node, or 2^63 bytes per column, whichever is smaller.
Row size	8MB. The row size is approximately the sum of its maximum column sizes, where, for example a varchar(80) has a maximum size of 80 bytes.
Key size	1600 x 4000
Number of tables/projections per database	Limited by physical RAM, as the catalog must fit in memory.
Number of concurrent connections per node	Default of 50, limited by physical RAM (or threads per process), typically 1024.
Number of concurrent connections per cluster	Limited by physical RAM of a single node (or threads per process), typically 1024.
Number of columns per table	1600.
Number of rows per load	2^63.
Number of partitions	256. **Note:** The maximum number of partitions varies with the number of columns in the table, as well as system RAM. Vertica recommends a maximum of 20 partitions. Ideally, create no more than 12.
Length for a fixed-length column	65000 bytes.
Length for a variable-length column	65000 bytes.
Length of basic names	128 bytes. Basic names include table names, column names, etc.
Depth of nesting subqueries	Unlimited in FROM or WHERE or HAVING clause.

SQL Language Elements

This chapter presents detailed descriptions of the language elements and conventions of Vertica SQL.

Keywords and Reserved Words

Keywords are words that have a specific meaning in the SQL language. Although SQL is not case-sensitive with respect to keywords, they are generally shown in uppercase letters throughout this documentation for readability purposes.

Some SQL keywords are also reserved words that cannot be used in an identifier unless enclosed in double quote (") characters.

Keywords

Keyword are words that are specially handled by the grammar. Every SQL statement contains one or more keywords.

Begins with	Keyword
A	ABORT, ABSOLUTE, ACCESS, ACCESRANK, ACTION, ADD, AFTER, AGGREGATE, ALL, ALSO, ALTER, ANALYSE, ANALYZE, AND, ANY, ARRAY, AS, ASC, ASSERTION, ASSIGNMENT, AT, AUTHORIZATION, AUTO, AUTO_INCREMENT
B	BACKWARD, BEFORE, BEGIN, BETWEEN, BIGINT, BINARY, BIT, BLOCK_DICT, BLOCKDICT_COMP, BOOLEAN, BOTH, BY, BYTEA, BZIP
C	CACHE, CALLED, CASCADE, CASE, CAST, CATALOGPATH, CHAIN, CHAR, CHAR_LENGTH, CHARACTER, CHARACTER_LENGTH, CHARACTERISTICS, CHARACTERS, CHECK, CHECKPOINT, CLASS, CLOSE, CLUSTER, COALESCE, COLLATE, COLUMN, COLUMN_COUNT, COMMENT, COMMIT, COMMITTED, COMMONDELTA_COMP, CONSTRAINT, CONSTRAINTS, COPY, CORRELATION, CREATE, CREATEDB, CREATEUSER, CROSS, CSV, CURRENT_DATABASE, CURRENT_DATE, CURRENT_SCHEMA, CURRENT_TIME, CURRENT_TIMESTAMP, CURRENT_USER, CURSOR, CYCLE
D	DATA, DATABASE, DATAPATH, DATE, DATEDIFF, DATETIME, DAY, DEALLOCATE, DEC, DECIMAL, DECLARE, DECODE, DEFAULT, DEFAULTS, DEFERRABLE, DEFERRED, DEFINER, DELETE, DELIMITER, DELIMITERS, DELTARANGE_COMP, DELTARANGE_COMP_SP, DELTAVAL, DESC, DETERMINES, DIRECT, DIRECTCOLS, DIRECTGROUPED, DISTINCT, DISTVALINDEX, DO, DOMAIN, DOUBLE, DROP, DURABLE
E	EACH, ELSE, ENCLOSED, ENCODING, ENCRYPTED, END, ENFORCELENGTH, EPOCH, ERROR, ESCAPE, EXCEPT, EXCEPTIONS, EXCLUDE, EXCLUDING, EXCLUSIVE, EXECUTE, EXISTS, EXPLAIN, EXTERNAL, EXTRACT
F	FALSE, FETCH, FILLER, FIRST, FLOAT, FOLLOWING, FOR, FORCE, FOREIGN, FORMAT, FORWARD, FREEZE, FROM, FULL, FUNCTION

G	GCDDELTA, GLOBAL, GRANT, GROUP, GROUPED, GZIP
H	HANDLER, HASH, HAVING, HOLD, HOUR, HOURS
I	IDENTITY, IGNORE, ILIKE, ILIKEB, IMMEDIATE, IMMUTABLE, IMPLICIT, IN, INCLUDING, INCREMENT, INDEX, INHERITS, INITIALLY, INNER, INOUT, INPUT, INSENSITIVE, INSERT, INSTEAD, INT, INTEGER, INTERSECT, INTERVAL, INTERVALYM, INTO, INVOKER, IS, ISNULL, ISOLATION
J	JOIN
K	KEY, KSAFE
L	LANCOMPILER, LANGUAGE, LARGE, LAST, LATEST, LEADING, LEFT, LESS, LEVEL, LIKE, LIKEB, LIMIT, LISTEN, LOAD, LOCAL, LOCALTIME, LOCALTIMESTAMP, LOCATION, LOCK
M	MANAGED, MATCH, MAXCONCURRENCY, MAXMEMORYSIZE, MAXVALUE, MEMORYCAP, MEMORYSIZE, MERGEOUT, MICROSECONDS, MILLISECONDS, MINUTE, MINUTES, MINVALUE, MODE, MONEY, MONTH, MOVE, MOVEOUT
N	NAME, NATIONAL, NATIVE, NATURAL, NCHAR, NEW, NEXT, NO, NOCREATEDB, NOCREATEUSER, NODE, NODES, NONE, NOT, NOTHING, NOTIFY, NOTNULL, NOWAIT, NULL, NULLCOLS, NULLS, NULLSEQUAL, NULLIF, NUMBER, NUMERIC
O	OBJECT, OCTETS, OF, OFF, OFFSET, OIDS, OLD, ON, ONLY, OPERATOR, OPTION, OR, ORDER, OTHERS, OUT, OUTER, OVER, OVERLAPS, OVERLAY, OWNER
P	PARTIAL, PASSWORD, PINNED, PLACING, PLANNEDCONCURRENCY, POOL, POSITION, PRECEDING, PRECISION, PREPARE, PRESERVE, PRIMARY, PRIOR, PRIORITY, PRIVILEGES, PROCEDURAL, PROCEDURE, PROFILE, PROJECTION
Q	QUEUETIMEOUT, QUOTE
R	RANGE, RAW, READ, REAL, RECHECK, RECORD, RECOVER, REFERENCES, REFRESH, REINDEX, REJECTED, REJECTMAX, RELATIVE, RELEASE, RENAME, REPEATABLE, REPLACE, RESET, RESOURCE, RESTART, RESTRICT, RETURN, RETURNREJECTED, REVOKE, RIGHT, RLE, ROLLBACK, ROW, ROWS, RULE, RUNTIMECAP
S	SAVEPOINT, SCHEMA, SCROLL, SECOND, SECONDS, SECURITY, SEGMENTED, SELECT, SEQUENCE, SERIALIZABLE, SESSION, SESSION_USER, SET, SETOF, SHARE, SHOW, SIMILAR, SIMPLE, SINGLEINITIATOR, SITE, SITES, SKIP, SMALLDATETIME, SMALLINT, SOME, SPLIT, STABLE, START, STATEMENT, STATISTICS, STDERR, STDIN, STDOUT, STORAGE, STREAM, STRICT, SUBSTRING, SYSDATE, SYSID
T	TABLE, TABLESPACE, TEMP, TEMPLATE, TEMPORARY, TEMPSPACECAP, TERMINATOR, THAN, THEN, TIES, TIME, TIMESERIES, TIMESTAMP, TIMESTAMPK, TIMESTAMPTZ, TIMETZ, TIMEZONE, TINYINT, TO, TOAST, TRAILING, TRANSACTION, TREAT, TRICKLE, TRIGGER, TRIM, TRUE, TRUNCATE, TRUSTED, TYPE
U	UNBOUNDED, UNCOMMITTED, UNENCRYPTED, UNION, UNIQUE, UNKNOWN, UNLISTEN, UNSEGMENTED, UNTIL, UPDATE, USAGE, USER,

	USING
V	VACUUM, VALID, VALIDATOR, VALINDEX, VALUES, VARBINARY, VARCHAR, VARYING, VERBOSE, VIEW, VOLATILE
W	WHEN, WHERE, WINDOW, WITH, WITHIN, WITHOUT, WORK, WRITE
Y	YEAR
Z	ZONE

Reserved Words

Many SQL keywords are also reserved words, all reserved word is not necessarily keyword; for example, a reserved word might be reserved for other/future use. In Vertica, reserved words can be used anywhere an identifier is used, as long as they are double-quoted.

Begins with	Reserved Word
A	ACCESRANK, ALL, ANALYSE, ANALYZE, AND, ANY, ARRAY, AS, ASC, AUTHORIZATION, AUTO_INCREMENT
B	BETWEEN, BIGINT, BINARY, BIT, BOOLEAN, BOTH, BYTEA
C	CASE, CAST, CHAR, CHAR_LENGTH, CHARACTER, CHARACTER_LENGTH, CHECK, COLLATE, COLUMN, CONSTRAINT, CORRELATION, CREATE, CROSS, CURRENT_DATABASE, CURRENT_DATE, CURRENT_SCHEMA, CURRENT_TIME, CURRENT_TIMESTAMP, CURRENT_USER
D	DATEDIFF, DATETIME, DECIMAL, DECODE, DEFAULT, DEFERRABLE, DESC, DISTINCT, DO
E	ELSE, ENCODED, END, EXCEPT, EXISTS, EXTRACT
F	FALSE, FLOAT, FOR, FOREIGN, FREEZE, FROM, FULL
G	GRANT, GROUP. GROUPED
H	HAVING
I	IDENTITY, ILIKE, ILIKEB, IN, IN_P, INITIALLY, INNER, INOUT, INT, INTEGER, INTERSECT, INTERVAL, INTERVALYM, INTO, IS, ISNULL
J	JOIN
K	KSAFE
L	LEADING, LEFT, LIKE, LIKEB, LIMIT, LOCALTIME, LOCALTIMESTAMP
M	MONEY
N	NATIONAL, NATURAL, NCHAR, NEW, NODE, NODES, NONE, NOT, NOTNULL, NULL, NULLSEQUAL, NUMBER, NUMERIC
O	OFF, OFFSET, OLD, ON, ONLY, OR, ORDER, OUT, OUTER, OVER, OVERLAPS, OVERLAY
P	PINNED, PLACING, POSITION, PRECISION, PRIMARY, PROJECTION
R	RAW, REAL, REFERENCES, RIGHT, ROW

S	SCHEMA, SEGMENTED, SELECT, SESSION_USER, SETOF, SIMILAR, SMALLDATETIME, SMALLINT, SOME, SUBSTRING, SYSDATE
T	TABLE, THEN, TIME, TIMESERIES, TIMESTAMP, TIMESTAMPTZ, TIMETZ, TIMEZONE, TINYINT, TO, TRAILING, TREAT, TRIM, TRUE_P
U	UNBOUNDED, UNION, UNIQUE, UNSEGMENTED, USER, USING
V	VALINDEX, VARBINARY, VARCHAR, VERBOSE,
W	WHEN, WHERE, WINDOW, WITH, WITHIN

Identifiers

Identifiers (names) of objects such as schema, table, projection, column names, and so on, can be up to 128 bytes in length.

Unquoted Identifiers

Unquoted SQL identifiers must begin with one of the following:

- An alphabetic character (A-Z or a-z, including letters with diacritical marks and non-Latin letters)
- Underscore (_)

Subsequent characters in an identifier can be:

- Alphabetic
- Digits(0-9)
- Dollar sign (`$`). Dollar sign is not allowed in identifiers according to the SQL standard and could cause application portability problems.

Quoted Identifiers

Identifiers enclosed in double quote (`"`) characters can contain any character. If you want to include a double quote, you need a pair of them; for example `""""`. You can use names that would otherwise be invalid, such as names that include only numeric characters (`"123"`) or contain space characters, punctuation marks, keywords, and so on; for example, `CREATE SEQUENCE "my sequence!";`

Double quotes are required for non-alphanumerics and SQL keywords such as "1time", "Next week" and "Select".

Note: Identifiers are not case-sensitive. Thus, identifiers `"ABC"`, `"ABc"`, and `"aBc"` are synonymous, as are `ABC`, `ABc`, and `aBc`.

Identifiers Are Stored As Created

SQL identifiers, such as table and column names, are no longer converted to lowercase. They are stored as created, and references to them are resolved using case-insensitive compares. It is not necessary to double quote mixed-case identifiers. For example, The following statement creates table ALLCAPS.

```
=> CREATE TABLE ALLCAPS(c1 varchar(30));
=> INSERT INTO ALLCAPS values('upper case');
```

The following statements are variations of the same query and all return identical results:

```
=> SELECT * FROM ALLCAPS;
=> SELECT * FROM allcaps;
=> SELECT * FROM "allcaps";
```

All three commands return the same result:

```
     c1
------------
 upper case
(1 row)
```

Note that the system returns an error if you try to create table AllCaps:

```
=> CREATE TABLE allcaps(c1 varchar(30));
   ROLLBACK:  table "AllCaps" already exists
```

See QUOTE_IDENT (page 288) for additional information.

Special note about Case-sensitive System Tables

The `V_CATALOG.TABLES (page 681).TABLE_SCHEMA` and `TABLE_NAME` columns are case sensitive when used with an equality (=) predicate in queries. For example, given the following schema:

```
=> CREATE SCHEMA SS;
=> CREATE TABLE SS.TT (c1 int);
=> INSERT INTO ss.tt VALUES (1);
```

If you execute a query using the = predicate, Vertica returns 0 rows:

```
=> SELECT table_schema, table_name FROM v_catalog.tables WHERE table_schema
='ss';
 table_schema | table_name
--------------+------------
(0 rows)
```

Use the case-insensitive ILIKE predicate to return the expected results:

```
=> SELECT table_schema, table_name FROM v_catalog.tables WHERE table_schema
ILIKE 'ss';
 table_schema | table_name
--------------+------------
 SS           | TT
(1 row)
```

Literals

Literals are numbers or strings used in SQL as constants. Literals are included in the select-list, along with expressions and built-in functions and can also be constants.

Vertica provides support for number-type literals (integers, numerics, and floating points) string literals, and date/time literals. The various string literal formats are discussed in this section.

Number-type Literals

There are three types of numbers in Vertica: Integers, numerics, and floats.

- ***Integers*** (page 97) are whole numbers less than 2^63 and must be digits.
- ***Numerics*** (page 97) are very large integers or include a decimal point with a precision and a scale.

  Note: Whole numbers that are larger than 2^63 are treated as numerics. Numbers with a decimal point but no exponent are treated as numerics with default precision and scale.
- ***Floating point*** (page 94) literals are like numerics with the addition of an exponent.

Numeric-type values can also be generated using casts from character strings. This is a more general syntax. See the Examples section below, as well as ***Data Type Coercion Operators (CAST)*** (page 37).

Syntax

```
digits
digits.[digits] | [digits].digits
digits e[+-]digits | [digits].digits e[+-]digits | digits.[digits] e[+-]digits
```

Parameters

digits represents one or more numeric characters (0 through 9).

Notes

- At least one digit must follow the exponent marker (`e`), if `e` is present.
- There cannot be any spaces or other characters embedded in the constant.
- Leading plus (+) or minus (-) signs are not considered part of the constant; they are unary operators applied to the constant.
- A numeric constant that contains neither a decimal point nor an exponent is initially presumed to be type `INTEGER` if its value fits; otherwise it is presumed to be `NUMERIC`.
- In most cases a numeric-type constant is automatically coerced to the most appropriate type depending on context. When necessary, you can force a numeric value to be interpreted as a specific data type by casting it as described in ***Data Type Coercion Operators (CAST)*** (page 37).
- Vertica follows the IEEE specification for floating point, including NaN (not a number) and Infinity (Inf).
- A NaN is not greater than and at the same time not less than anything, even itself. In other words, comparisons always return false whenever a NaN is involved. See ***Numeric Expressions*** (page 49) for examples.

Examples

The following are examples of number-type literals:

```
42
3.5
4.
.001
5e2
1.925e-3
```

Scientific notation:

```
=> SELECT NUMERIC '1e10';
  ?column?
-------------
 10000000000
(1 row)
```

`BINARY` scaling:

```
=> SELECT NUMERIC '1p10';
 ?column?
----------
     1024
(1 row)
```

```
=> SELECT FLOAT 'Infinity';
?column?
----------
 Infinity
(1 row)
```

See Also

Data Type Coercion (page 101)

String Literals

String literals are surrounded by single or double quotes.

Double-quoted strings are subject to the backslash

Single-quoted strings do not require a backslash, except for \' and \\

You can embed single quotes and backslashes into single-quoted strings.

To include other backslash (escape) sequences, such as \t (tab), you must use the double-quoted form.

Single quoted strings require a preceding space between them and the word before because single quotes are allowed in identifiers.

Standard Conforming Strings and Escape Characters

When interpreting commands, such as those entered in vsql or in queries passed via JDBC or ODBC, Vertica uses standard conforming strings as specified in the SQL standard. In standard conforming strings, backslashes are treated as string literals (ordinary characters), not escape characters.

Note: Text read in from files or streams (such as the data inserted using the ***COPY*** (page 497) statement) are not treated as literal strings. The COPY command defines its own escape characters for the data it reads. See the ***COPY*** (page 497) statement documentation for details.

In Vertica databases prior to 4.0, standard conforming strings was not on by default, and backslashes were considered escape sequences. After 4.0, escape sequences, including Windows path names, do not work as before. For example, the TAB character `'\t'` is two characters: `'\'` and `'t'`.

`E'...'` is the ***Extended character string literal*** (page 24) format, so to treat backslashes as escape characters, use `E'\t'`.

You have the following options, but Vertica recommends that you migrate your application to use standard conforming strings at your earliest convenience, when the warnings have been addressed.

- To revert to this older behavior, set the StandardConformingStrings parameter to '0', as described in Configuration Parameters in the Administrator's Guide.
- To enable standard conforming strings permanently, set the StandardConformingStrings parameter to '1', as described in the procedure below.

- To enable standard conforming strings per session, use ***SET STANDARD_CONFORMING_STRING TO ON*** (page 646), which treats backslashes as escape characters for the current session.

The two sections that follow help you identify issues between Vertica 3.5 and 4.0.

Identifying Strings that are not Standard Conforming

The following procedure can be used to identify non-standard conforming strings in your application so that you can convert them into standard conforming strings:

1 Be sure the StandardConformingStrings parameter is off, as described in Internationalization Parameters in the Administrator's Guide.

```
=> SELECT SET_CONFIG_PARAMETER ('StandardConformingStrings' ,'0');
```

Note: Vertica recommends that you migrate your application to use Standard Conforming Strings at your earliest convenience.

2 Turn on the EscapeStringWarning parameter. (ON is the default in <DBMS_SHORT 4.0.)

```
=> SELECT SET_CONFIG_PARAMETER ('EscapeStringWarning','1');
```

Vertica now returns a warning each time it encounters an escape string within a string literal. For example, Vertica interprets the `\n` in the following example as a new line:

```
=> SELECT 'a\nb';
   WARNING:  nonstandard use of escape in a string literal at character
   8
   HINT:  Use the escape string syntax for escapes, e.g., E'\r\n'.
 ?column?
----------
 a
b
(1 row)
```

When StandardConformingStrings is ON, the string is interpreted as four characters: `a \ n b`.

Modify each string that Vertica flags by extending it as in the following example:

```
E'a\nb'
```

Or if the string has quoted single quotes, double them; for example, `'one'' double'`.

3 Turn on the StandardConformingStrings parameter for all sessions:

```
SELECT SET_CONFIG_PARAMETER ('StandardConformingStrings' ,'1');
```

Doubled Single Quotes

This section discusses vsql inputs that are not passed on to the server.

Vertica recognizes two consecutive single quotes within a string literal as one single quote character. For example, the following inputs, `'You''re here!'` ignored the second consecutive quote and returns the following:

```
vmartdb=> SELECT 'You''re here!';
   ?column?
--------------
 You're here!
```

```
(1 row)
```

This is the SQL standard representation and is preferred over the form, `'You\'re here!'`, because backslashes are not parsed as before. You need to escape the backslash:

```
=> SELECT (E'You\'re here!');
   ?column?
--------------
 You're here!
(1 row)
```

This behavior change introduces a potential incompatibility in the use of the vsql \set command, which automatically concatenates its arguments. For example, the following works in both Vertica 3.5 and 4.0:

```
\set file  '\''  `pwd`  '/file.txt'  '\''
\echo :file
```

vsql takes the four arguments and outputs the following:

```
'/home/vertica/file.txt'
```

In Vertica 3.5 the above `\set file` command could be written all with the arguments run together, but in 4.0 the adjacent single quotes are now parsed differently:

```
\set file  '\''`pwd`'/file.txt''\''
\echo :file
'/home/vertica/file.txt''
```

Note the extra single quote at the end. This is due to the pair of adjacent single quotes together with the backslash-quoted single quote.

The extra quote can be resolved either as in the first example above, or by combining the literals as follows:

```
\set file '\''`pwd`'/file.txt'''
\echo :file
'/home/vertica/file.txt'
```

In either case the backslash-quoted single quotes should be changed to doubled single quotes as follows:

```
\set file '''' `pwd` '/file.txt'''
```

See Also

STANDARD_CONFORMING_STRINGS (page 646)

ESCAPE_STRING_WARNING (page 635)

Internationalization Parameters and Implement Locales for International Data Sets in the Administrator's Guide

String Literals (Standard)

Syntax

'*characters*'

Parameters

characters is an arbitrary sequence of UTF-8 characters bounded by single quotes (').

Using Single Quotes in a String

The SQL standard way of writing a single-quote character within a string literal is to write two adjacent single quotes. for example:

`SELECT 'Chester''s gorilla'` returns `Chester's gorilla`.

Standard Conforming Strings and Escape Characters

Vertica uses standard conforming strings as specified in the SQL standard, which means that backslashes are treated as string literals, not escape characters.

Note: Earlier versions of Vertica did not use standard conforming strings, and backslashes were always considered escape sequences. To revert to this older behavior, set the `StandardConformingStrings` parameter to '0', as described in Configuration Parameters in the Administrator's Guide.

Notes

Vertica supports the UTF-8 character set.

Examples

```
=> SELECT 'This is a string';
     ?column?
------------------
 This is a string
(1 row)

=> SELECT 'This \is a string';
   WARNING:  nonstandard use of escape in a string literal at character 8
   HINT:  Use the escape string syntax for escapes, e.g., E'\r\n'.
     ?column?
------------------
 This is a string
(1 row)

vmartdb=> SELECT E'This \is a string';
     ?column?
------------------
 This is a string
=> SELECT E'This is a \n new line';
       ?column?
----------------------
 This is a
 new line
(1 row)

=> SELECT 'String''s characters';
      ?column?
--------------------
```

```
 String's characters
(1 row)
```

String Literals (Character)

Character string literals are a sequence of characters from a predefined character set and are enclosed by single quotes. If the single quote is part of the sequence, it must be doubled as `"''"`.

Standard Conforming Strings

Vertica now supports standard conforming strings as specified in the SQL standard, which means that backslashes are treated as ordinary characters, not escape characters. In that case, escape sequences, including Windows file names, do not work as before. To treat backslashes as escape characters, use the new Extended string syntax (`E'...'`).

To enable standard conforming strings permanently, set the `StandardConformingStrings` parameter to '1', as described in the procedure below.

To enable standard conforming strings per session, use `SET STANDARD_CONFORMING_STRING TO ON` (page 646), which treats back slashes as escape characters for the current session.

Identifying Strings that are not Standard Conforming

The following procedure can be used to identify non-standard conforming strings in your application so that you can convert them into standard conforming strings:

1. Be sure the StandardConformingStrings parameter is off, as described in Internationalization Parameters in the Administrator's Guide.

   ```
   => SELECT SET_CONFIG_PARAMETER ('StandardConformingStrings' ,'0');
   ```

   Note: Vertica recommends migrating your application to use Standard Conforming Strings at your earliest convenience.
2. Turn on the EscapeStringWarning parameter (ON is the default in <DBMS_SHORT 4.0):

   ```
   => SELECT SET_CONFIG_PARAMETER ('EscapeStringWarning','1');
   ```

   Vertica now returns a warning each time it encounters an escape string within a string literal. For example, Vertica interprets the `\n` in the following example as a new line:

   ```
   'a\nb'
   ```

   When `StandardConformingStrings` is ON, the string is interpreted as four characters.
3. Modify each string that Vertica flags.

   To modify the string, extended it as in the following example:

   ```
   E'a\nb'
   ```

   Or if the string has quoted single quotes, double them; for example, `'one'' double'`.
4. Turn on the `StandardConformingStrings` parameter:

   ```
   => SELECT SET_CONFIG_PARAMETER ('StandardConformingStrings' ,'1');
   ```

Doubled Single Quotes in vsql

Vertica recognizes two consecutive single quotes within a string literal as one single quote character. For example, `'You''re here!'`. This is the SQL standard representation and is preferred over the form, `E'You\'re here!'`, as backslashes are not parsed as before.

This behavior change introduces a potential incompatibility in the use of the vsql `\set` command, which automatically concatenates its arguments. vsql commands (backslash commands) do not use the standard conforming strings syntax, but accept two consecutive single quotes as one single quote character. `''` is preferred over `\'` because `''` works in all cases. For example, the following works in both Vertica 3.5 and 4.0:

```
\set file  '\''  `pwd`  '/file.txt'  '\''
\echo :file
```

vsql takes the four arguments and outputs the following:

```
'/home/vertica/file.txt'
```

In Vertica 3.5 the above `\set file` command could be written all with the arguments run together, but in 4.0 the adjacent single quotes are now parsed differently:

```
\set file  '\''`pwd`'/file.txt''\''
\echo :file
'/home/vertica/file.txt''
```

Note the extra single quote at the end. This is due to the pair of adjacent single quotes together with the backslash-quoted single quote.

The extra quote can be resolved either as in the first example above, or by combining the literals as follows:

```
\set file '\''`pwd`'/file.txt'''
\echo :file
'/home/vertica/file.txt'
```

In either case the backslash-quoted single quotes should be changed to doubled single quotes as follows:

```
\set file '''' `pwd` '/file.txt'''
```

See Also

STANDARD_CONFORMING_STRINGS (page 646) and ***ESCAPE_STRING_WARNING*** (page 635) in the SQL Reference Manual

Internationalization Parameters and Implement Locales for International Data Sets in the Administrator's Guide

Extended String Literals

Syntax

`E'`*characters*`'`

Parameters

characters is an arbitrary sequence of characters bounded by single quotes (').

You can use C-style backslash sequence in extended string literals, which are an extension to the SQL standard. You specify an escape string literal by writing the letter E as a prefix (before the opening single quote); for example:

```
E'extended character string\n'
```

When an extended string literal continues across lines, write `E` only before the first opening quote.

Within an escape string, the backslash character (`\`) starts a C-style backslash escape sequence, in which the combination of backslash and following character or numbers represent a special byte value, as shown in the following list. Any other character following a backslash is taken literally; for example, to include a backslash character, write two backslashes (`\\`).

- `\\` is a backslash
- `\b` is a backspace
- `\f` is a form feed
- `\n` is a newline
- `\r` is a carriage return
- `\t` is a tab
- `\x##` is a tab where `##` is a 1 or 2-digit hexadecimal number
- `\###`, where `###` is a 1, 2, or 3-digit octal number representing a byte with the corresponding code.

Note: It is your responsibility to ensure that the byte sequences you create contain valid characters.

Unicode String Literals

Syntax

```
U&'characters' [ UESCAPE '<Unicode escape character>' ]
```

Parameters

characters is an arbitrary sequence of UTF-8 characters bounded by single quotes (').

Unicode escape character is a single character from the source language character set other than a hexit, plus sign (+), quote ('), double quote (''), or white space.

When StandardConformingStrings is enabled, Vertica supports SQL standard Unicode character string literals (the character set is UTF-8 only).

Before entering a Unicode character string literal, enable standard conforming strings in one of the following ways.

- To enable for all sessions, update the StandardConformingStrings configuration parameter. See Configuration Parameters in the Administrator's Guide.

- To treats back slashes as escape characters for the current session, use the ***SET STANDARD_CONFORMING_STRINGS*** (page 646) statement.

To enter a Unicode character in hexadecimal, use the following syntax:

```
SET STANDARD_CONFORMING_STRINGS TO ON;
```

To enter, for example, the Russian phrase for "thank you":

```
SELECT U&'\0441\043F\0430\0441\0438\0431\043E' as 'thank you';
 thank you
-----------
 спасибо
(1 row)
```

To enter in hexadecimal, for example, the German word 'mude' (where u is really u-umlaut):

```
SELECT U&'m\00fcde';
?column?
----------
müde
(1 row)

SELECT 'ü';
?column?
----------
ü
(1 row)
```

See Also

STANDARD_CONFORMING_STRINGS (page 646) and ***ESCAPE_STRING_WARNING*** (page 635) in the SQL Reference Manual

Internationalization Parameters and Implement Locales for International Data Sets in the Administrator's Guide

String Literals (Dollar-Quoted)

Dollar-quoted string literals are rarely used but are here for your convenience.

The standard syntax for specifying string literals can be difficult to understand. To allow more readable queries in such situations, Vertica SQL provides "dollar quoting." Dollar quoting is not part of the SQL standard, but it is often a more convenient way to write complicated string literals than the standard-compliant single quote syntax. It is particularly useful when representing string literals inside other literals.

Syntax

```
$$characters$$
```

Parameters

characters is an arbitrary sequence of UTF-8 characters bounded by paired dollar signs ($$).

Dollar-quoted string content is treated as a literal. Single quote, backslash, and dollar sign characters have no special meaning within a dollar-quoted string.

Notes

A dollar-quoted string that follows a keyword or identifier must be separated from it by whitespace; otherwise the dollar quoting delimiter would be taken as part of the preceding identifier.

Examples

```
SELECT $$Fred's\n car$$;
     ?column?
------------------
 Fred's\n car
(1 row)
SELECT 'SELECT 'fact';';
```

Date/Time Literals

Date or time literal input must be enclosed in single quotes. Input is accepted in almost any reasonable format, including ISO 8601, SQL-compatible, traditional POSTGRES, and others.

Vertica is more flexible in handling date/time input than the SQL standard requires.The exact parsing rules of date/time input and for the recognized text fields including months, days of the week, and time zones are described in ***Date/Time Expressions*** (page 47).

Time Zone Values

Vertica attempts to be compatible with the SQL standard definitions for time zones. However, the SQL standard has an odd mix of date and time types and capabilities. Obvious problems are:

- Although the `DATE` (page 69) type does not have an associated time zone, the `TIME` (page 85) type can. Time zones in the real world have little meaning unless associated with a date as well as a time, since the offset can vary through the year with daylight-saving time boundaries.
- Vertica assumes your local time zone for any data type containing only date or time.
- The default time zone is specified as a constant numeric offset from UTC. It is therefore not possible to adapt to daylight-saving time when doing date/time arithmetic across DST boundaries.

To address these difficulties, Vertica recommends using Date/Time types that contain both date and time when you use time zones. Vertica recommends that you do *not* use the type `TIME WITH TIME ZONE`, even though it is supported it for legacy applications and for compliance with the SQL standard.

Time zones and time-zone conventions are influenced by political decisions, not just earth geometry. Time zones around the world became somewhat standardized during the 1900's, but continue to be prone to arbitrary changes, particularly with respect to daylight-savings rules.

Vertica currently supports daylight-savings rules over the time period 1902 through 2038, corresponding to the full range of conventional UNIX system time. Times outside that range are taken to be in "standard time" for the selected time zone, no matter what part of the year in which they occur.

Example	Description
`PST`	Pacific Standard Time
`-8:00`	ISO-8601 offset for PST
`-800`	ISO-8601 offset for PST
`-8`	ISO-8601 offset for PST
`zulu`	Military abbreviation for UTC
`z`	Short form of `zulu`

Day of the Week Names

The following tokens are recognized as names of days of the week:

Day	Abbreviations
SUNDAY	SUN
MONDAY	MON
TUESDAY	TUE, TUES
WEDNESDAY	WED, WEDS
THURSDAY	THU, THUR, THURS
FRIDAY	FRI
SATURDAY	SAT

Month Names

The following tokens are recognized as names of months:

Month	Abbreviations
JANUARY	JAN
FEBRUARY	FEB
MARCH	MAR
APRIL	APR
MAY	MAY
JUNE	JUN
JULY	JUL
AUGUST	AUG

SEPTEMBER	SEP, SEPT
OCTOBER	OCT
NOVEMBER	NOV
DECEMBER	DEC

Interval Values

An interval value represents the duration between two points in time.

Syntax

```
[ @ ] quantity unit [ quantity unit... ] [ AGO ]
```

Parameters

@	(at sign) is optional and ignored
quantity	Is an integer ***numeric constant*** (page 17)
unit	Is one of the following units or abbreviations or plurals of the following units: MILLISECOND DAY DECADE SECOND WEEK CENTURY MINUTE MONTH MILLENNIUM HOUR YEAR
AGO	[Optional] specifies a negative interval value (an interval going back in time). 'AGO' is a synonym for '-'.

The amounts of different units are implicitly added up with appropriate sign accounting.

Notes

- Quantities of days, hours, minutes, and seconds can be specified without explicit unit markings. For example:

  `'1 12:59:10'` is read the same as `'1 day 12 hours 59 min 10 sec'`
- The boundaries of an interval constant are:
  - '9223372036854775807 usec' to '9223372036854775807 usec ago'
  - 296533 years 3 mons 21 days 04:00:54.775807 to -296533 years -3 mons -21 days -04:00:54.775807
- The range of an interval constant is +/- 2^{63} - 1 (plus or minus two to the sixty-third minus one) microseconds.
- In Vertica, the interval fields are additive and accept large floating point numbers.

Examples

```
SELECT INTERVAL '1 12:59:10';
  ?column?
------------
 1 12:59:10
```

```
(1 row)
SELECT INTERVAL '9223372036854775807 usec';
         ?column?
--------------------------
 106751991 04:00:54.775807
(1 row)
SELECT INTERVAL '-9223372036854775807 usec';
          ?column?
---------------------------
 -106751991 04:00:54.775807
(1 row)
SELECT INTERVAL '-1 day 48.5 hours';
 ?column?
----------
 -3 00:30
(1 row)
SELECT TIMESTAMP 'Apr 1, 07' - TIMESTAMP 'Mar 1, 07';
 ?column?
----------
 31
(1 row)
SELECT TIMESTAMP 'Mar 1, 07' - TIMESTAMP 'Feb 1, 07';
 ?column?
----------
 28
(1 row)
SELECT TIMESTAMP 'Feb 1, 07' + INTERVAL '29 days';
      ?column?
---------------------
  03/02/2007 00:00:00
(1 row)
SELECT TIMESTAMP WITHOUT TIME ZONE '1999-10-01' + INTERVAL '1 month - 1
second'
AS "Oct 31";
      Oct 31
---------------------
 10/30/1999 23:59:59
(1 row)
```

interval-literal

The following table lists the units allowed for an `interval-literal` parameter.

Unit	Description
`a`	Julian year, 365.25 days exactly
`ago`	Indicates negative time offset
`c, cent, century`	Century
`centuries`	Centuries
`d, day`	Day

days	Days
dec, decade	Decade
decades, decs	Decades
h, hour, hr	Hour
hours, hrs	Hours
ka	Julian kilo-year, 365250 days exactly
m	Minute or month for year/month, depending on context. See Notes below table.
microsecond	Microsecond
microseconds	Microseconds
mil, millennium	Millennium
millennia, mils	Millennia
millisecond	Millisecond
milliseconds	Milliseconds
min, minute, mm	Minute
mins, minutes	Minutes
mon, month	Month
mons, months	Months
ms, msec, millisecond	Millisecond
mseconds, msecs	Milliseconds
p	Start of ISO Duration (Period) fields
qtr, quarter	Quarter
s, sec, second	Second
seconds, secs	Seconds
t	Start of ISO Duration (Period) fields
time zone	Time zone, if quoted time offset
timezone	Timezone time offset
timezone_h	Timezone hour
timezone_m	Timezone minutes
us, usec	Microsecond
microseconds, useconds, usecs	Microseconds
w, week	Week
weeks	Weeks

y, year, yr	Year
years, yrs	Years

Notes

The input unit 'm' can represent either 'months' or 'minutes,' depending on context. To illustrate, the following command creates a one-column table with some interval vales:

```
=> CREATE TABLE int_test(i INTERVAL YEAR TO MONTH);
```

In the first INSERT statement, the values are inserted as 1 year, six months:

```
=> INSERT INTO int_test VALUES('1 year 6 months');
```

In the second INSERT statement, the minutes value is ignored, as the DAY TO SECOND part is truncated:

```
=> INSERT INTO int_test VALUES('1 year 6 minutes');
```

In the third INSERT statement, the 'm' counts as minutes value is ignored, as the DAY TO SECOND part is truncated:

=> INSERT INTO int_test VALUES('1 year 6 m'); -- the m counts as months Query the table and you will notice that the second row does not contain the minutes input:

```
=> SELECT * FROM int_test;
  i
-----
 1-6
 1-0
 1-6
(3 rows)
```

In the following command, the the 'm' counts as minutes, because the DAY TO SECOND interval-qualifier extracts day/time values from the input:

```
=> SELECT INTERVAL '1y6m' DAY TO SECOND;
 ?column?
-----------
 365 00:06
(1 row)
```

interval-qualifier

The following table lists the optional interval qualifiers. Values in INTERVAL fields, other than SECOND, are integers with a default precision of 2 when they are not the first field.

Interval Type	Units	Valid interval-literal entries
Day/time intervals	DAY	Unconstrained.
	DAY TO HOUR	An interval that represents a span of days and hours.

	DAY TO MINUTE	An interval that represents a span of days and minutes.
	DAY TO SECOND	(Default) interval that represents a span of days, hours, minutes, seconds, and fractions of a second if subtype unspecified.
	HOUR	Hours within days.
	HOUR TO MINUTE	An interval that represents a span of hours and minutes.
	HOUR TO SECOND	An interval that represents a span of hours and seconds.
	MINUTE	Minutes within hours.
	MINUTE TO SECOND	An interval that represents a span of minutes and seconds.
	SECOND	Seconds within minutes. **Note:** The SECOND field can have an interval fractional seconds precision, which indicates the number of decimal digits maintained following the decimal point in the SECONDS value. When SECOND is not the first field, it has a precision of 2 places before the decimal point.
Year/month intervals	MONTH	Months within year.
	YEAR	Unconstrained.
	YEAR TO MONTH	An interval that represents a span of years and months.

Notes

You cannot combine day/time and year/month qualifiers. For example, the following intervals are not allowed:

- DAY TO YEAR
- HOUR TO MONTH

Operators

Operators are logical, mathematical, and equality symbols used in SQL to evaluate, compare, or calculate values.

Binary Operators

Each of the functions in the following table works with binary and varbinary data types.

Operator	Function	Description
'='	binary_eq	Equal to
'<>'	binary_ne	Not equal to
'<'	binary_lt	Less than
'<='	binary_le	Less than or equal to
'>'	binary_gt	Greater than
'>='	binary_ge	Greater than or equal to
'&'	binary_and	And
'~'	binary_not	Not
'|'	binary_or	Or
'#'	binary_xor	Either or
'||'	binary_cat	Concatenate

Notes

If the arguments vary in length binary operators treat the values as though they are all equal in length by right-extending the smaller values with the zero byte to the full width of the column (except when using the `binary_cat` function). For example, given the values `'ff'` and `'f'`, the value `'f'` is treated as `'f0'`.

Operators are strict with respect to nulls. The result is null if any argument is null. For example, `null <> 'a'::binary` returns null.

To apply the OR (`'|'`) operator to a varbinary type, explicitly cast the arguments; for example:

```
=> SELECT '1'::VARBINARY | '2'::VARBINARY;
 ?column?
----------
 3
(1 row)
```

Similarly, to apply the ***LENGTH*** (page 279), ***REPEAT*** (page 289), ***TO_HEX*** (page 216), and ***SUBSTRING*** (page 298) functions to a binary type, explicitly cast the argument; for example:

```
=> SELECT LENGTH('\\001\\002\\003\\004'::varbinary(4));
 LENGTH
--------
      4
(1 row)
```

When applying an operator or function to a column, the operator's or function's argument type is derived from the column type.

Examples

In the following example, the zero byte is not removed from column cat1 when values are concatenated:

```
=> SELECT 'ab'::BINARY(3) || 'cd'::BINARY(2) AS cat1, 'ab'::VARBINARY(3) ||
   'cd'::VARBINARY(2) AS cat2;
   cat1    | cat2
-----------+------
 ab\000cd | abcd
(1 row)
```

When the binary value `'ab'::binary(3)` is translated to varbinary, the result is equivalent to `'ab\\000'::varbinary(3)`; for example:

```
=> SELECT 'ab'::binary(3);
 binary
--------
 ab\000
(1 row)
```

The following example performs a bitwise AND operation on the two input values (see also ***BIT_AND*** (page 172)):

```
=> SELECT '10001' & '011' as AND;
 AND
-----
   1
(1 row)
```

The following example performs a bitwise OR operation on the two input values (see also ***BIT_OR*** (page 173)):

```
=> SELECT '10001' | '011' as OR;
  OR
-------
 10011
(1 row)
```

The following example concatenates the two input values:

```
=> SELECT '10001' || '011' as CAT;
   CAT
----------
 10001011
(1 row)
```

Boolean Operators

Syntax

```
[ AND | OR | NOT ]
```

Parameters

SQL uses a three-valued Boolean logic where the null value represents "unknown."

a	b	a AND b	a OR b
TRUE	TRUE	TRUE	TRUE
TRUE	FALSE	FALSE	TRUE
TRUE	NULL	NULL	TRUE
FALSE	FALSE	FALSE	FALSE
FALSE	NULL	FALSE	NULL
NULL	NULL	NULL	NULL

a	NOT a
TRUE	FALSE
FALSE	TRUE
NULL	NULL

Notes

- The operators `AND` and `OR` are commutative, that is, you can switch the left and right operand without affecting the result. However, the order of evaluation of subexpressions is not defined. When it is essential to force evaluation order, use a ***CASE*** (page 44) construct.
- Do not confuse Boolean operators with the ***Boolean-predicate*** (page 51) or the ***Boolean*** (page 65) data type, which can have only two values: true and false.

Comparison Operators

Comparison operators are available for all data types where comparison makes sense. All comparison operators are binary operators that return values of True, False, or NULL.

Syntax and Parameters

<	less than
>	greater than
<=	less than or equal to
>=	greater than or equal to

= or <=>	equal
<> or !=	not equal

Notes

- The != operator is converted to <> in the parser stage. It is not possible to implement != and <> operators that do different things.
- The comparison operators return NULL (signifying "unknown") when either operand is null.
- The <=> operator performs an equality comparison like the = operator, but it returns true, instead of NULL, if both operands are NULL, and false, instead of NULL, if one operand is NULL.

Data Type Coercion Operators (CAST)

Data type coercion (casting) passes an expression value to an input conversion routine for a specified data type, resulting in a constant of the indicated type.

Syntax

```
CAST ( expression AS data-type )
   expression::data-type
   data-type 'string'
```

Parameters

expression	Is an expression of any type
data-type	Converts the value of *expression* to one of the following data types: ***BINARY*** (page 61) ***BOOLEAN*** (page 65) ***CHARACTER*** (page 66) ***DATE/TIME*** (page 68) ***NUMERIC*** (page 92)

Notes

- In Vertica, data type coercion (casting) can be invoked only by an explicit cast request. It must use, for example, one of the following constructs:

  ```
  CAST(x AS data-type-name)
  ```

  or

  ```
  x::data-type-name
  ```

- Type coercion format of *data-type* '*string*' can be used only to specify the data type of a quoted string constant.
- The explicit type cast can be omitted if there is no ambiguity as to the type the constant must be. For example, when a constant is assigned directly to a column, it is automatically coerced to the column's data type.
- If a binary value is cast (implicitly or explicitly) to a binary type with a smaller length, the value is silently truncated. For example:

```
=> SELECT 'abcd'::BINARY(2);
 binary
--------
 ab
(1 row)
```

- No casts other than BINARY to and from VARBINARY and resize operations are currently supported.
- On binary data that contains a value with fewer bytes than the target column, values are right-extended with the zero byte `'\0'` to the full width of the column. Trailing zeros on variable length binary values are not right-extended:

```
=> SELECT 'ab'::BINARY(4), 'ab'::VARBINARY(4); binary   | varbinary
------------+-----------
 ab\000\000 | ab
(1 row)
```

Examples

```
=> SELECT CAST((2 + 2) AS VARCHAR);
 varchar
---------
 4
(1 row)
=> SELECT (2 + 2)::VARCHAR;
 varchar
---------
 4
(1 row)
=> SELECT '2.2' + 2;
   ERROR:  invalid input syntax for integer: "2.2"
=> SELECT FLOAT '2.2' + 2;
 ?column?
----------
      4.2
(1 row)
```

See Also

Data Type Coercion (page 101)

Date/Time Operators

Syntax

```
[ + | - | * | / ]
```

Parameters

```
+  Addition
-  Subtraction
*  Multiplication
/  Division
```

Notes

- The operators described below that take `TIME` or `TIMESTAMP` inputs actually come in two variants: one that takes `TIME WITH TIME ZONE` or `TIMESTAMP WITH TIME ZONE`, and one that takes `TIME WITHOUT TIME ZONE` or `TIMESTAMP WITHOUT TIME ZONE`. For brevity, these variants are not shown separately.
- The `+` and `*` operators come in commutative pairs (for example both `DATE + INTEGER` and `INTEGER + DATE`); only one of each such pair is shown.

Example	Result Type	Result
`DATE '2001-09-28' + INTEGER '7'`	`DATE`	`'2001-10-05'`
`DATE '2001-09-28' + INTERVAL '1 HOUR'`	`TIMESTAMP`	`'2001-09-28 01:00:00'`
`DATE '2001-09-28' + TIME '03:00'`	`TIMESTAMP`	`'2001-09-28 03:00:00'`
`INTERVAL '1 DAY' + INTERVAL '1 HOUR'`	`INTERVAL`	`'1 DAY 01:00:00'`
`TIMESTAMP '2001-09-28 01:00' + INTERVAL '23 HOURS'`	`TIMESTAMP`	`'2001-09-29 00:00:00'`
`TIME '01:00' + INTERVAL '3 HOURS'`	`TIME`	`'04:00:00'`
`- INTERVAL '23 HOURS'`	`INTERVAL`	`'-23:00:00'`
`DATE '2001-10-01' - DATE '2001-09-28'`	`INTEGER`	`'3'`
`DATE '2001-10-01' - INTEGER '7'`	`DATE`	`'2001-09-24'`
`DATE '2001-09-28' - INTERVAL '1 HOUR'`	`TIMESTAMP`	`'2001-09-27 23:00:00'`
`TIME '05:00' - TIME '03:00'`	`INTERVAL`	`'02:00:00'`
`TIME '05:00' - INTERVAL '2 HOURS'`	`TIME`	`'03:00:00'`
`TIMESTAMP '2001-09-28 23:00' - INTERVAL '23 HOURS'`	`TIMESTAMP`	`'2001-09-28 00:00:00'`
`INTERVAL '1 DAY' - INTERVAL '1 HOUR'`	`INTERVAL`	`'1 DAY -01:00:00'`
`TIMESTAMP '2001-09-29 03:00' - TIMESTAMP '2001-09-27 12:00'`	`INTERVAL`	`'1 DAY 15:00:00'`
`900 * INTERVAL '1 SECOND'`	`INTERVAL`	`'00:15:00'`
`21 * INTERVAL '1 DAY'`	`INTERVAL`	`'21 DAYS'`
`DOUBLE PRECISION '3.5' * INTERVAL '1 HOUR'`	`INTERVAL`	`'03:30:00'`
`INTERVAL '1 HOUR' / DOUBLE PRECISION '1.5'`	`INTERVAL`	`'00:40:00'`

Mathematical Operators

Mathematical operators are provided for many data types.

Operator	Description	Example	Result
`!`	Factorial	`5 !`	`120`
`+`	Addition	`2 + 3`	`5`
`-`	Subtraction	`2 - 3`	`-1`
`*`	Multiplication	`2 * 3`	`6`
`/`	Division (integer division truncates results)	`4 / 2`	`2`
`%`	Modulo (remainder)	`5 % 4`	`1`
`^`	Exponentiation	`2.0 ^ 3.0`	`8`
`|/`	Square root	`|/ 25.0`	`5`
`||/`	Cube root	`||/ 27.0`	`3`

!!	Factorial (prefix operator)	!! 5	120
@	Absolute value	@ -5.0	5
&	Bitwise AND	91 & 15	11
|	Bitwise OR	32 | 3	35
#	Bitwise XOR	17 # 5	20
~	Bitwise NOT	~1	-2
<<	Bitwise shift left	1 << 4	16
>>	Bitwise shift right	8 >> 2	2

Notes

- The bitwise operators work only on integer data types, whereas the others are available for all numeric data types.
- Vertica supports the use of the factorial operators on positive and negative floating point (`DOUBLE PRECISION` (page 94)) numbers as well as integers. For example:

```
=> SELECT 4.98!;
     ?column?
------------------
 115.978600750905
(1 row)
```

- Factorial is defined in term of the gamma function, where (-1) = Infinity and the other negative integers are undefined. For example

  (-4)! = NaN

  -4! = -(4!) = -24.
- Factorial is defined as z! = gamma(z+1) for all complex numbers z. See the ***Handbook of Mathematical Functions http://www.math.sfu.ca/~cbm/aands/*** (1964) Section 6.1.5.
- See `MOD()` (page 238) for details about the behavior of %.

NULL Operators

To check whether a value is or is not NULL, use the constructs:

expression `IS NULL` *expression* `IS NOT NULL`

Alternatively, use equivalent, but nonstandard, constructs:

expression `ISNULL` *expression* `NOTNULL`

Do not write *expression* `= NULL` because `NULL` is not "equal to" `NULL`. (The null value represents an unknown value, and it is not known whether two unknown values are equal.) This behavior conforms to the SQL standard.

Note: Some applications might expect that *expression* = NULL returns true if *expression* evaluates to the null value. Vertica strongly recommends that these applications be modified to comply with the SQL standard.

String Concatenation Operators

To concatenate two strings on a single line, use the concatenation operator (two consecutive vertical bars).

Syntax

string || *string*

Parameters

string	Is an expression of type CHAR or VARCHAR

Notes

- || is used to concatenate expressions and constants. The expressions are cast to VARCHAR if possible, otherwise to VARBINARY, and must both be one or the other.
- Two consecutive strings within a single SQL statement on separate lines are automatically concatenated

Examples

The following example is a single string written on two lines:

```
=> SELECT E'xx'
-> '\\';
 ?column?
----------
 xx\
(1 row)
```

This example shows two strings concatenated:

```
=> SELECT E'xx' ||
-> '\\';
 ?column?
----------
 xx\\
(1 row)

=> SELECT 'auto' || 'mobile';
 ?column?
----------
 automobile
(1 row)
=> SELECT 'auto'
-> 'mobile';
 ?column?
----------
 automobile
(1 row)
=> SELECT 1 || 2;
 ?column?
----------
 12
```

```
(1 row)
=> SELECT '1' || '2';
 ?column?
----------
 12
(1 row)
=> SELECT '1'
-> '2';
 ?column?
----------
 12
(1 row)
```

Expressions

SQL expressions are the components of a query that compare a value or values against other values. They can also perform calculations. Expressions found inside any SQL command are usually in the form of a conditional statement.

Operator Precedence

The following table shows operator precedence in decreasing (high to low) order.

Note: When an expression includes more than one operator, Vertica Systems, Inc. recommends that you specify the order of operation using parentheses, rather than relying on operator precedence.

Operator/Element	Associativity	Description
.	left	table/column name separator
::	left	typecast
[ ]	left	array element selection
-	right	unary minus
^	left	exponentiation
* / %	left	multiplication, division, modulo
+ -	left	addition, subtraction
IS		IS TRUE, IS FALSE, IS UNKNOWN, IS NULL
IN		set membership
BETWEEN		range containment
OVERLAPS		time interval overlap
LIKE		string pattern matching
< >		less than, greater than
=	right	equality, assignment

NOT	right	logical negation
AND	left	logical conjunction
OR	left	logical disjunction

Expression Evaluation Rules

The order of evaluation of subexpressions is not defined. In particular, the inputs of an operator or function are not necessarily evaluated left-to-right or in any other fixed order. To force evaluation in a specific order, use a CASE (page 44) construct. For example, this is an untrustworthy way of trying to avoid division by zero in a WHERE clause:

```
=> SELECT x, y WHERE x <> 0 AND y/x > 1.5;
```

But this is safe:

```
=> SELECT x, y
   WHERE
     CASE
       WHEN x <> 0 THEN y/x > 1.5
       ELSE false
     END;
```

A CASE construct used in this fashion defeats optimization attempts, so use it only when necessary. (In this particular example, it would be best to avoid the issue by writing `y > 1.5*x` instead.)

Aggregate Expressions

An aggregate expression represents the application of an ***aggregate function*** (page 107) across the rows or groups of rows selected by a query.

Using AVG() as an example, the syntax of an aggregate expression is one of the following.

Invokes the aggregate across all input rows for which the given expression yields a non-null value:

```
AVG (expression)
```

Is the same as AVG(*expression*), because ALL is the default:

```
AVG (ALL expression)
```

Invokes the AVG() function across all input rows for all distinct, non-null values of the expression, where *expression* is any value expression that does not itself contain an aggregate expression.

```
AVG (DISTINCT expression)
```

An aggregate expression only can appear in the select list or HAVING clause of a SELECT statement. It is forbidden in other clauses, such as WHERE, because those clauses are evaluated before the results of aggregates are formed.

CASE Expressions

The CASE expression is a generic conditional expression that can be used wherever an expression is valid. It is similar to case and if/then/else statements in other languages.

Syntax (form 1)

```
CASE
  WHEN condition THEN result
  [ WHEN condition THEN result ]...
  [ ELSE result ]
END
```

Parameters

condition	Is an expression that returns a boolean (true/false) result. If the result is false, subsequent WHEN clauses are evaluated in the same manner.
result	Specifies the value to return when the associated *condition* is true.
ELSE *result*	If no *condition* is true then the value of the CASE expression is the result in the ELSE clause. If the ELSE clause is omitted and no condition matches, the result is null.

Syntax (form 2)

```
CASE expression
 WHEN value THEN result
 [ WHEN value THEN result ]...
 [ ELSE result ]
END
```

Parameters

expression	Is an expression that is evaluated and compared to all the *value* specifications in the WHEN clauses until one is found that is equal.
value	Specifies a value to compare to the *expression*.
result	Specifies the value to return when the *expression* is equal to the specified *value*.
ELSE *result*	Specifies the value to return when the *expression* is not equal to any *value*; if no ELSE clause is specified, the value returned is null.

Notes

The data types of all the result expressions must be convertible to a single output type.

Examples

```
=> SELECT * FROM test;

 a
---
 1
 2
 3
=> SELECT a,
     CASE WHEN a=1 THEN 'one'
          WHEN a=2 THEN 'two'
          ELSE 'other'
     END
   FROM test;

 a | case
---+-------
 1 | one
 2 | two
 3 | other
=> SELECT a,
     CASE a WHEN 1 THEN 'one'
            WHEN 2 THEN 'two'
            ELSE 'other'
     END
   FROM test;

 a | case
---+-------
 1 | one
 2 | two
 3 | other
```

Special Example

A `CASE` expression does not evaluate subexpressions that are not needed to determine the result. You can use this behavior to avoid division-by-zero errors:

```
=> SELECT x FROM T1 WHERE
      CASE WHEN x <> 0 THEN y/x > 1.5
      ELSE false
    END;
```

Column References

Syntax

```
[ [ schemaname. ] tablename. ] columnname
```

Parameters

schemaname	Is the name of the schema
tablename	Is one of:

	▪ The name of a table ▪ An alias for a table defined by means of a FROM clause in a query
columnname	Is the name of a column that must be unique across all the tables being used in a query

Notes

There are no space characters in a column reference.

If you do not specify a *schemaname*, Vertica searches the existing schemas according to the order defined in the `SET SEARCH_PATH` (page 639) command.

Example

This example uses the schema from the VMart Example Database.

In the following command, `transaction_type` and `transaction_time` are the unique column references, `store` is the name of the schema, and `store_sales_fact` is the table name:

```
=> SELECT transaction_type, transaction_time
   FROM store.store_sales_fact
   ORDER BY transaction_time;
 transaction_type | transaction_time
------------------+------------------
 purchase         | 00:00:23
 purchase         | 00:00:32
 purchase         | 00:00:54
 purchase         | 00:00:54
 purchase         | 00:01:15
 purchase         | 00:01:30
 purchase         | 00:01:50
 return           | 00:03:34
 return           | 00:03:35
 purchase         | 00:03:39
 purchase         | 00:05:13
 purchase         | 00:05:20
 purchase         | 00:05:23
 purchase         | 00:05:27
 purchase         | 00:05:30
 purchase         | 00:05:35
 purchase         | 00:05:35
 purchase         | 00:05:42
 return           | 00:06:36
 purchase         | 00:06:39
(20 rows)
```

Comments

A comment is an arbitrary sequence of characters beginning with two consecutive hyphen characters and extending to the end of the line. For example:

```
   -- This is a standard SQL comment
```

A comment is removed from the input stream before further syntax analysis and is effectively replaced by white space.

Alternatively, C-style block comments can be used where the comment begins with `/*` and extends to the matching occurrence of `*/`.

```
/* multiline comment
 * with nesting: /* nested block comment */
 */
```

These block comments nest, as specified in the SQL standard. Unlike C, you can comment out larger blocks of code that might contain existing block comments.

Date/Time Expressions

Vertica uses an internal heuristic parser for all date/time input support. Dates and times are input as strings, and are broken up into distinct fields with a preliminary determination of what kind of information might be in the field. Each field is interpreted and either assigned a numeric value, ignored, or rejected. The parser contains internal lookup tables for all textual fields, including months, days of the week, and time zones.

The date/time type inputs are decoded using the following procedure.

- Break the input string into tokens and categorize each token as a string, time, time zone, or number.
- If the numeric token contains a colon (:), this is a time string. Include all subsequent digits and colons.
- If the numeric token contains a dash (-), slash (/), or two or more dots (.), this is a date string which might have a text month.
- If the token is numeric only, then it is either a single field or an ISO 8601 concatenated date (for example, 19990113 for January 13, 1999) or time (for example, 141516 for 14:15:16).
- If the token starts with a plus (+) or minus (-), then it is either a time zone or a special field.
- If the token is a text string, match up with possible strings.
- Do a binary-search table lookup for the token as either a special string (for example, today), day (for example, Thursday), month (for example, January), or noise word (for example, at, on).
- Set field values and bit mask for fields. For example, set year, month, day for today, and additionally hour, minute, second for now.
- If not found, do a similar binary-search table lookup to match the token with a time zone.
- If still not found, throw an error.
- When the token is a number or number field:
- If there are eight or six digits, and if no other date fields have been previously read, then interpret as a "concatenated date" (for example, 19990118 or 990118). The interpretation is `YYYYMMDD` or `YYMMDD`.
- If the token is three digits and a year has already been read, then interpret as day of year.
- If four or six digits and a year has already been read, then interpret as a time (`HHMM` or `HHMMSS`).

- If three or more digits and no date fields have yet been found, interpret as a year (this forces yy-mm-dd ordering of the remaining date fields).
- Otherwise the date field ordering is assumed to follow the `DateStyle` setting: mm-dd-yy, dd-mm-yy, or yy-mm-dd. Throw an error if a month or day field is found to be out of range.
- If BC has been specified, negate the year and add one for internal storage. (There is no year zero in the Gregorian calendar, so numerically 1 BC becomes year zero.)
- If BC was not specified, and if the year field was two digits in length, then adjust the year to four digits. If the field is less than 70, then add 2000, otherwise add 1900.

Tip: Gregorian years AD 1-99 can be entered by using 4 digits with leading zeros (for example, 0099 is AD 99).

Month Day Year Ordering

For some formats, ordering of month, day, and year in date input is ambiguous and there is support for specifying the expected ordering of these fields. See Date/Time Run-Time Parameters for information about output styles.

Special Date/Time Values

Vertica supports several special date/time values for convenience, as shown below. All of these values need to be written in single quotes when used as constants in SQL statements.

The values `INFINITY` and `-INFINITY` are specially represented inside the system and are displayed the same way. The others are simply notational shorthands that are converted to ordinary date/time values when read. (In particular, `NOW` and related strings are converted to a specific time value as soon as they are read.)

String	Valid Data Types	Description
`epoch`	`DATE, TIMESTAMP`	1970-01-01 00:00:00+00 (UNIX SYSTEM TIME ZERO)
`INFINITY`	`TIMESTAMP`	Later than all other time stamps
`-INFINITY`	`TIMESTAMP`	Earlier than all other time stamps
`NOW`	`DATE, TIME, TIMESTAMP`	Current transaction's start time **Note:** `NOW` is not the same as the ***NOW*** (see "***NOW [Date/Time]***" on page 202) function.
`TODAY`	`DATE, TIMESTAMP`	Midnight today
`TOMORROW`	`DATE, TIMESTAMP`	Midnight tomorrow
`YESTERDAY`	`DATE, TIMESTAMP`	Midnight yesterday
`ALLBALLS`	`TIME`	00:00:00.00 UTC

The following SQL-compatible functions can also be used to obtain the current time value for the corresponding data type:

- `CURRENT_DATE` (page 181)
- `CURRENT_TIME` (page 182)

- CURRENT_TIMESTAMP (page 182)
- LOCALTIME (page 199)
- LOCALTIMESTAMP (page 200)

The latter four accept an optional precision specification. (See Date/Time Functions.) Note however that these are SQL functions and are not recognized as data input strings.

NULL Value

NULL is a reserved keyword used to indicate that a data value is unknown.

Be very careful when using NULL in expressions. NULL is not greater than, less than, equal to, or not equal to any other expression. Use the ***Boolean-predicate*** (on page 51) for determining whether an expression value is NULL.

Notes

- Vertica stores data in projections, which are sorted in a specific way. All columns are stored in ASC (ascending) order. For columns of data type NUMERIC, INTEGER, DATE, TIME, TIMESTAMP, and INTERVAL, NULL values are placed at the beginning of sorted projections (NULLS FIRST), while for columns of data type FLOAT, STRING, and BOOLEAN, NULL values are placed at the end (NULLS LAST). For details, see Null Placement in the Programmer's Guide.
- Vertica also accepts NUL characters ('\0') in constant strings and no longer removes null characters from VARCHAR fields on input or output. NUL is the ASCII abbreviation for the NULL character.
- You can write queries with expressions that contain the <=> operator for NULL=NULL joins. See Equi-joins and Non Equi-Joins in the Programmer's Guide.

See Also

NULL-handling Functions (page 248)

Numeric Expressions

Vertica follows the IEEE specification for floating point, including NaN.

A NaN is not greater than and at the same time not less than anything, even itself. In other words, comparisons always return false whenever a NaN is involved.

Examples

```
=> SELECT CBRT('Nan'); -- cube root
 cbrt
------
  NaN
(1 row)
=> SELECT 'Nan' > 1.0;
 ?column?
----------
 f
(1 row)
```

Predicates

In general, predicates are truth-valued functions; that is, when invoked, they return a truth value. Predicates have a set of parameters and arguments. For example, in the following example `WHERE` clause:

```
WHERE name = 'Smith';
```

- `name = 'Smith'` is the predicate
- `'Smith'` is an expression

BETWEEN-predicate

The special `BETWEEN` predicate is available as a convenience.

Syntax

a `BETWEEN` *x* `AND` *y*

Notes

a `BETWEEN` *x* `AND` *y*

Is equivalent to:

a `>=` *x* `AND` *a* `<=` *y*

Similarly:

a `NOT BETWEEN` *x* `AND` *y*

is equivalent to:

a `<` *x* `OR` *a* `>` *y*

Boolean-predicate

Retrieves rows where the value of an expression is true, false, or unknown (null).

Syntax

```
expression IS [NOT] TRUE
expression IS [NOT] FALSE
expression IS [NOT] UNKNOWN
```

Notes

- A null input is treated as the value `UNKNOWN`.
- `IS UNKNOWN` and `IS NOT UNKNOWN` are effectively the same as the ***NULL-predicate*** (page 59), except that the input expression does not have to be a single column value. To check a single column value for `NULL`, use the NULL-predicate.
- Do not confuse the boolean-predicate with ***Boolean Operators*** (on page 36) or the ***Boolean*** (page 65) data type, which can have only two values: true and false.

column-value-predicate

Syntax

column-name comparison-op constant-expression

Parameters

column-name	Is a single column of one the tables specified in the FROM ***clause*** (page 620).
comparison-op	Is one of the ***comparison operators*** (on page 36).
constant-expression	Is a constant value of the same data type as the *column-name.*

Notes

To check a column value for NULL, use the ***NULL-predicate*** (page 59).

Examples

```
table.column1 = 2
table.column2 = 'Seafood'
table.column3 IS NULL
```

IN-predicate

Syntax

column-expression [NOT] IN (*list-expression*)

Parameters

column-expression	A single column of one the tables specified in the ***FROM clause*** (page 620).
list-expression	A comma-separated list of constant values matching the data type of the *column-expression*

Examples

```
x IN (5, 6, 7)
x, y IN ((1,2), (3, 4)), OR x, y IN (SELECT a, b FROM table)
```

join-predicate

Combines records from two or more tables in a database.

Syntax

column-reference (see "*Column References*" on page 45) = *column-reference*

Parameters

column-reference	Refers to a column of one the tables specified in the ***FROM clause*** (page 620).

LIKE-predicate

Retrieves rows where the string value of a column matches a specified pattern. The pattern can contain one or more wildcard characters. ILIKE is equivalent to LIKE except that the match is case-insensitive (non-standard extension).

Syntax

```
string [ NOT ]{ LIKE | ILIKE | LIKEB | ILIKEB }
... pattern [ESCAPE 'escape-character' ]
```

Parameters

string	(CHAR, VARCHAR, BINARY, VARBINARY) is the column value to be compared to the *pattern*.
NOT	Returns true if LIKE returns false, and the reverse; equivalent to NOT *string* LIKE *pattern*.
pattern	Specifies a string containing wildcard characters. ▪ Underscore (_) matches any single character. ▪ Percent sign (%) matches any string of zero or more characters.
ESCAPE	Specifies an *escape-character*. An ESCAPE character can be used to escape itself, underscore (_), and % only. This is enforced only for non-default collations. To match the ESCAPE character itself, use two consecutive escape characters. The default ESCAPE character is the backslash (\) character, although standard SQL specifies no default ESCAPE character. ESCAPE works for char and varchar strings only.
escape-character	Causes character to be treated as a literal, rather than a wildcard, when preceding an underscore or percent sign character in the *pattern*.

Notes

- The LIKE predicate is compliant with the SQL standard.
- In the default locale, LIKE and ILIKE handle UTF-8 character-at-a-time, locale-insensitive comparisons. ILIKE handles language-independent case-folding.

  Note: In non-default locales, LIKE and ILIKE do locale-sensitive string comparisons, including some automatic normalization, using the same algorithm as the "=" operator on VARCHAR types.
- The LIKEB and ILIKEB predicates do byte-at-a-time ASCII comparisons, providing access to Vertica 4.0 functionality.
- LIKE and ILIKE are stable for character strings, but immutable for binary strings, while LIKEB and ILIKEB are both immutable
- For collation=binary settings, the behavior is similar to Vertica 4.0. For other collations, LIKE operates on UTF-8 character strings, with the exact behavior dependent on collation parameters, such as strength. In particular, ILIKE works by setting S=2 (ignore case) in the current session locale. See Locale Specification in the Administrator's Guide.

- Although the SQL standard specifies no default ESCAPE character, in Vertica the default is the backslash (\) and works for CHAR and VARCHAR strings only.

  Tip: Vertica recommends that you specify an explicit escape character in all cases, to avoid problems should this behavior change. To use a backslash character as a literal, either specify a different escape character or use two backslashes.
- ESCAPE expressions evaluate to exactly one octet — or one UTF-8 character for non-default locales.
- An ESCAPE character can be used only to escape itself, _, and %. This is enforced only for non-default collations.
- LIKE requires that the entire string expression match the pattern. To match a sequence of characters anywhere within a string, the pattern must start and end with a percent sign.
- The LIKE predicate does not ignore trailing "white space" characters. If the data values that you want to match have unknown numbers of trailing spaces, tabs, etc., terminate each LIKE predicate pattern with the percent sign wildcard character.
- To use binary data types, you must use a valid binary character as the escape character, since backslash is not a valid BINARY character.
- The following symbols are substitutes for the actual keywords:

  ```
  ~~     LIKE
  ~~*    ILIKE
  !~~    NOT LIKE
  !~~*   NOT ILIKE
  ```

  The ESCAPE keyword is not valid for the above symbols.

Querying Case-sensitive data in System Tables

The V_CATALOG.TABLES (page 681).TABLE_SCHEMA and TABLE_NAME columns are case sensitive when used with an equality (=) predicate in queries. For example, given the following schema:

```
=> CREATE SCHEMA SS;
=> CREATE TABLE SS.TT (c1 int);
=> INSERT INTO ss.tt VALUES (1);
```

If you execute a query using the = predicate, Vertica returns 0 rows:

```
=> SELECT table_schema, table_name FROM v_catalog.tables WHERE table_schema ='ss';
table_schema | table_name
-------------+------------
(0 rows)
```

Use the case-insensitive ILIKE predicate to return the expected results:

```
=> SELECT table_schema, table_name FROM v_catalog.tables WHERE table_schema ILIKE
'ss';
 table_schema | table_name
--------------+------------
 SS           | TT
(1 row)
```

Examples

```
'abc' LIKE 'abc'  true
'abc' LIKE 'a%'   true
'abc' LIKE '_b_'  true
'abc' LIKE 'c'    false
'abc' LIKE 'ABC' false
'abc' ILIKE 'ABC' true
'abc' not like 'abc' false
not 'abc' like 'abc' false
```

The following example illustrates pattern matching in locales.

```
\locale default
=> CREATE TABLE src(c1 VARCHAR(100));
=> INSERT INTO src VALUES (U&'\00DF'); --The beta (ß)
=> INSERT INTO src VALUES ('ss');
=> COMMIT;
```

Querying the `src` table in the default locale returns both ss and beta.

```
=> SELECT * FROM src;
 c1
----
 ß
 ss
(2 rows)
```

The following query combines pattern-matching predicates to return the results from column `c1`:

```
=> SELECT c1, c1 = 'ss' AS equality, c1 LIKE 'ss' AS LIKE, c1
   ILIKE 'ss' AS ILIKE FROM src;
 c1 | equality | LIKE | ILIKE
----+----------+------+-------
 ß  | f        | f    | f
 ss | t        | t    | t
(2 rows)
```

The next query specifies unicode format for `c1`:

```
=> SELECT c1, c1 = U&'\00DF' AS equality, c1 LIKE U&'\00DF' AS LIKE, c1 ILIKE
U&'\00DF' AS ILIKE from src;

 c1 | equality | LIKE | ILIKE
----+----------+------+-------
 ß  | t        | t    | t
 ss | f        | f    | f
(2 rows)
```

Now change the locale to German with a strength of 1 (ignore case and accents):

```
\locale LDE_S1
=> SELECT c1, c1 = 'ss' AS equality, c1 LIKE 'ss' as LIKE, c1 ILIKE 'ss' AS ILIKE
from src;

 c1 | equality | LIKE | ILIKE
----+----------+------+-------
 ß  | t        | t    | f
 ss | t        | t    | t
```

```
(2 rows)
```

The following query fails because ILIKE forces collation into S2. Because the locale is S1, the ignore-accents part is lost and the beta is considered an accent:

```
=> SELECT c1, c1 = U&'\00DF' AS equality, c1 LIKE U&'\00DF' AS LIKE, c1 ILIKE
U&'\00DF' AS ILIKE from src;

 c1 | equality | LIKE | ILIKE
----+----------+------+-------
 ss | t        | t    | f
 ß  | t        | t    | t
(2 rows)
```

This example illustrates binary data types with pattern-matching predicates:

```
=> CREATE TABLE t (c BINARY(1));
=> INSERT INTO t values(HEX_TO_BINARY('0x00'));
=> INSERT INTO t values(HEX_TO_BINARY('0xFF'));
=> SELECT TO_HEX(c) from t;
 TO_HEX
--------
 00
 ff
(2 rows)
select * from t;
  c
------
 \000
 \377
(2 rows)

=> SELECT c, c = '\000', c LIKE '\000', c ILIKE '\000' from t;

  c   | ?column? | ?column? | ?column?
------+----------+----------+----------
 \000 | t        | t        | t
 \377 | f        | f        | f
(2 rows)
=> SELECT c, c = '\377', c LIKE '\377', c ILIKE '\377' from t; c   | ?column? |
?column? | ?column?
------+----------+----------+----------
 \000 | f        | f        | f
 \377 | t        | t        | t
(2 rows)
```

NULL-predicate

Tests for null values.

Syntax

column-name IS [NOT] NULL

Parameters

column-name	Is a single column of one the tables specified in the ***FROM clause*** (page 620).

Examples

```
a IS NULL
b IS NOT NULL
```

See Also

NULL Value (page 49)

SQL Data Types

The following tables summarizes the data types supported by Vertica, as well as the default placement of null values in projections. The Size column is shown in uncompressed bytes.

Type	Size	Description	NULL Sorting
Binary types			
BINARY	1 to 65000	Fixed-length binary string	NULLS LAST
VARBINARY	1 to 65000	Variable-length binary string	NULLS LAST
BYTEA	1 to 65000	Variable-length binary string (synonym for VARBINARY)	NULLS LAST
RAW	1 to 65000	Variable-length binary string (synonym for VARBINARY)	NULLS LAST
Boolean types			
BOOLEAN	1	True or False or NULL	NULLS LAST
Character types			
CHAR	1 to 65000	Fixed-length character string	NULLS LAST
VARCHAR	1 to 65000	Variable-length character string	NULLS LAST
Date/time types			
DATE	8	Represents a month, day, and year	NULLS FIRST
DATETIME	8	Represents a date and time with or without timezone (synonym for TIMESTAMP)	NULLS FIRST
SMALLDATETIME	8	Represents a date and time with or without timezone (synonym for TIMESTAMP)	NULLS FIRST
TIME	8	Represents a time of day without timezone	NULLS FIRST
TIME WITH TIMEZONE	8	Represents a time of day with timezone	NULLS FIRST
TIMESTAMP	8	Represents a date and time without timezone	NULLS FIRST
TIMESTAMP WITH TIMEZONE	8	Represents a date and time with timezone	NULLS FIRST
INTERVAL	8	Measures the difference between two points in time	NULLS FIRST

Approximate numeric types			
DOUBLE PRECISION	8	Signed 64-bit IEEE floating point number, requiring 8 bytes of storage	NULLS LAST
FLOAT	8	Signed 64-bit IEEE floating point number, requiring 8 bytes of storage	NULLS LAST
FLOAT(n)	8	Signed 64-bit IEEE floating point number, requiring 8 bytes of storage	NULLS LAST
FLOAT8	8	Signed 64-bit IEEE floating point number, requiring 8 bytes of storage	NULLS LAST
REAL	8	Signed 64-bit IEEE floating point number, requiring 8 bytes of storage	NULLS LAST
Exact numeric types			
INTEGER	8	Signed 64-bit integer, requiring 8 bytes of storage	NULLS FIRST
INT	8	Signed 64-bit integer, requiring 8 bytes of storage	NULLS FIRST
BIGINT	8	Signed 64-bit integer, requiring 8 bytes of storage	NULLS FIRST
INT8	8	Signed 64-bit integer, requiring 8 bytes of storage	NULLS FIRST
SMALLINT	8	Signed 64-bit integer, requiring 8 bytes of storage	NULLS FIRST
TINYINT	8	Signed 64-bit integer, requiring 8 bytes of storage	NULLS FIRST
DECIMAL	8+	8 bytes for the first 18 digits of precision, plus 8 bytes for each additional 19 digits	NULLS FIRST
NUMERIC	8+	8 bytes for the first 18 digits of precision, plus 8 bytes for each additional 19 digits	NULLS FIRST
NUMBER	8+	8 bytes for the first 18 digits of precision, plus 8 bytes for each additional 19 digits	NULLS FIRST
MONEY	8+	8 bytes for the first 18 digits of precision, plus 8 bytes for each additional 19 digits	NULLS FIRST

Binary Data Types

Store raw-byte data, such as IP addresses, up to 65000 bytes.

Syntax

```
BINARY ( length )
{ VARBINARY | BINARY VARYING | BYTEA | RAW } ( max-length )
```

Parameters

length | *max-length*	Specifies the length of the string.

Notes

- The data types BINARY and BINARY VARYING (VARBINARY) are collectively referred to as *binary string types* and the values of binary string types are referred to as *binary strings*.
- A binary string is a sequence of octets, or bytes. Binary strings store raw-byte data, while character strings store text.
- The binary data types, BINARY and VARBINARY, are similar to the ***character data types*** (page 66), CHAR and VARCHAR, respectively, except that binary data types contain byte strings, rather than character strings. The allowable maximum length is the same for binary data types as it is for character data types, except that the length for BINARY and VARBINARY is a length in bytes, rather than in characters.
- **BINARY —** A fixed-width string of *length* bytes, where the number of bytes is declared as an optional specifier to the type. If length is omitted, the default is 1. Where necessary, values are right-extended to the full width of the column with the zero byte. For example:

```
=> SELECT TO_HEX('ab'::BINARY(4));
  to_hex
----------
 61620000
```

- **VARBINARY —** A variable-width string up to a length of *max-length* bytes, where the maximum number of bytes is declared as an optional specifier to the type. The default is the default attribute size, which is 80, and the maximum length is 65000 bytes. Varbinary values are not extended to the full width of the column. For example:

```
=> SELECT TO_HEX('ab'::VARBINARY(4));
 to_hex
--------
 6162
```

- BYTEA and RAW are synonyms for VARBINARY.
- You can use several formats when working with binary values, but the hexadecimal format is generally the most straightforward and is emphasized in Vertica documentation.
- The &, ~, | and # binary operands have special behavior for binary data types, as described in ***Binary Operators*** (page 33).
- On input, strings are translated from hexadecimal representation to a binary value using the HEX_TO_BINARY (page 268) function. Strings are translated from bitstring representation to binary values using the BITSTRING_TO_BINARY (page 261) function. Both functions take a VARCHAR argument and return a VARBINARY value. See the Examples section below.

  Binary values can also be represented in octal format by prefixing the value with a backslash '\'.

Note: If you use vsql, you must use the escape character (\) when inserting another backslash on input; for example, input `'\141'` as `'\\141'`.

You can also input values represented by printable characters. For example, the hexadecimal value `'0x61'` can also be represented by the symbol `'`.

See Loading Binary Data in the Administrator's Guide.

- Like the input format the output format is a hybrid of octal codes and printable ASCII characters. A byte in the range of printable ASCII characters (the range `[0x20, 0x7e]`) is represented by the corresponding ASCII character, with the exception of the backslash (`'\'`), which is escaped as `'\\'`. All other byte values are represented by their corresponding octal values. For example, the bytes {97,92,98,99}, which in ASCII are `{a,\,b,c}`, are translated to text as `'a\\bc'`.
- The following aggregate functions are supported for binary data types:
  - `BIT_AND (page 172)`
  - ***BIT_OR*** (page 173)
  - ***BIT_XOR*** (page 175)
  - ***MAX*** (page 112)
  - ***MIN*** (page 112)

  `BIT_AND`, `BIT_OR`, and `BIT_XOR` are bitwise operations that are applied to each non-null value in a group, while `MAX` and `MIN` are bytewise comparisons of binary values.
- Like their ***binary operator*** (page 33) counterparts, if the values in a group vary in length, the aggregate functions treat the values as though they are all equal in length by extending shorter values with zero bytes to the full width of the column. For example, given a group containing the values `'ff', null, and 'f'`, a binary aggregate ignores the null value and treats the value `'f'` as `'f0'`. Also, like their binary operator counterparts, these aggregate functions operate on `VARBINARY` types explicitly and operate on `BINARY` types implicitly through casts. See ***Data Type Coercion Operators (CAST)*** (page 37).

Examples

The following example shows `VARBINARY HEX_TO_BINARY (page 268)(VARCHAR)` and `VARCHAR TO_HEX (page 216)(VARBINARY)` usage.

Table `t` and and its projection are created with binary columns:

```
=> CREATE TABLE t (c BINARY(1));
=> CREATE PROJECTION t_p (c) AS SELECT c FROM t;
```

Insert minimum byte and maximum byte values:

```
=> INSERT INTO t values(HEX_TO_BINARY('0x00'));
=> INSERT INTO t values(HEX_TO_BINARY('0xFF'));
```

Binary values can then be formatted in hex on output using the TO_HEX function:

```
=> SELECT TO_HEX(c) FROM t;
 to_hex
 --------
  00
  ff
```

```
 (2 rows)
```

The BIT_AND, BIT_OR, and BIT_XOR functions are interesting when operating on a group of values. For example, create a sample table and projections with binary columns:

This examples uses the following schema, which creates table t with a single column of VARBINARY data type:

```
=> CREATE TABLE t (
      c VARBINARY(2) );
=> INSERT INTO t values(HEX_TO_BINARY('0xFF00'));
=> INSERT INTO t values(HEX_TO_BINARY('0xFFFF'));
=> INSERT INTO t values(HEX_TO_BINARY('0xF00F'));
```

Query table t to see column c output:

```
=> SELECT TO_HEX(c) FROM t;
 TO_HEX
--------
 ff00
 ffff
 f00f
(3 rows)
```

Now issue the bitwise AND operation. Because these are aggregate functions, an implicit GROUP BY operation is performed on results using (ff00&(ffff)&f00f):

```
=> SELECT TO_HEX(BIT_AND(c)) FROM t;
to_hex
--------
f000
(1 row)
```

Issue the bitwise OR operation on (ff00|(ffff)|f00f):

```
=> SELECT TO_HEX(BIT_OR(c)) FROM t;
to_hex
--------
ffff
(1 row)
```

Issue the bitwise XOR operation on (ff00#(ffff)#f00f):

```
=> SELECT TO_HEX(BIT_XOR(c)) FROM t;
to_hex
--------
f0f0
(1 row)
```

See Also

Aggregate functions ***BIT_AND*** (page 172), ***BIT_OR*** (page 173), ***BIT_XOR*** (page 175), ***MAX*** (page 112), and ***MIN*** (page 112)

Binary Operators (page 33)

COPY (page 497)

Data Type Coercion Operators (CAST) (page 37)

IP conversion function ***INET_ATON*** (page 222), ***INET_NTOA*** (page 223), ***V6_ATON*** (page 224), ***V6_NTOA*** (page 225), ***V6_SUBNETA*** (page 226), ***V6_SUBNETN*** (page 227), ***V6_TYPE*** (page 228)

String functions ***BITCOUNT*** (page 261), ***BITSTRING_TO_BINARY*** (page 261), ***HEX_TO_BINARY*** (page 268), ***LENGTH*** (page 279), ***REPEAT*** (page 289), ***SUBSTRING*** (page 298), ***TO_HEX*** (page 216), and ***TO_BITSTRING*** (page 212)

Loading Binary Data in the Administrator's Guide

Boolean Data Type

Vertica provides the standard SQL type BOOLEAN, which has two states: true and false. The third state in SQL boolean logic is unknown, which is represented by the NULL value.

Syntax

```
BOOLEAN
```

Parameters

Valid literal data values for input are:

TRUE	't'	'true'	'y'	'yes'	'1'
FALSE	'f'	'false'	'n'	'no'	'0'

Notes

- Do not confuse the `BOOLEAN` data type with ***Boolean Operators*** (on page 36) or the ***Boolean-predicate*** (on page 51).
- The keywords `TRUE` and FALSE are preferred and are SQL-compliant.
- All other values must be enclosed in single quotes.
- Boolean values are output using the letters t and f.

See Also

NULL Value (page 49)

Character Data Types

Stores strings of letters, numbers and symbols. Character data can be stored as fixed-length or variable-length strings; the difference is that fixed-length strings are right-extended with spaces on output, and variable-length strings are not extended.

Syntax

```
[ CHARACTER | CHAR ] ( length )
[ VARCHAR | CHARACTER VARYING ] ( length )
```

Parameters

length	Specifies the length of the string in octets.

Notes

- A character is a Unicode codepoint represented as UTF-8.
- The data types CHARACTER (CHAR) and CHARACTER VARYING (VARCHAR) are collectively referred to as *character string types,* and the values of character string types are known as *character strings*.
- **CHAR** is conceptually a fixed-length, blank padded string. Any trailing blanks (spaces) are removed on input, and only restored on output. The default length is 1 and the maximum length is 65000 octets (bytes).
- **VARCHAR** is a variable-length character data type. The default length is 80 and the maximum length is 65000 octets. Values can include trailing spaces.
- When you define character columns, you specify the maximum size of any string to be stored in the column. For example, if you want to store strings up to 24 octets in length, you could use either of the following definitions:

  ```
  CHAR(24)    /* fixed-length */
  VARCHAR(24) /* variable-length */
  ```

- The maximum length parameter for VARCHAR and CHAR data type refers to the number of octets that can be stored in that field and not number of characters. When using multibyte UTF-8 characters, the fields must be sized to accommodate from 1 to 4 octets per character, depending on the data. If the data being loaded into a VARCHAR/CHAR column exceeds the specified maximum size for that column, data is truncated on UTF-8 character boundaries to fit within the specified size. See COPY (page 497).

  Note: Remember to include the extra octets required for multibyte characters in the column-width declaration, keeping in mind the 65000 octet column-width limit.

- String literals in SQL statements must be enclosed in single quotes.
- Due to compression in Vertica, the cost of over-estimating the length of these fields is incurred primarily at load time and during sorts.
- NULL appears last (largest) in ascending order. See also ***GROUP BY Clause*** (page 626) for additional information about null ordering.

NULL vs NUL

`NUL` represents a character whose ASCII/Unicode code is zero, sometimes qualified "ASCII NUL".

`NULL` means no value, and is true of a field (column) or constant, not of a character.

`VARCHAR` string data types accept ASCII NULs.

The following example casts the input string containing NUL values to VARCHAR:

```
=> SELECT E'vert\0ica'::CHARACTER VARYING AS varchar;
 varchar
---------
 vertica
(1 row)
```

The following example casts the input string containing NUL values to VARBINARY:

```
=> SELECT E'vert\0ica'::BINARY VARYING as varbinary;
  varbinary
-------------
 vert\000ica
(1 row)
```

In both cases, the result contains 8 characters, but in the VARCHAR case, the '\000' is not visible:

```
=> SELECT LENGTH('vert\0ica'::CHARACTER VARYING);
 length
--------
      8
(1 row)
=> SELECT LENGTH('vert\0ica'::BINARY VARYING);
 length
--------
      8
(1 row)
```

See Also

Data Type Coercion (page 101)

Date/Time Data Types

Vertica supports the full set of SQL date and time data types. In most cases, a combination of DATE, DATETIME, SMALLDATETIME, TIME, TIMESTAMP WITHOUT TIME ZONE, and TIMESTAMP WITH TIME ZONE, and INTERVAL provides a complete range of date/time functionality required by any application.

In compliance with the SQL standard, Vertica also supports the TIME WITH TIME ZONE data type.

The following table lists the date/time data types, their sizes, values, and resolution.

Date/Time Data Types

Name	Size	Description	Low Value	High Value	Resolution
DATE	8 bytes	Dates only (no time of day)	4713 BC	5874897 AD	1 day
DATETIME	8 bytes	Both date and time, with [w/o] time zone	4713 BC	5874897 AD	1 microsecond/14 digits
INTERVAL [(p)]	8 bytes	Time intervals	-178000000 yrs	178000000 yrs	1 microsecond/14 digits
SMALLDATETIME	8 bytes	Both date and time, with [w/o] time zone	4713 BC	5874897 AD	1 microsecond/14 digits
TIME [(p) [WITHOUT TIME ZONE]	8 bytes	Times of day only (no date)	00:00:00.00	23:59:59.99	1 microsecond/14 digits
TIME [(p)] WITH TIME ZONE	8 bytes	Times of day only, with time zone	00:00:00.00+12	23:59:59.99-12	1 microsecond/14 digits
TIMESTAMP [(p)] [{ WITH | WITHOUT} TIME ZONE] | TIMESTAMPTZ	8 bytes	Both date and time, with [w/o] time zone	4713 BC	5874897 AD	1 microsecond/14 digits

Time Zone Abbreviations for Input

The files in /opt/vertica/share/timezonesets are recognized by Vertica as date/time input values and define the default list of strings accepted in the AT TIME ZONE *zone* parameter. The names are not necessarily used for date/time output — output is driven by the official time zone abbreviations associated with the currently selected time zone parameter setting.

Notes

- In Vertica, TIME ZONE is a synonym for TIMEZONE.
- Vertica uses Julian dates for all date/time calculations. They can correctly predict and calculate any date more recent than 4713 BC to far into the future, based on the assumption that the length of the year is 365.2425 days.
- All date/time types are stored in eight bytes.
- A date/time value of NULL appears first (smallest) in ascending order.

- All the date/time data types accept the special literal value NOW to specify the current date and time. For example:

```
=> SELECT TIMESTAMP 'NOW';
           ?column?
----------------------------
 2010-10-04 11:18:15.227544
(1 row)
```

- In Vertica, The INTERVALS (page 70) data type is SQL-2008 compliant and allows modifiers, called ***interval qualifiers*** (page 32), that divide the INTERVAL type into two primary subtypes, DAY TO SECOND (the default) and YEAR TO MONTH. You use the SET INTERVALSTYLE (page 635) command to change the run-time parameter for the current session.

  Intervals are represented internally as some number of microseconds and printed as up to 60 seconds, 60 minutes, 24 hours, 30 days, 12 months, and as many years as necessary. Fields can be positive or negative.

See Also

Set the Default Time Zone and Using Time Zones with Vertica in the Installation Guide

Sources for Time Zone and Daylight Saving Time Data
http://www.twinsun.com/tz/tz-link.htm

DATE

Consists of a month, day, and year.

Syntax

```
DATE
```

Parameters

Low Value	High Value	Resolution
4713 BC	32767 AD	1 DAY

See ***SET DATESTYLE*** (page 634) for information about ordering.

Example	Description
January 8, 1999	Unambiguous in any datestyle input mode
1999-01-08	ISO 8601; January 8 in any mode (recommended format)
1/8/1999	January 8 in MDY mode; August 1 in DMY mode
1/18/1999	January 18 in MDY mode; rejected in other modes
01/02/03	January 2, 2003 in MDY mode February 1, 2003 in DMY mode February 3, 2001 in YMD mode
1999-Jan-08	January 8 in any mode

Jan-08-1999	January 8 in any mode
08-Jan-1999	January 8 in any mode
99-Jan-08	January 8 in YMD mode, else error
08-Jan-99	January 8, except error in YMD mode
Jan-08-99	January 8, except error in YMD mode
19990108	ISO 8601; January 8, 1999 in any mode
990108	ISO 8601; January 8, 1999 in any mode
1999.008	Year and day of year
J2451187	Julian day
January 8, 99 BC	Year 99 before the Common Era

DATETIME

DATETIME is an alias for ***TIMESTAMP*** (page 87).

INTERVAL

Measures the difference between two points in time. The INTERVAL data type is divided into two major subtypes: DAY TO SECOND (day/time, kept in microseconds) and YEAR TO MONTH (year/month, kept in months). A day/time interval represents a span of days, hours, minutes, seconds, and fractional seconds. A year/month interval represents a span of years and months. The default interval-qualifier, if not specified, is INTERVAL DAY TO SECOND(6). Intervals can be positive or negative.

Syntax

INTERVAL [(*p*)] [- '***interval-literal*** (on page 30)'] [***interval-qualifier*** (on page 32)]

Parameters

p	(Precision) can specify the number of fractional digits retained in the seconds field, in the range 0 to 6. The default is 6.
interval-literal	[Optional] A literal character string expressing a specific interval. Sometimes referred to as *data* in this topic.
interval-qualifier	Specifies a range of interval subtypes with optional precision specifications. If omitted, the default is DAY TO SECOND(6). Sometimes referred to as *subtype* in this topic.

You can specify optional date/time units on interval input and output. The sections that follow describe each of the three methods available to you:

- The SQL-compliant implementation: no units on output (the default)
- The Vertica extension: optional units on output
- Optional units on input

No units on output

The default style is PLAIN (no units on output) and follows the SQL-2008 standard:

```
=> SELECT INTERVAL '3 2';
 ?column?
----------
 3 02:00
(1 row)
```

Note that the following command returns the same result, even though units are specified inside the interval-literal. Those units are omitted from the result:

```
=> SELECT INTERVAL '3 days 2 hours';
 ?column?
----------
 3 02:00
(1 row)
```

You change the INTERVAL style with the ***SET INTERVALSTYLE*** (page 635) command:

```
=> SET INTERVALSTYLE TO PLAIN;
```

If you get unexpected results, issue the ***SHOW*** (page 650) command to display the run-time parameters:

```
=> SHOW INTERVALSTYLE;
     name      | setting
---------------+---------
 intervalstyle | plain
(1 row)
```

The same interval (3 days, 2 hours) can be expressed in several other ways in SQL-2008. For example, if you issue the command `SET DATESTYLE to SQL` the output matches INTERVALSTYLE PLAIN (no units); thus, all of the following commands return `3 02`:

```
=> SELECT INTERVAL '3' DAY + INTERVAL '2' HOUR;
=> SELECT INTERVAL '3  2' DAY TO HOUR;
=> SELECT INTERVAL '3  days 2 hours' DAY TO HOUR;
=> SELECT INTERVAL '3  days 2' DAY TO HOUR;
```

The following example extracts the HOUR value from the input parameters:

```
=> SELECT INTERVAL '28 days 3 hours' HOUR;
 ?column?
----------
 675
(1 row)
```

In the next example, HOUR(2) instructs Vertica to use up to 2 places to output hours, but note that Vertica uses as many entries as needed, so the (2) specification is ignored. Note also that Vertica ignores spaces; for example HOUR(2) is processed the same as HOUR (2).

```
=> SELECT INTERVAL '28 days 3 hours' HOUR (2);
```

```
 ?column?
----------
 675
(1 row)
```

If seconds contain decimal places, they are rounded on output to the precision you specify; for example `INTERVAL(3)` in the following command:

```
=> SELECT INTERVAL(3) '28 days 3 hours 1.234567 sec';
 ?column?
----------
 28 03:00:01.235
(1 row)
```

Vertica ignores a precision placed on a unit specified inside an interval-literal:

```
=> SELECT INTERVAL '28 days 3 hours 1.234567 sec(3)';
      ?column?
--------------------
 28 03:03:01.234567
(1 row)
```

If you move the precision outside of the interval-literal, Vertica honors it:

```
=> SELECT INTERVAL '28 days 3 hours 1.234567)' second(3);
  ?column?
-------------
 2430001.235
(1 row)
```

If there are two different specifiers, Vertica picks the lesser ot the two for seconds. For example, in the following command, Vertica picks (1):

```
=> SELECT INTERVAL(1) '1.2467' SECOND(2);
 ?column?
----------
 1.2
(1 row)
```

Intervals can be cast *within* the day/time or the year/month subtypes but not between them. For example, the following command converts to `DAY TO SECOND` (the default):

```
=> SELECT CAST(INTERVAL '4440' MINUTE as INTERVAL);
 ?column?
----------
 3 02:00
(1 row)

=> SELECT CAST(INTERVAL -'01:15' as INTERVAL MINUTE);
 ?column?
----------
 -75
(1 row)
```

The following query, however, returns an error:

```
=> SELECT INTERVAL '1 02:03:04.56' HOUR TO SECOND;
   ERROR:  invalid input syntax for type interval hour to second: "1 02:03:04.56"
```

The error is legitimate. For standalone fields without units, such as the first '1' in an interval-literal '1 02:03:04.56', the units are determined as the first not-already matched subtype field. Thus if the subtype range is `HOUR TO SECOND`, the first '1' is '1 hour' and conflicts with the '02' in the example, which is also an hour.

Following are some examples showing no units on output:

```
=> SELECT INTERVAL '15' MINUTE;
 ?column?
----------
 15
(1 row)

=> SELECT INTERVAL '12 03' DAY TO HOUR;
 ?column?
----------
 12 03
(1 row)
```

The following example illustrates a SQL extension, where the 1 is in hours:

```
=> SELECT INTERVAL '1 2:3.004' HOUR TO SECOND;
   ?column?
--------------
 01:02:03.004
(1 row)
```

You can express the same inputs using a cast, or you can specify units:

```
=> SELECT (INTERVAL '1 02:03:04.56')::INTERVAL HOUR TO SECOND;
  ?column?
-------------
 26:03:04.56
(1 row)
```

You can also specify units in the above command:

```
=> SELECT INTERVAL '1 day 02:03:04.56' HOUR TO SECOND;
  ?column?
-------------
 26:03:04.56
(1 row)
```

Units on output

To enable interval units on output, issue the following command:

```
=> SET INTERVALSTYLE TO UNITS;
```

Units are now returned with the interval value 'days':

```
=> SELECT INTERVAL '3 days 2 hours';
   ?column?
--------------
 3 days 02:00
(1 row)
```

INTERVALSTYLE (page 635) and DATESTYLE (page 634) settings affect the interval output format only, not the interval input format. All interval output formats are accepted as input, independent of the current output format.

When units are enabled, their format is controlled by DATESTYLE (page 634). If you are expecting units on output but not seeing them, issue the SHOW DATESTYLE command. DATESTYLE must be set to ISO for INTERVAL to display units on output.

Units on input

A Vertica extension lets you include units within the ***interval-literal*** (page 30). These units do not control or affect the declared subtype range, which is declared by the ***interval-qualifier*** (on page 32).

```
=> SELECT INTERVAL '3 days 2 hours';
   ?column?
--------------
 3 days 02:00
(1 row)
```

Using the same interval-literal from the previous example, the following command still specifies units as days and hours, but the interval-qualifier extracts minutes values from the inputs:

```
=> SELECT INTERVAL '3 days 2 hours' MINUTE;
 ?column?
-----------
 4440 mins
(1 row)
```

Note: Inside the single quotes of an interval-literal, units can be plural, but outside the quotes, the interval-qualifier must take the singular form.

Vertica allows combinations of units, such as second and millisecond together in an INTERVAL DAY TO SECOND (or HOUR TO SECOND) subtype; however, each unit can be used one time only in the interval-literal string. The follow commands shows some of the combinations of units that are allowed:

```
=> SELECT INTERVAL '1 second 1 millisecond' DAY TO SECOND;
   ?column?
--------------
 00:00:01.001
(1 row)

=> SELECT INTERVAL '12:13:14 15 microseconds' DAY TO SECOND;
    ?column?
-----------------
 12:13:14.000015
(1 row)

=> SELECT INTERVAL '12:13:14.123 15 microseconds' DAY TO SECOND;
    ?column?
-----------------
 12:13:14.123015
(1 row)
```

The following command, however, is rejected because there are two seconds fields:

```
=> SELECT INTERVAL '12:13:14 15 seconds' DAY TO SECOND;
   ERROR:  invalid input syntax for type interval: "12:13:14 15 seconds"
```

If you remove the `seconds` unit, the command returns the expected result of 15 days, 12 hours, 13 minutes, and 14 seconds:

```
=> SELECT INTERVAL '12:13:14 15' DAY TO SECOND;
  ?column?
-------------
 15 12:13:14
(1 row)
```

There are cases where the data (interval-literal) looks like a year/month type, but the type is day/second, and the reverse. Vertica reads interval-literal data from left to right, where number-number is years-months, and number <space> <signed number> is whatever the units specify.

The following command is processed as follows: (-) 1 year 1 month as (-) 365 + 30 = -395 days:

```
=> SELECT INTERVAL '-1-1' DAY TO HOUR;
 ?column?
----------
 -395
(1 row)
```

The next command is processed as follows: (-) 1 day - 1 hour as (-) 24 - 1 = -23 hours:

```
=> SELECT INTERVAL '-1 -1' DAY TO HOUR;
 ?column?
----------
 -23
(1 row)
```

The next command is processed as follows: (-) 1 year - 1 month as (-) 365 - 30 = -335 days

```
=> SELECT INTERVAL '-1--1' DAY TO HOUR;
 ?column?
----------
 -335
(1 row)
```

The next command is processed as follows: 1 year 0 month -1 day as 365 + 0 - 1 = -364 days

```
=> SELECT INTERVAL '1- -1' DAY TO HOUR;
 ?column?
----------
 364
(1 row)
```

In the following example, the inputs '1 4 5 6' returns 1 day, 4 hours, 5 minutes, 6 seconds:

```
=> SELECT INTERVAL '1 4 5 6';
   ?column?
------------
  1 04:05:06
(1 row)
```

The following example shows the previous command with units turned on:

```
=> SELECT INTERVAL '1 4 5 6';
```

```
    ?column?
----------------
 1 day 04:05:06
(1 row)
```

In this example, the system recognizes the colon as being part of the timestamp and outputs 4 hours, 5 minutes, 6 seconds appropriately. When it reaches the 1, it knows it has already processed hours, minutes, and seconds and assigns the 1 value to the day field:

```
=> SELECT INTERVAL '4:5:6 1';
   ?column?
------------
  1 04:05:06
(1 row)
```

You get the same results if you rewrite the command as follows:

```
=> SELECT INTERVAL '1 4:5:6';
```

In the next example, Vertica recognizes the 4:5 combination as hour/minute, so input value 1 is assigned to day and the final value 2 is assigned to seconds:

```
SELECT INTERVAL '4:5 1 2';
   ?column?
------------
  1 04:05:02
(1 row)
```

You get the same results if you rewrite the command as follows:

```
=> SELECT INTERVAL '1 4:5 2';
```

If you reverse the 1 and the 2. the results change because of how Vertica processes the command:

```
=> SELECT INTERVAL '2 4:5 1';
  ?column?
------------
 2 04:05:01
(1 row)
```

Day/time and year/month intervals are logically independent and cannot be combined with or compared to one another. For example, in the following command, the `days` interval-literal is ignored when combined with the YEAR TO MONTH interval-qualifier, so the system returns only 1 year:

```
=> SELECT INTERVAL '1 y 30 days' YEAR TO MONTH;
 ?column?
----------
 1-0
(1 row)
```

If you replace the days interval-literal with an appropriate unit, for example one that represents months, Vertica returns the correct information of 1 year, 3 months:

```
=> SELECT INTERVAL '1 y 3 m' YEAR TO MONTH;
 ?column?
----------
 1-3
```

```
(1 row)
```

Notice that `m` was used as the interval-literal in the previous example, representing months. If you specify a DAY TO SECOND interval-qualifier, Vertica knows that `m` represents minutes. The following command, for example, returns 1 day, 0 hours, and three minutes:

```
=> SELECT INTERVAL '1 d 3 m' DAY TO SECOND;
 ?column?
----------
 1 00:03
(1 row)
```

The following series of examples use units in the input to return microseconds:

```
=> SELECT INTERVAL '4:5 1 2 34us';
      ?column?
-------------------
  1 04:05:02.000034
(1 row)
=> SELECT INTERVAL '4:5 1d 2 34us' HOUR TO SECOND;
     ?column?
-----------------
  28:05:02.000034
(1 row)
```

In the following example, 4:5 represents min:sec.

```
=> SELECT INTERVAL '4:5 1d 34us' MINUTE TO SECOND;
     ?column?
----------------
  1444:05.000034
(1 row)
```

The input unit `'m'` can represent either 'months' or 'minutes,' depending on context. To illustrate, the following command creates a one-column table with some interval vales:

```
=> CREATE TABLE int_test(i INTERVAL YEAR TO MONTH);
```

In the first `INSERT` statement, the values are inserted as 1 year, six months:

```
=> INSERT INTO int_test VALUES('1 year 6 months');
```

In the second `INSERT` statement, the minutes value is ignored, as the DAY TO SECOND part is truncated:

```
=> INSERT INTO int_test VALUES('1 year 6 minutes');
```

In the third `INSERT` statement, the 'm' counts as minutes value is ignored, as the `DAY TO SECOND` part is truncated:

=> INSERT INTO int_test VALUES('1 year 6 m'); -- the m counts as months Query the table and you will notice that the second row does not contain the minutes input:

```
=> SELECT * FROM int_test;
  i
-----
 1-6
 1-0
 1-6
```

```
(3 rows)
```

In the following command, the the 'm' counts as minutes, because the `DAY TO SECOND` interval-qualifier extracts day/time values from the input:

```
=> SELECT INTERVAL '1y6m' DAY TO SECOND;
 ?column?
-----------
 365 00:06
(1 row)
```

Notes

- The Vertica INTERVAL data type is SQL-2008 compliant, with extensions. It maintains compatibility with existing interval data. On Vertica databases created prior to version 4.0, all `INTERVAL` columns are interpreted as `INTERVAL DAY TO SECOND`, as in the previous release.
- On input, day/time intervals can be expressed as a combination of fields. Vertica converts these to microseconds, adds them together, and operates on the sum.
- An `INTERVAL` can include only the subset of units that you need; however, year/month intervals represent calendar years and months with no fixed fixed number of days, so year/month interval values cannot include days, hours, minutes. Similarly, day/time intervals cannot include year, month, and so on..
- Day/time and year/month intervals are logically independent and cannot be combined with or compared to one another. In the following example, data that contains `days` cannot be combined with the `YEAR TO MONTH` type.
- The primary day/time (`DAY TO SECOND`) and year/month (`YEAR TO MONTH`) subtype ranges can be restricted to more specific range of types by an interval-qualifier. For example, `HOUR TO MINUTE` is a limited form of day/time interval, which can be used to express time zone offsets.
- Quantities of days, hours, minutes, and seconds can be specified without explicit unit markings. For example, '1 12:59:10' is read the same as '1 day 12 hours 59 minutes 10 seconds'.
- Vertica accepts intervals up to 2^63 – 1 microseconds or months (about 18 digits).
- If an interval-qualifier is not specified, the default type is `DAY TO SECOND(6)`, no matter what data goes inside the quotes. For example, as an extension to SQL-2008, both of the following commands return `910` (days):

  ```
  => SELECT INTERVAL '2-6';
  => SELECT INTERVAL '2 years 6 months';
  ```

  However, if you change the interval-qualifier to `YEAR TO MONTH`, as in the following command, the returned value is 2-6 for 2 years 6 months:

  ```
  => SELECT INTERVAL '2 years 6 months' YEAR TO MONTH;
  ```

- SQL-2008 allows both the leftmost units field and the `SECOND` units field to include a precision specification of up to 6 fractional second places, with rounding, if fewer digits are wanted. When `SECOND` is not the first field, it has a precision of 2 places before the decimal point.

The following command specifies that the day field can hold 4 digits, the hour field 2 digits, the minutes field 2 digits, the seconds field 2 digits, and the fractional seconds field 6 digits:

```
=> SELECT INTERVAL '1000 12:00:01.123456' DAY(4) TO SECOND(6);
         ?column?
--------------------------
 1000 days 12:00:01.123456
```

A Vertica extension also lets you specify the seconds precision in the leftmost field. The result is the same:

```
=> SELECT INTERVAL(6) '1000 12:00:01.123456' DAY(4) TO SECOND;
 1000 12:00:01.123456
```

If you specify the seconds precision in both places, Vertica chooses the lesser value, rounding down:

```
=> SELECT INTERVAL(4) '1000 12:00:01.123456' DAY(4) TO SECOND(6);
   1000 12:00:01.1235
```

Notice that the placement of the seconds precision does not matter; Vertica chooses the lesser value, rounding down:

```
=> SELECT INTERVAL(6) '1000 12:00:01.123456' DAY(4) TO SECOND(4);
   1000 12:00:01.1235
```

- An interval-qualifier subtype can extracts other values from the input parameters. For example, the following commands extracts the `HOUR` value from the input parameters:

```
=> SELECT INTERVAL '3 days 2 hours' HOUR;
  ?column?
----------
 74
```

- When specifying intervals that use subtype `YEAR TO MONTH`, the returned value is kept as months. For example, in SQL format, `SELECT INTERVAL` '2 years 6 months' `YEAR TO MONTH`; returns 2-6, for two years and six months. If you use interval-qualifier month, you force the system to extract months from the input parameter; for example:

```
=> SELECT INTERVAL '2 years 6 months' MONTH;
 ?column?
-----------
 30
```

- `INTERVAL YEAR TO MONTH` can be used in an analytic RANGE window when the `ORDER BY` column type is `TIMESTAMP/TIMESTAMP WITH TIMEZONE`, or `DATE`; `TIME/TIME WITH TIMEZONE` are not supported. `INTERVAL DAY TO SECOND` can be used when the `ORDER BY` column type is `TIMESTAMP/TIMESTAMP WITH TIMEZONE`, `DATE`, and `TIME/TIME WITH TIMEZONE`.
- When months or years are specified for day/time intervals, the intervals extension assumes 30 days per month and 365 days per year.
- Since the length of a given month or year varies, day/time intervals are never output as months or years, only as days, hours, minutes, and so on.
- If you divide an interval by an interval, you get a pure number. For example, an interval divided by an interval returns `FLOAT`:

```
=> SELECT INTERVAL '28 days 3 hours' HOUR(4) / INTERVAL '27 days 3 hours'
   HOUR(4);
```

```
   1.036866359447
```

- `INTERVAL` divided by `FLOAT` is `INTERVAL`:

```
=> SELECT INTERVAL '3' MINUTE / 1.5;
   2
```

- `INTERVAL MODULO` (remainder) `INTERVAL` returns an `INTERVAL`:

```
=> SELECT INTERVAL '28 days 3 hours' HOUR(4) % INTERVAL '27 days 3 hours'
   HOUR(4);
   24
```

- You can add `INTERVAL` and `TIME`. `TIME` implicitly converts to `INTERVAL`, if necessary.

```
=> SELECT INTERVAL '1' HOUR + TIME '1:30';
   02:30:00
```

- Vertica supports intervals in milliseconds (hh:mm:ss:ms), where `01:02:03:25` represents 1 hour, 2 minutes, 3 seconds, and 025 milliseconds.

  Milliseconds are converted to fractional seconds; for example, the following command returns 1 day, 2 hours, 3 minutes, 4 seconds, and 25.5 milliseconds:

```
=> SELECT INTERVAL '1 02:03:04:25.5';
   1 02:03:04.0255
```

- In the SQL-2008 standard, the placement of a minus sign either before an `INTERVAL` literal or as the first character of the literal negates the entire literal, not just the first component.

  In Vertica a leading minus sign negates the entire interval, not just the first component. For example, both of the following commands return `-29 23:59:59`:

```
=> SELECT INTERVAL '-1 month - 1 second';
=> SELECT INTERVAL -'1 month - 1 second';
```

  Use one of the following commands instead, which return the intended `-30 00:00:01`:

```
=> SELECT INTERVAL -'1 month 1 second';
=> SELECT INTERVAL -'30 00:00:01';
```

  Note that two negatives together return a positive:

```
=> SELECT INTERVAL -'-1 month - 1 second';
   29 23:59:59
=> SELECT INTERVAL -'-1 month 1 second';
   30 00:00:01
```

- Vertica allows the input of negative months but requires two negatives when paired with years. Note that the year-hyphen-month syntax allows no spaces:

```
=> SELECT INTERVAL '3-3' YEAR TO MONTH;
   3-3
=> SELECT INTERVAL '3--3' YEAR TO MONTH;
   2-9
```

- Vertica allows fractional minutes. If the number comes out uneven enough it goes into the seconds field. In the following example, the command returns a value of 0 hours and 10 minutes:

```
=> SELECT INTERVAL '10 minutes';
   00:10
```

  Now specify an interval of 10.5 minutes:

```
=> SELECT INTERVAL '10.5 minutes';
```

```
   00:10:30
```

- `INTERVALYM` is an alias for the `INTERVAL YEAR TO MONTH` subtypes and is used only on input. For example, the following command returns 1 year:

```
=> SELECT INTERVALYM '1' year;
   1
```

However, you cannot use day as the input:

```
=> SELECT INTERVALYM '1' day;
   ERROR:  Conflicting INTERVAL subtypes
```

Examples

The table that follows shows additional interval examples. The INTERVALSTYLE is set to plain (omitting units on output) for brevity.

Note: Remember that if you omit the ***interval-qualifier*** (page 32), the type defaults to DAY TO SECOND(6).

Command	Result
`select interval '00:2500:00';`	1 17:40
`select interval '2500' minute to second;`	2500
`select interval '2500' minute;`	2500
`select interval '28 days 3 hours' hour to second;`	675.00
`select interval(3) '28 days 3 hours';`	28 03:00
`select interval(3) '28 days 3 hours 1.234567';`	28 03:01:14.074
`select interval(3) '28 days 3 hours 1.234567 sec';`	28 03:00:01.235
`select interval(3) '28 days 3.3 hours' hour to second;`	675.18
`select interval(3) '28 days 3.35 hours' hour to second;`	675.21
`select interval(3) '28 days 3.37 hours' hour to second;`	675:22:12
`select interval '1.234567 days' hour to second;`	29:37:46.5888
`select interval '1.23456789 days' hour to second;`	29:37:46.665696
`select interval(3) '1.23456789 days' hour to second;`	29:37:46.666
`select interval(3) '1.23456789 days' hour to second(2);`	29:37:46.67
`select interval(3) '01:00:01.234567' as "one hour+";`	01:00:01.235
`select interval(3) '01:00:01.234567' = interval(3) '01:00:01.234567';`	t
`select interval(3) '01:00:01.234567' = interval '01:00:01.234567';`	f
`select interval(3) '01:00:01.234567' = interval '01:00:01.234567' hour to second(3);`	t
`select interval(3) '01:00:01.234567' = interval '01:00:01.234567' minute to second(3);`	t
`select interval '255 1.1111' minute to second(3);`	255:01.111
`select interval '@ - 5 ago';`	5
`select interval '@ - 5 minutes ago';`	00:05
`select interval '@ 5 minutes ago';`	-00:05
`select interval '@ ago -5 minutes';`	00:05
`select date_part('month', interval '2-3' year to month);`	3
`SELECT FLOOR((TIMESTAMP '2005-01-17 10:00' - TIMESTAMP '2005-01-01') / INTERVAL '7');`	2

See Also

Interval Values (page 29) for a description of the values that can be represented in an INTERVAL type

INTERVALSTYLE (page 635) and ***DATESTYLE*** (page 634)

AGE_IN_MONTHS (page 178) and ***AGE_IN_YEARS*** (page 179)

interval-literal

The following table lists the units allowed for an `interval-literal` parameter.

Unit	Description
a	Julian year, 365.25 days exactly
ago	Indicates negative time offset
c, cent, century	Century
centuries	Centuries
d, day	Day
days	Days
dec, decade	Decade
decades, decs	Decades
h, hour, hr	Hour
hours, hrs	Hours
ka	Julian kilo-year, 365250 days exactly
m	Minute or month for year/month, depending on context. See Notes below table.
microsecond	Microsecond
microseconds	Microseconds
mil, millennium	Millennium
millennia, mils	Millennia
millisecond	Millisecond
milliseconds	Milliseconds
min, minute, mm	Minute
mins, minutes	Minutes
mon, month	Month
mons, months	Months
ms, msec, millisecond	Millisecond
mseconds, msecs	Milliseconds
p	Start of ISO Duration (Period) fields
qtr, quarter	Quarter
s, sec, second	Second

seconds, secs	Seconds
t	Start of ISO Duration (Period) fields
time zone	Time zone, if quoted time offset
timezone	Timezone time offset
timezone_h	Timezone hour
timezone_m	Timezone minutes
us, usec	Microsecond
microseconds, useconds, usecs	Microseconds
w, week	Week
weeks	Weeks
y, year, yr	Year
years, yrs	Years

Notes

The input unit `'m'` can represent either 'months' or 'minutes,' depending on context. To illustrate, the following command creates a one-column table with some interval vales:

```
=> CREATE TABLE int_test(i INTERVAL YEAR TO MONTH);
```

In the first `INSERT` statement, the values are inserted as 1 year, six months:

```
=> INSERT INTO int_test VALUES('1 year 6 months');
```

In the second `INSERT` statement, the minutes value is ignored, as the DAY TO SECOND part is truncated:

```
=> INSERT INTO int_test VALUES('1 year 6 minutes');
```

In the third `INSERT` statement, the 'm' counts as minutes value is ignored, as the `DAY TO SECOND` part is truncated:

=> INSERT INTO int_test VALUES('1 year 6 m'); -- the m counts as months Query the table and you will notice that the second row does not contain the minutes input:

```
=> SELECT * FROM int_test;
  i
-----
 1-6
 1-0
 1-6
(3 rows)
```

In the following command, the the 'm' counts as minutes, because the `DAY TO SECOND` interval-qualifier extracts day/time values from the input:

```
=> SELECT INTERVAL '1y6m' DAY TO SECOND;
 ?column?
-----------
```

```
 365 00:06
(1 row)
```

interval-qualifier

The following table lists the optional interval qualifiers. Values in INTERVAL fields, other than SECOND, are integers with a default precision of 2 when they are not the first field.

Interval Type	Units	Valid interval-literal entries
Day/time intervals	DAY	Unconstrained.
	DAY TO HOUR	An interval that represents a span of days and hours.
	DAY TO MINUTE	An interval that represents a span of days and minutes.
	DAY TO SECOND	(Default) interval that represents a span of days, hours, minutes, seconds, and fractions of a second if subtype unspecified.
	HOUR	Hours within days.
	HOUR TO MINUTE	An interval that represents a span of hours and minutes.
	HOUR TO SECOND	An interval that represents a span of hours and seconds.
	MINUTE	Minutes within hours.
	MINUTE TO SECOND	An interval that represents a span of minutes and seconds.
	SECOND	Seconds within minutes. **Note:** The SECOND field can have an interval fractional seconds precision, which indicates the number of decimal digits maintained following the decimal point in the SECONDS value. When SECOND is not the first field, it has a precision of 2 places before the decimal point.
Year/month intervals	MONTH	Months within year.
	YEAR	Unconstrained.
	YEAR TO MONTH	An interval that represents a span of years and months.

Notes

You cannot combine day/time and year/month qualifiers. For example, the following intervals are not allowed:

- DAY TO YEAR
- HOUR TO MONTH

SMALLDATETIME

SMALLDATETIME is an alias for ***TIMESTAMP*** (page 87).

TIME

Consists of a time of day with or without a time zone.

Syntax

```
TIME [ (p) ] [ { WITH | WITHOUT } TIME ZONE ] | TIMETZ
[ AT TIME ZONE (see "TIME AT TIME ZONE" on page 86) ]
```

Parameters

p	(Precision) specifies the number of fractional digits retained in the seconds field. By default, there is no explicit bound on precision. The allowed range 0 to 6.
WITH TIME ZONE	Specifies that valid values must include a time zone
WITHOUT TIME ZONE	Specifies that valid values do not include a time zone (default). If a time zone is specified in the input it is silently ignored.
TIMETZ	Is the same as TIME WITH TIME ZONE with no precision

Limits

Data Type	Low Value	High Value	Resolution
TIME [*p*]	00:00:00.00	23:59:59.99	1 MS / 14 digits
TIME [*p*] WITH TIME ZONE	00:00:00.00+12	23:59:59.99-12	1 ms / 14 digits

Example	Description
04:05:06.789	ISO 8601
04:05:06	ISO 8601
04:05	ISO 8601
040506	ISO 8601
04:05 AM	Same as 04:05; AM does not affect value
04:05 PM	Same as 16:05; input hour must be <= 12
04:05:06.789-8	ISO 8601
04:05:06-08:00	ISO 8601

04:05-08:00	ISO 8601
040506-08	ISO 8601
04:05:06 PST	Time zone specified by name

Notes

- TIME is purely a time-of-day, so you cannot ***ADD_MONTHS*** (page 177) to it or cast it to a TIMESTAMP; both of these need a date-part.
- Vertica supports adding milliseconds to a TIME or TIMETZ value.

```
=> CREATE TABLE temp (datecol TIME);
=> INSERT INTO temp VALUES (TIME '12:47:32.62');
=> INSERT INTO temp VALUES (TIME '12:55:49.123456');
=> INSERT INTO temp VALUES (TIME '01:08:15.12374578');
=> SELECT * FROM temp;
     datecol
-----------------
 12:47:32.62
 12:55:49.123456
 01:08:15.123746
(3 rows)
```

TIME AT TIME ZONE

The TIME AT TIME ZONE construct converts TIMESTAMP and TIMESTAMP WITH ZONE types to different time zones.

TIME ZONE is a synonym for TIMEZONE. Both are allowed in Vertica syntax.

Syntax

timestamp AT TIME ZONE *zone*

Parameters

timestamp	TIMESTAMP	Converts UTC to local time in given time zone
	TIMESTAMP WITH TIME ZONE	Converts local time in given time zone to UTC
	TIME WITH TIME ZONE	Converts local time across time zones
zone	Is the desired time zone specified either as a text string (for example: 'PST') or as an interval (for example: INTERVAL '-08:00'). In the text case, the available zone names are abbreviations. The files in /opt/vertica/share/timezonesets define the default list of strings accepted in the *zone* parameter	

Examples

The local time zone is PST8PDT. The first example takes a zone-less timestamp and interprets it as MST time (UTC- 7) to produce a UTC timestamp, which is then rotated to PST (UTC-8) for display:

```
=> SELECT TIMESTAMP '2001-02-16 20:38:40' AT TIME ZONE 'MST'; timezone
-----------------------
 2001-02-16 22:38:40-05
(1 row)
```

The second example takes a timestamp specified in EST (UTC-5) and converts it to local time in MST (UTC-7):

```
=> SELECT TIMESTAMP WITH TIME ZONE '2001-02-16 20:38:40-05' AT TIME ZONE 'MST';
timezone
--------------------
 2001-02-16 18:38:40
(1 row)
```

TIMESTAMP

Consists of a date and a time with or without a time zone and with or without a historical epoch (AD or BC).

Syntax

```
TIMESTAMP [ (p) ] [ { WITH | WITHOUT } TIME ZONE ] | TIMESTAMPTZ
[ AT TIME ZONE (see "TIME AT TIME ZONE" on page 86) ]
```

Parameters

p	Optional precision value that specifies the number of fractional digits retained in the seconds field. By default, there is no explicit bound on precision. The allowed range of *p* is 0 to 6.
WITH TIME ZONE	Specifies that valid values must include a time zone. All TIMESTAMP WITH TIME ZONE values are stored internally in UTC. They are converted to local time in the zone specified by the time zone configuration parameter before being displayed to the client.
WITHOUT TIME ZONE	Specifies that valid values do not include a time zone (default). If a time zone is specified in the input it is silently ignored.
TIMESTAMPTZ	Is the same as TIMESTAMP WITH TIME ZONE.

Limits

In the following table, values are rounded.

Data Type	Low Value	High Value	Resolution
TIMESTAMP [(*p*)] [WITHOUT TIME ZONE]	290279 BC	294277 AD	1 US / 14 digits
TIMESTAMP [(*p*)] WITH TIME ZONE	290279 BC	294277 AD	1 US / 14 digits

Notes

- TIMESTAMP is an alias for DATETIME and SMALLDATETIME.
- Valid input for TIMESTAMP types consists of a concatenation of a date and a time, followed by an optional time zone, followed by an optional AD or BC.

- AD/BC can appear before the time zone, but this is not the preferred ordering.
- The SQL standard differentiates TIMESTAMP WITHOUT TIME ZONE and TIMESTAMP WITH TIME ZONE literals by the existence of a "+"; or "-". Hence, according to the standard:

  TIMESTAMP '2004-10-19 10:23:54' is a TIMESTAMP WITHOUT TIME ZONE.

  TIMESTAMP '2004-10-19 10:23:54+02' is a TIMESTAMP WITH TIME ZONE.

  Note: Vertica differs from the standard by requiring that TIMESTAMP WITH TIME ZONE literals be explicitly typed:
  TIMESTAMP WITH TIME ZONE '2004-10-19 10:23:54+02'
- If a literal is not explicitly indicated as being of TIMESTAMP WITH TIME ZONE, Vertica silently ignores any time zone indication in the literal. That is, the resulting date/time value is derived from the date/time fields in the input value, and is not adjusted for time zone.
- For TIMESTAMP WITH TIME ZONE, the internally stored value is always in UTC. An input value that has an explicit time zone specified is converted to UTC using the appropriate offset for that time zone. If no time zone is stated in the input string, then it is assumed to be in the time zone indicated by the system's TIME ZONE parameter, and is converted to UTC using the offset for the TIME ZONE zone.
- When a TIMESTAMP WITH TIME ZONE value is output, it is always converted from UTC to the current TIME ZONE zone and displayed as local time in that zone. To see the time in another time zone, either change TIME ZONE or use the AT TIME ZONE construct.
- Conversions between TIMESTAMP WITHOUT TIME ZONE and TIMESTAMP WITH TIME ZONE normally assume that the TIMESTAMP WITHOUT TIME ZONE value are taken or given as TIME ZONE local time. A different zone reference can be specified for the conversion using AT TIME ZONE.
- TIMESTAMPTZ and TIMETZ are not parallel SQL constructs. TIMESTAMPTZ records a time and date in GMT, converting from the specified TIME ZONE. TIMETZ records the specified time and the specified time zone, in minutes, from GMT.timezone
- The following list represents typical date/time input variations:
  - 1999-01-08 04:05:06
  - 1999-01-08 04:05:06 -8:00
  - January 8 04:05:06 1999 PST
- Vertica supports adding a floating-point (in days) to a TIMESTAMP or TIMESTAMPTZ value.
- Vertica supports adding milliseconds to a TIMESTAMP or TIMESTAMPTZ value.
- In Vertica, ***intervals*** (page 70) are represented internally as some number of microseconds and printed as up to 60 seconds, 60 minutes, 24 hours, 30 days, 12 months, and as many years as necessary. Fields are either positive or negative.

Examples

You can return infinity by specifying 'infinity':

```
=> SELECT TIMESTAMP 'infinity';
 timestamp
-----------
 infinity
(1 row)
```

To use the minimum TIMESTAMP value lower than the minimum rounded value:

```
=> SELECT '-infinity'::timestamp;
 timestamp
-----------
 -infinity
(1 row)
```

TIMESTAMP/TIMESTAMPTZ has +/-infinity values.

AD/BC can be placed almost anywhere within the input string; for example:

```
SELECT TIMESTAMPTZ 'June BC 1, 2000 03:20 PDT';
        timestamptz
---------------------------
 2000-06-01 05:20:00-05 BC
(1 row)
```

Notice the results are the same if you move the BC after the 1:

```
SELECT TIMESTAMPTZ 'June 1 BC, 2000 03:20 PDT';
        timestamptz
---------------------------
 2000-06-01 05:20:00-05 BC
(1 row)
```

And the same if you place the BC in front of the year:

```
SELECT TIMESTAMPTZ 'June 1, BC 2000 03:20 PDT';
        timestamptz
---------------------------
 2000-06-01 05:20:00-05 BC
(1 row);
```

The following example returns the year 45 before the Common Era:

```
=> SELECT TIMESTAMP 'April 1, 45 BC';
       timestamp
-----------------------
 0045-04-01 00:00:00 BC
(1 row)
```

If you omit the BC from the date input string, the system assumes you want the year 45 in the current century:

```
=> SELECT TIMESTAMP 'April 1, 45';
      timestamp
--------------------
 2045-04-01 00:00:00
(1 row)
```

In the following example, Vertica returns results in years, months, and days, whereas other RDBMS might return results in days only:

```
=> SELECT TIMESTAMP WITH TIME ZONE '02/02/294276'- TIMESTAMP WITHOUT TIME ZONE
'02/20/2009' AS result;
           result
-----------------------------
 292266 years 11 mons 12 days
```

```
(1 row)
```

To specify a specific time zone, add it to the statement, such as the use of 'ACST' in the following example:

```
=> SELECT T1 AT TIME ZONE 'ACST', t2 FROM test;
      timezone       | t2
---------------------+-------------
 2009-01-01 04:00:00 | 02:00:00-07
 2009-01-01 01:00:00 | 02:00:00-04
 2009-01-01 04:00:00 | 02:00:00-06
```

You can specify a floating point in days:

```
=> SELECT 'NOW'::TIMESTAMPTZ + INTERVAL '1.5 day' AS '1.5 days from now';
       1.5 days from now
-------------------------------
 2009-03-18 21:35:23.633-04
(1 row)
```

The following example illustrates the difference between TIMESTAMPTZ with and without a precision specified:

```
=> SELECT TIMESTAMPTZ(3) 'now', TIMESTAMPTZ 'now';
        timestamptz         |          timestamptz
----------------------------+-------------------------------
 2009-02-24 11:40:26.177-05 | 2009-02-24 11:40:26.177368-05
(1 row)
```

The following statement returns an error because the TIMESTAMP is out of range:

```
=> SELECT TIMESTAMP '294277-01-09 04:00:54.775808';
ERROR:  date/time field value out of range: "294277-01-09 04:00:54.775808"
```

There is no 0 AD, so be careful when you subtract BC years from AD years:

```
=> SELECT EXTRACT(YEAR FROM TIMESTAMP '2001-02-16 20:38:40'); date_part
-----------
      2001
(1 row)
```

The following commands create a table with a TIMESTAMP column that contains milliseconds:

```
CREATE TABLE temp (datecol TIMESTAMP);
INSERT INTO temp VALUES (TIMESTAMP '2010-03-25 12:47:32.62');
INSERT INTO temp VALUES (TIMESTAMP '2010-03-25 12:55:49.123456');
INSERT INTO temp VALUES (TIMESTAMP '2010-03-25 01:08:15.12374578');
 SELECT * FROM temp;
          datecol
----------------------------
 2010-03-25 12:47:32.62
 2010-03-25 12:55:49.123456
 2010-03-25 01:08:15.123746
(3 rows)
```

Additional Examples

Command	Result
`select (timestamp '2005-01-17 10:00' - timestamp '2005-01-01');`	16 10:10
`select (timestamp '2005-01-17 10:00' - timestamp '2005-01-01') / 7;`	2 08:17:08.571429
`select (timestamp '2005-01-17 10:00' - timestamp '2005-01-01') day;`	16
`select cast((timestamp '2005-01-17 10:00' - timestamp '2005-01-01') day as integer) / 7;`	2
`select floor((timestamp '2005-01-17 10:00' - timestamp '2005-01-01') / interval '7');`	2
`select timestamptz '2009-05-29 15:21:00.456789';`	2009-05-29 15:21:00.456789-04
`select timestamptz '2009-05-28';`	2009-05-28 00:00:00-04
`select timestamptz '2009-05-29 15:21:00.456789'-timestamptz '2009-05-28';`	1 15:21:00.456789
`select (timestamptz '2009-05-29 15:21:00.456789'-timestamptz '2009-05-28');`	1 15:21:00.456789
`select (timestamptz '2009-05-29 15:21:00.456789'-timestamptz '2009-05-28')(3);`	1 15:21:00.457
`select (timestamptz '2009-05-29 15:21:00.456789'-timestamptz '2009-05-28')second;`	141660.456789
`select (timestamptz '2009-05-29 15:21:00.456789'-timestamptz '2009-05-28') year;`	0
`select (timestamptz '2009-05-29 15:21:00.456789'-timestamptz '2007-01-01') month;`	28
`select (timestamptz '2009-05-29 15:21:00.456789'-timestamptz '2007-01-01') year;`	2
`select (timestamptz '2009-05-29 15:21:00.456789'-timestamptz '2007-01-01') year to month;`	2-4
`select (timestamptz '2009-05-29 15:21:00.456789'-timestamptz '2009-05-28') second(3);`	141660.457
`select (timestamptz '2009-05-29 15:21:00.456789'-timestamptz '2009-05-28') minute(3);`	2361
`select (timestamptz '2009-05-29 15:21:00.456789'-timestamptz '2009-05-28') minute;`	2361
`select (timestamptz '2009-05-29 15:21:00.456789'-timestamptz '2009-05-28') minute to second(3);`	2361:00.457
`select (timestamptz '2009-05-29 15:21:00.456789'-timestamptz '2009-05-28') minute to second;`	2361:00.456789

TIMESTAMP AT TIME ZONE

The `TIMESTAMP AT TIME ZONE` construct converts `TIMESTAMP` and `TIMESTAMP WITH ZONE` types to different time zones.

`TIME ZONE` is a synonym for `TIMEZONE`. Both are allowed in Vertica syntax.

Syntax

`timestamp` `AT TIME ZONE` *`zone`*

Parameters

`timestamp`	`TIMESTAMP`	Converts UTC to local time in given time zone
	`TIMESTAMP WITH TIME ZONE`	Converts local time in given time zone to UTC
	`TIME WITH TIME ZONE`	Converts local time across time zones

zone	Is the desired time zone specified either as a text string (for example: `'PST'`) or as an interval (for example: `INTERVAL '-08:00'`). In the text case, the available zone names are abbreviations. The files in `/opt/vertica/share/timezonesets` define the default list of strings accepted in the *zone* parameter.

Examples

The local time zone is `PST8PDT`. The first example takes a zone-less timestamp and interprets it as MST time (UTC- 7) to produce a UTC timestamp, which is then rotated to PST (UTC-8) for display:

```
=> SELECT TIMESTAMP '2001-02-16 20:38:40' AT TIME ZONE 'MST'; timezone
------------------------
 2001-02-16 22:38:40-05
(1 row)
```

The second example takes a timestamp specified in EST (UTC-5) and converts it to local time in MST (UTC-7):

```
=> SELECT TIMESTAMP WITH TIME ZONE '2001-02-16 20:38:40-05' AT TIME ZONE 'MST';
timezone
---------------------
 2001-02-16 18:38:40
(1 row)
```

Numeric Data Types

Numeric data types are numbers stored in database columns. These data types are typically grouped by:

- **Exact** numeric types , values where the precision and scale need to be preserved. The exact numeric types are `BIGINT`, `DECIMAL`, `INTEGER`, `NUMERIC`, `NUMBER`, and `MONEY`.
- **Approximate** numeric types, values where the precision needs to be preserved and the scale can be floating. The approximate numeric types are `DOUBLE PRECISION`, `FLOAT`, and `REAL`.

Implicit casts from `INTEGER`, `FLOAT`, and `NUMERIC` to `VARCHAR` are not supported. If you need that functionality, write an explicit cast using one of the following forms:

`CAST(x AS data-type-name)` or `x::data-type-name`

The following example casts a float to an integer:

```
=> SELECT(FLOAT '123.5')::INT;
 ?column?
----------
      124
(1 row)
```

String-to-numeric data type conversions accept formats of quoted constants for scientific notation, binary scaling, hexadecimal, and combinations of numeric-type literals:

- Scientific notation:
  ```
  => SELECT FLOAT '1e10';
  ```

```
  ?column?
-------------
 10000000000
(1 row)
```

- `BINARY` scaling:

```
=> SELECT NUMERIC '1p10';
 ?column?
----------
     1024
(1 row)
```

- Hexadecimal:

```
=> SELECT NUMERIC '0x0abc';
 ?column?
----------
     2748
(1 row)
```

- Combinations:

```
=> SELECT NUMERIC '0x1pe3';
 ?column?
----------
     1000
(1 row)
```

Note: The `p` (which defaults to `p0`) is required for hexadecimal, because `SELECT '0x1e3'::NUMERIC = 483`.

DOUBLE PRECISION (FLOAT)

Vertica supports the numeric data type DOUBLE PRECISION, which is the IEEE-754 8-byte floating point type, along with most of the usual floating point operations.

Syntax

```
[ DOUBLE PRECISION | FLOAT | FLOAT(n) | FLOAT8 | REAL ]
```

Parameters

Note: On a machine whose floating-point arithmetic does not follow IEEE-754, these values probably do not work as expected.

Double precision is an inexact, variable-precision numeric type. In other words, some values cannot be represented exactly and are stored as approximations. Thus, input and output operations involving double precision might show slight discrepancies.

- All of the DOUBLE PRECISION data types are synonyms for 64-bit IEEE FLOAT.
- The *n* in FLOAT(n) must be between 1 and 53, inclusive, but a 53-bit fraction is always used. See the IEEE-754 standard for details.
- For exact numeric storage and calculations (money for example), use NUMERIC.
- Floating point calculations depend on the behavior of the underlying processor, operating system, and compiler.
- Comparing two floating-point values for equality might not work as expected.

Values

COPY (page 497) accepts floating-point data in the following format:

1 Optional leading white space

2 An optional plus ("+") or minus sign ("-")

3 A decimal number, a hexadecimal number, an infinity, a NAN, or a null value

A decimal number consists of a non-empty sequence of decimal digits possibly containing a radix character (decimal point "."), optionally followed by a decimal exponent. A decimal exponent consists of an "E" or "e", followed by an optional plus or minus sign, followed by a non-empty sequence of decimal digits, and indicates multiplication by a power of 10.

A hexadecimal number consists of a "0x" or "0X" followed by a non-empty sequence of hexadecimal digits possibly containing a radix character, optionally followed by a binary exponent. A binary exponent consists of a "P" or "p", followed by an optional plus or minus sign, followed by a non-empty sequence of decimal digits, and indicates multiplication by a power of 2. At least one of radix character and binary exponent must be present.

An infinity is either INF or INFINITY, disregarding case.

A NaN (Not A Number) is NAN (disregarding case) optionally followed by a sequence of characters enclosed in parentheses. The character string specifies the value of NAN in an implementation-dependent manner. (The Vertica internal representation of NAN is 0xfff8000000000000LL on x86 machines.)

When writing infinity or NAN values as constants in a SQL statement, enclose them in single quotes. For example:

```
=> UPDATE table SET x = 'Infinity'
```

Note: Vertica follows the IEEE definition of NaNs (IEEE 754). The SQL standards do not specify how floating point works in detail.

IEEE defines NaNs as a set of floating point values where each one is not equal to anything, even to itself. A NaN is not greater than and at the same time not less than anything, even itself. In other words, comparisons always return false whenever a NaN is involved.

However, for the purpose of sorting data, NaN values must be placed somewhere in the result. The value generated 'NaN' appears in the context of a floating point number matches the NaN value generated by the hardware. For example, Intel hardware generates (0xfff8000000000000LL), which is technically a Negative, Quiet, Non-signaling NaN.

Vertica uses a different NaN value to represent floating point NULL (0x7ffffffffffffffeLL). This is a Positive, Quiet, Non-signaling NaN and is reserved by Vertica

The load file format of a null value is user defined, as described in the `COPY` (page 497) command. The Vertica internal representation of a null value is 0x7fffffffffffffffLL. The interactive format is controlled by the vsql printing option null. For example:

```
\pset null '(null)'
```

The default option is not to print anything.

Rules

- -0 == +0
- 1/0 = Infinity
- 0/0 == Nan
- NaN != anything (even NaN)

To search for NaN column values, use the following predicate:

```
... WHERE column != column
```

This is necessary because `WHERE` *column* `= 'Nan'` cannot be true by definition.

Sort Order (Ascending)

- NaN
- -Inf
- numbers
- +Inf
- NULL

Notes

- Vertica does not support `REAL` (`FLOAT4`) or `NUMERIC`.

- `NULL` appears last (largest) in ascending order.
- All overflows in floats generate +/-infinity or NaN, per the IEEE floating point standard.

INTEGER

A signed 8-byte (64-bit) data type.

Syntax

```
[ INTEGER | INT | BIGINT | INT8 | SMALLINT | TINYINT ]
```

Parameters

`INT`, `INTEGER`, `INT8`, and `BIGINT` are all synonyms for the same signed 64-bit integer data type. Automatic compression techniques are used to conserve disk space in cases where the full 64 bits are not required.

Notes

- The range of values is -2^63+1 to 2^63-1.
- 2^63 = 9,223,372,036,854,775,808 (19 digits).
- The value -2^63 is reserved to represent NULL.
- `NULL` appears first (smallest) in ascending order.
- Vertica does not have an explicit 4-byte (32-bit integer) or smaller types. Vertica's encoding and compression automatically eliminate the storage overhead of values that fit in less than 64 bits.

Restrictions

- The JDBC type INTEGER is 4 bytes and is not supported by Vertica. Use `BIGINT` instead.
- Vertica does not support the SQL/JDBC types `NUMERIC`, `SMALLINT`, or `TINYINT`.
- Vertica does not check for overflow (positive or negative) except in the aggregate function `SUM (page 116)()`. If you encounter overflow when using `SUM`, use `SUM_FLOAT (page 117)()` which converts to floating point.

NUMERIC

Numeric data types store numeric data. For example, a money value of $123.45 could be stored in a `NUMERIC(5,2)` field.

Syntax

```
NUMERIC | DECIMAL | NUMBER | MONEY [ ( precision [ , scale ] ) ]
```

Parameters

precision	The number of significant decimal digits, or the number of digits that the data type stores. Precision *p* must be positive and <= 1024.
scale	Expressed in decimal digits and can be any integer representable in a 16-bit field. The default scale *s* is 0 <=scale <= precision; omitting scale is the same as s=0.

Notes

- NUMERIC, DECIMAL, NUMBER, and MONEY are all synonyms that return NUMERIC types. Note, however, that the default values for NUMBER and MONEY are implemented a bit differently:

Type	Precision	Scale
NUMERIC	37	15
DECIMAL	37	15
NUMBER	38	0
MONEY	18	4

- NUMERIC data types support exact representations of numbers that can be expressed with a number of digits before and after a decimal point. This contrasts slightly with existing Vertica data types:
  - DOUBLE PRECISION (page 94) (FLOAT) types support ~15 digits, variable exponent, and represent numeric values approximately.
  - INTEGER (page 97) (and similar) types support ~18 digits, whole numbers only.
- NUMERIC data types are generally called *exact* numeric data types because they store numbers of a specified precision and scale. The *approximate* numeric data types, such as DOUBLE PRECISION, use floating points and are less precise.
- Supported numeric operations include the following:
  - Basic math; for example, +, -, *, /
  - Aggregation; for example, SUM, MIN, MAX, COUNT
  - Comparison operators; for example, <=, =, <=>, <>, >, >=
- NUMERIC divide operates directly on numeric values, without converting to floating point. The result has at least 18 decimal places and is rounded.
- NUMERIC mod (including %) operates directly on numeric values, without converting to floating point. The result has the same scale as the numerator and never needs rounding.
- ***COPY*** (page 497) accepts DECIMAL number with a decimal point ('.'), prefixed by - or +(optional).
- LZO, RLE, and BLOCK_DICT are supported encoding types. Anything that can be used on an INTEGER can also be used on a NUMERIC, as long as the precision is <= 18.
- NUMERIC is preferred for non-integer constants, as this typically improves precision. For example:

```
=> SELECT 1.1 + 2.2 = 3.3;
 ?column?
----------
 t
(1 row)
=>  SELECT 1.1::float + 2.2::float = 3.3::float;
 ?column?
----------
 f
(1 row)
```

- Performance of the NUMERIC data type has been fine tuned for the common case of 18 digits of precision.

- Some of the more complex operations used with NUMERIC data types result in an implicit cast to FLOAT. When using SQRT, STDDEV, transcendental functions such as LOG, and TO_CHAR/TO_NUMBER formatting, the result is always FLOAT.

Examples

The following series of commands creates a table that contains a NUMERIC data type and then performs some mathematical operations on the data:

```
=> CREATE TABLE num1 (id INTEGER, amount NUMERIC(8,2));
```

Now insert some values into the table:

```
=> INSERT INTO num1 VALUES (1, 123456.78);
```

Query the table:

```
=> SELECT * FROM num1;
  id  |  amount
------+-----------
    1 | 123456.78
(1 row)
```

The following example returns the NUMERIC column, amount, from table num1:

```
=> SELECT amount FROM num1;
  amount
-----------
 123456.78
(1 row)
```

The following syntax adds one (1) to the amount:

```
=> SELECT amount+1 AS 'amount' FROM num1;
  amount
-----------
 123457.78
(1 row)
```

The following syntax multiplies the amount column by 2:

```
=> SELECT amount*2 AS 'amount' FROM num1;
  amount
-----------
 246913.56
(1 row)
```

The following syntax returns a negative number for the amount column:

```
=> SELECT -amount FROM num1;
  ?column?
------------
 -123456.78
(1 row)
```

The following syntax returns the absolute value of the amount argument:

```
=> SELECT ABS(amount) FROM num1;
    ABS
-----------
```

```
 123456.78
(1 row)
```

The following syntax casts the NUMERIC `amount` as a FLOAT data type:

```
=> SELECT amount::float FROM num1;
  amount
-----------
 123456.78
(1 row)
```

See Also

Mathematical Functions (page 229)

Numeric Data Type Overflow

Vertica does not check for overflow (positive or negative) except in the aggregate function `SUM (page 116)()`. If you encounter overflow when using `SUM`, use `SUM_FLOAT (page 117)()` which converts to floating point.

For `INTEGER` data types, dividing zero by zero returns zero:

```
=>  SELECT 0/0;
 ?column?
----------
        0
(1 row)
```

Dividing anything else by zero returns a run-time error.

```
=> SELECT 1/0;
   ERROR:  division by zero
=> SELECT 0.0/0;
   ERROR:  numeric division by zero
```

Add, subtract, and multiply operations ignore overflow. Sum and average operations use 128-bit arithmetic internally. `SUM (page 116)()` reports an error if the final result overflows, suggesting the use of `SUM_FLOAT (page 117)(INT)`, which converts the 128-bit sum to a `FLOAT8`. For example:

```
=> CREATE TEMP TABLE t (i INT);
=> INSERT INTO t VALUES (1<<62);
=> INSERT INTO t VALUES (1<<62);
=> INSERT INTO t VALUES (1<<62);
=> INSERT INTO t VALUES (1<<62);
=> INSERT INTO t VALUES (1<<62);
=> SELECT SUM(i) FROM t;
   ERROR: sum() overflowed
   HINT: try sum_float() instead
=> SELECT SUM_FLOAT(i) FROM t;
     sum_float
---------------------
 2.30584300921369e+19
```

Data Type Coercion

Vertica currently has two types of cast, implicit and explicit. Vertica implicitly casts (coerces) expressions from one type to another under certain circumstances.

To illustrate, first get today's date:

```
=> SELECT DATE 'now';
  ?column?
------------
 2010-10-19
(1 row)
```

The following command converts `DATE` to a `TIMESTAMP` and adds a day and a half to the results by using `INTERVAL`:

```
=> SELECT DATE 'now' + INTERVAL '1 12:00:00';
      ?column?
---------------------
 2010-10-20 12:00:00
(1 row)
```

When there is no ambiguity as to the data type of an expression value, it is implicitly coerced to match the expected data type. In the following command,the quoted string constant '`2`' is implicitly coerced into an `INTEGER` value so that it can be the operand of an arithmetic operator (addition):

```
=> SELECT 2 + '2';
 ?column?
----------
        4
(1 row)
```

The result of the following arithmetic expression `2 + 2` and the `INTEGER` constant `2` are implicitly coerced into VARCHAR values so that they can be concatenated.

```
=> SELECT 2 + 2 || 2;
 ?column?
----------
 42
(1 row)
```

Most implicit casts stay within their relational family and go in one direction, from less detailed to more detailed. For example:

- `DATE` to `TIMESTAMP/TZ`
- `INTEGER` to `NUMERIC` to `FLOAT`
- `CHAR` to `FLOAT`
- `CHAR` to `VARCHAR`

`CHAR` and/or `VARCHAR` to `FLOAT` More specifically, data type coercion works in this manner in Vertica:

- INT8 -> FLOAT8—implicit, can lose significance
- FLOAT8 -> INT8—explicit, rounds

- VARCHAR <-> CHAR—implicit, adjusts trailing spaces
- VARBINARY <-> BINARY—implicit, adjusts trailing NULs

No other types cast to or from varbinary or binary. In the following list, <any> means one these types: INT8, FLOAT8, DATE, TIME, TIMETZ, TIMESTAMP, TIMESTAMPTZ, INTERVAL

- <any> -> VARCHAR—implicit
- VARCHAR -> <any>—explicit, except that VARCHAR->FLOAT is implicit
- <any> <-> CHAR—explicit
- DATE -> TIMESTAMP/TZ—implicit
- TIMESTAMP/TZ -> DATE—explicit, loses time-of-day
- TIME -> TIMETZ—implicit, adds local timezone
- TIMETZ -> TIME—explicit, loses timezone
- TIME -> INTERVAL—implicit, day to second with days=0
- INTERVAL -> TIME—explicit, truncates non-time parts
- TIMESTAMP <-> TIMESTAMPTZ—implicit, adjusts to local timezone
- TIMESTAMP/TZ -> TIME—explicit, truncates non-time parts
- TIMESTAMPTZ -> TIMETZ—explicit

IMPORTANT: Implicit casts from `INTEGER`, `FLOAT`, and `NUMERIC` to `VARCHAR` are not supported. If you need that functionality, write an explicit cast:

```
CAST(x AS data-type-name)
```

or

```
x::data-type-name
```

The following example casts a `FLOAT` to an `INTEGER`:

```
=> SELECT(FLOAT '123.5')::INT;
 ?column?
----------
      124
(1 row)
```

String-to-numeric data type conversions accept formats of quoted constants for scientific notation, binary scaling, hexadecimal, and combinations of numeric-type literals:

- Scientific notation:

```
=> SELECT FLOAT '1e10';
  ?column?
-------------
 10000000000
(1 row)
```

- `BINARY` scaling:

```
=> SELECT NUMERIC '1p10';
 ?column?
----------
```

```
     1024
(1 row)
```

- Hexadecimal:

```
=> SELECT NUMERIC '0x0abc';
 ?column?
----------
     2748
(1 row)
```

- Combinations:

```
=> SELECT NUMERIC '0x1pe3';
 ?column?
----------
     1000
(1 row)
```

Note: The `p` (which defaults to `p0`) is required for hexadecimal, because `SELECT '0x1e3'::NUMERIC = 483`.

Examples

```
=> SELECT NUMERIC '12.3e3', '12.3p10'::NUMERIC, CAST('0x12.3p-10e3' AS NUMERIC);
 ?column? | ?column? |     ?column?
----------+----------+------------------
    12300 |  12595.2 | 17.76123046875000
(1 row)
=> SELECT (18. + 3./16)/1024*1000;
                ?column?
----------------------------------------
 17.761230468750000000000000000000000000
(1 row)
```

Note: In SQL expressions, pure numbers between -(2^63-1) and (2^63-1) are `INTEGERs`; numbers with decimal points are `NUMERIC`, and do not support the above notation. Numbers using `e` notation are `FLOAT`.

The following two examples show queries that once work but now fail; below the failed query is a rewrite with the cast to VARCHAR to make such queries work again:

```
=> SELECT TO_NUMBER(1);
ERROR:  function to_number(int) does not exist
HINT:  No function matches the given name and argument types. You may need to add
explicit type casts.
=> SELECT TO_NUMBER(1::VARCHAR);
 to_number
-----------
         1
(1 row)
=> SELECT TO_DATE(20100302, 'YYYYMMDD');
ERROR:  function to_date(int, "unknown") does not exist
HINT:  No function matches the given name and argument types. You may need to add
explicit type casts.
=> SELECT TO_DATE(20100302::VARCHAR, 'YYYYMMDD');
```

```
  to_date
------------
 2010-03-02
(1 row)
```

See Also

Data Type Coercion Chart (page 104)

Data Type Coercion Operators (CAST) (page 37)

Data Type Coercion Chart

Conversion Types

The following table defines all possible type conversions that Vertica supports. The values across the top row are the data types you want, and the values down the first column on the left are the data types that you have.

Want > Have	BOOL	INT	FLT	CHR	VCHR	DTM	TM	TS	TSTZ	INVL	TTZ	NUM	VBIN	BIN	INTYM
BOOL	N/A			a	a										
INT		N/A	i	a**	a**					a		i			a
FLT		a	N/A	a	a							a			
CHR	e	e	i	Yes	i	e	e	e	e	e	e	e			e
VCHR	e	e	i	i	Yes	e	e	e	e	e	e	e			e
DTM				a	a	N/A		i	a						
TM				a	a		Yes			i	i				
TS				a	a	a	a	Yes	i						
TSTZ				a	a	a	a	i	Yes		a				
INVL		a		a	a		a			Yes					
TTZ				a	a		a				Yes				
NUM		a	i	a	a							Yes			
VBIN													Yes	i	
BIN													i	Yes	
INTYM		a		a	a										Yes

KEY

```
Type:
(i)mplicit,
(a)ssignment,
(e)xplicit

Matrix:
 ** means that the numeric meaning is lost, and the
value is subject to (VAR)CHAR compares

Abbreviation:
 BOOL = Boolean
 INT = Integer
 FLT = Float
 CHR = Char
 VCHR = Varchar
 DTM = Date
 TM = Time
 TS = Timestamp
 TSTZ = Timestamp with Time Zone
 INVL = Interval Day to Second
 TTZ = Time with time zone
 NUM = Numeric
 VBIN = Varbinary
 BIN = Binary
 INTYM = Interval Year to Month
```

See Also

Data Type Coercion Operators (CAST) (page 37)

SQL Functions

Functions return information from the database and are allowed anywhere an expression is allowed. The exception is ***Vertica-specific functions*** (page 318), which are not allowed everywhere.

Some functions could produce different results on different invocations with the same set of arguments. The following three categories of functions are defined based on their behavior:

- **Immutable (invariant)**: When run with a given set of arguments, immutable functions always produces the same result. The function is independent on any environment or session settings, such as locale. For example, 2+2 always equals 4. Another immutable function is AVG(). Some immutable functions can take an optional stable argument; in this case they are treated as stable functions.
- **Stable**: When run with a given set of arguments, stable functions produce the same result within a single query or scan operation. However, a stable function could produce different results when issued under a different environment, such as a change of locale and time zone. Expressions that could give different results in the future are also stable, for example `SYSDATE()` or `'today'`.
- **Volatile**: Regardless of the arguments or environment, volatile functions can return different results on multiple invocations. RANDOM() is one example.

This chapter describes the functions that Vertica supports.

- Each function is annotated with behavior type as immutable, stable or volatile.
- All Vertica-specific functions can be assumed to be volatile and are not annotated individually.

Aggregate Functions

Note: All functions in this section that have an ***analytic*** (page 120) function counterpart are appended with [Aggregate] to avoid confusion between the two.

Aggregate functions summarize data over groups of rows from a query result set. The groups are specified using the ***GROUP BY*** (page 626) clause. They are allowed only in the select list and in the ***HAVING*** (page 628) and ***ORDER BY*** (page 629) clauses of a ***SELECT*** (page 617) statement (as described in ***Aggregate Expressions*** (page 43)).

Notes

- Except for COUNT, these functions return a null value when no rows are selected. In particular, SUM of no rows returns NULL, not zero.
- In some cases you can replace an expression that includes multiple aggregates with an single aggregate of an expression. For example SUM(x) + SUM(y) can be expressed as as SUM(x+y) (where x and y are NOT NULL).
- Vertica does not support nested aggregate functions.

You can also use some of the simple aggregate functions as analytic (window) functions. See ***Analytic Functions*** (page 120) for details. See also Using SQL Analytics in the Programmer's Guide.

AVG [Aggregate]

Computes the average (arithmetic mean) of an expression over a group of rows. It returns a `DOUBLE PRECISION` value for a floating-point expression. Otherwise, the return value is the same as the expression data type.

Behavior Type

Immutable

Syntax

```
AVG ( [ ALL | DISTINCT ] expression )
```

Parameters

`ALL`	Invokes the aggregate function for all rows in the group (default).
`DISTINCT`	Invokes the aggregate function for all distinct non-null values of the expression found in the group.
`expression`	The value whose average is calculated over a set of rows. Can be any expression resulting in `DOUBLE PRECISION`.

Notes

The `AVG()` aggregate function is different from the `AVG()` analytic function, which computes an average of an expression over a group of rows within a window.

Examples

The following example returns the average income from the `customer` table:

```
=> SELECT AVG(annual_income) FROM customer_dimension;
     avg
--------------
 2104270.6485
(1 row)
```

See Also

AVG (page 128) analytic function

COUNT (page 108) and ***SUM*** (page 116)

Numeric Data Types (page 92)

COUNT [Aggregate]

Returns the number of rows in each group of the result set for which the expression is not `NULL`. The return value is a `BIGINT`.

Behavior Type

Immutable

Syntax

```
COUNT ( [ * ] [ ALL | DISTINCT ] expression )
```

Parameters

*	Indicates that the count does not apply to any specific column or expression in the select list. Requires a `FROM` ***clause*** (page 620).
`ALL`	Invokes the aggregate function for all rows in the group (default).
`DISTINCT`	Invokes the aggregate function for all distinct non-null values of the expression found in the group.
expression	Returns the number of rows in each group for which the *expression* is not null. Can be any expression resulting in `BIGINT`.

Notes

The `COUNT()` aggregate function is different from the `COUNT()` analytic function, which returns the number over a group of rows within a window.

Examples

The following query returns the number of distinct values in the `primary_key` column of the `date_dimension` table:

```
=> SELECT COUNT (DISTINCT date_key) FROM date_dimension; count
-------
  1826
(1 row)
```

The next example returns all distinct values of evaluating the expression `x+y` for all records of fact.

```
=> SELECT COUNT (DISTINCT date_key + product_key) FROM inventory_fact; count
-------
 21560
(1 row)
```

An equivalent query is as follows (using the `LIMIT` key to restrict the number of rows returned):

```
=> SELECT COUNT(date_key + product_key) FROM inventory_fact
   GROUP BY date_key LIMIT 10;
 count
-------
   173
    31
   321
   113
   286
    84
   244
   238
   145
   202
(10 rows)
```

Each distinct product_key value in table `inventory_fact` and returns the number of distinct values of `date_key` in all records with the specific distinct `product_key` value.

```
=> SELECT product_key, COUNT (DISTINCT date_key) FROM  inventory_fact
   GROUP BY product_key LIMIT 10;
 product_key | count
-------------+-------
           1 |    12
           2 |    18
           3 |    13
           4 |    17
           5 |    11
           6 |    14
           7 |    13
           8 |    17
           9 |    15
          10 |    12
(10 rows)
```

This query counts each distinct `product_key` value in table `inventory_fact` with the constant "1".

```
=> SELECT product_key, COUNT (DISTINCT product_key) FROM  inventory_fact
  GROUP BY product_key LIMIT 10;
product_key | count
-------------+-------
           1 |     1
```

```
           2 |     1
           3 |     1
           4 |     1
           5 |     1
           6 |     1
           7 |     1
           8 |     1
           9 |     1
          10 |     1
(10 rows)
```

This query selects each distinct `date_key` value and counts the number of distinct `product_key` values for all records with the specific `product_key` value. It then sums the `qty_in_stock` values in all records with the specific `product_key` value and groups the results by `date_key`.

```
=> SELECT date_key, COUNT (DISTINCT product_key), SUM(qty_in_stock) FROM
inventory_fact
   GROUP BY date_key LIMIT 10;
 date_key | count |  sum
----------+-------+--------
        1 |   173 |  88953
        2 |    31 |  16315
        3 |   318 | 156003
        4 |   113 |  53341
        5 |   285 | 148380
        6 |    84 |  42421
        7 |   241 | 119315
        8 |   238 | 122380
        9 |   142 |  70151
       10 |   202 |  95274
(10 rows)
```

This query selects each distinct `product_key` value and then counts the number of distinct `date_key` values for all records with the specific `product_key` value and counts the number of distinct `warehouse_key` values in all records with the specific `product_key` value.

```
=> SELECT product_key, COUNT (DISTINCT date_key), COUNT (DISTINCT warehouse_key)
   FROM inventory_fact GROUP BY product_key LIMIT 15;
 product_key | count | count
-------------+-------+-------
           1 |    12 |    12
           2 |    18 |    18
           3 |    13 |    12
           4 |    17 |    18
           5 |    11 |     9
           6 |    14 |    13
           7 |    13 |    13
           8 |    17 |    15
           9 |    15 |    14
          10 |    12 |    12
          11 |    11 |    11
          12 |    13 |    12
          13 |     9 |     7
          14 |    13 |    13
```

```
          15 |    18 |    17
(15 rows)
```

This query selects each distinct `product_key` value, counts the number of distinct `date_key` and `warehouse_key` values for all records with the specific `product_key` value, and then sums all `qty_in_stock` values in records with the specific `product_key` value. It then returns the number of `product_version` values in records with the specific `product_key` value.

```
=> SELECT product_key, COUNT (DISTINCT date_key), COUNT (DISTINCT warehouse_key),
   SUM (qty_in_stock), COUNT (product_version)
   FROM inventory_fact GROUP BY product_key LIMIT 15;
 product_key | count | count |  sum   | count
-------------+-------+-------+--------+-------
           1 |    12 |    12 |  5530  |    12
           2 |    18 |    18 |  9605  |    18
           3 |    13 |    12 |  8404  |    13
           4 |    17 |    18 | 10006  |    18
           5 |    11 |     9 |  4794  |    11
           6 |    14 |    13 |  7359  |    14
           7 |    13 |    13 |  7828  |    13
           8 |    17 |    15 |  9074  |    17
           9 |    15 |    14 |  7032  |    15
          10 |    12 |    12 |  5359  |    12
          11 |    11 |    11 |  6049  |    11
          12 |    13 |    12 |  6075  |    13
          13 |     9 |     7 |  3470  |     9
          14 |    13 |    13 |  5125  |    13
          15 |    18 |    17 |  9277  |    18
(15 rows)
```

The following example returns the number of warehouses from the `warehouse` dimension table:

```
=> SELECT COUNT(warehouse_name) FROM warehouse_dimension; count
-------
   100
(1 row)
```

The next example returns the total number of vendors:

```
=> SELECT COUNT(*) FROM vendor_dimension;
 count
-------
    50
(1 row)
```

See Also

Analytic Functions (page 120)

AVG (page 107)

SUM (page 116)

Using SQL Analytics in the Programmer's Guide

MAX [Aggregate]

Returns the greatest value of an expression over a group of rows. The return value is the same as the expression data type.

Behavior Type

Immutable

Syntax

```
MAX ( [ ALL | DISTINCT ] expression )
```

Parameters

`ALL | DISTINCT`	Are meaningless in this context.
expression	Can be any expression for which the maximum value is calculated, typically a ***column reference*** (see "***Column References***" on page 45).

Notes

The `MAX()` aggregate function is different from the `MAX()` analytic function, which returns the maximum value of an expression over a group of rows within a window.

Example

This example returns the largest value (dollar amount) of the `sales_dollar_amount` column.

```
=> SELECT MAX(sales_dollar_amount) AS highest_sale FROM store.store_sales_fact;
highest_sale
--------------
         600
(1 row)
```

See Also

Analytic Functions (page 120)

MIN (page 112)

MIN [Aggregate]

Returns the smallest value of an expression over a group of rows. The return value is the same as the expression data type.

Behavior Type

Immutable

Syntax

```
MIN ( [ ALL | DISTINCT ] expression )
```

Parameters

ALL | DISTINCT	Are meaningless in this context.
expression	Can be any expression for which the minimum value is calculated, typically a ***column reference*** (see "***Column References***" on page 45).

Notes

The MIN() aggregate function is different from the MIN() analytic function, which returns the minimum value of an expression over a group of rows within a window.

Example

This example returns the lowest salary from the employee dimension table.

```
=> SELECT MIN(annual_salary) AS lowest_paid FROM employee_dimension; lowest_paid
-------------
        1200
(1 row)
```

See Also

Analytic Functions (page 120)

MAX (page 112)

Using SQL Analytics in the Programmer's Guide

STDDEV [Aggregate]

Note: The non-standard function STDDEV() is provided for compatibility with other databases. It is semantically identical to STDDEV_SAMP() (page 115).

Evaluates the statistical sample standard deviation for each member of the group. The STDDEV_SAMP() return value is the same as the square root of the VAR_SAMP() function:

```
STDDEV(expression) = SQRT(VAR_SAMP(expression))
```

When VAR_SAMP() returns null, this function returns null.

Behavior Type

Immutable

Syntax

```
STDDEV ( expression )
```

Parameters

expression	Any NUMERIC ***data type*** (page 92) or any non-numeric data type that can be implicitly converted to a numeric data type. The function returns the same data type as the numeric data type of the argument.

Notes

The STDDEV() aggregate function is different from the STDDEV() analytic function, which computes the statistical sample standard deviation of the current row with respect to the group of rows within a window.

Examples

The following example returns the statistical sample standard deviation for each household ID from the customer dimension table.

```
=> SELECT STDDEV_SAMP(household_id) FROM customer_dimension; stddev_samp
------------------
 8651.50842400771
(1 row)
```

See Also

Analytic Functions (page 120)

STDDEV_SAMP (page 115)

Using SQL Analytics in the Programmer's Guide

STDDEV_POP [Aggregate]

Evaluates the statistical population standard deviation for each member of the group. The STDDEV_POP() return value is the same as the square root of the VAR_POP() function

```
STDDEV_POP(expression) = SQRT(VAR_POP(expression))
```

When VAR_SAMP() returns null, this function returns null.

Behavior Type

Immutable

Syntax

```
STDDEV_POP ( expression )
```

Parameters

expression	Any NUMERIC ***data type*** (page 92) or any non-numeric data type that can be implicitly converted to a numeric data type. The function returns the same data type as the numeric data type of the argument.

Notes

The STDDEV_POP() aggregate function is different from the STDDEV_POP() analytic function, which evaluates the statistical population standard deviation for each member of the group of rows within a window.

Examples

The following example returns the statistical population standard deviation for each household ID in the `customer` table.

```
=> SELECT STDDEV_POP(household_id) FROM customer_dimension; stddev_samp
------------------
 8651.41895973367
(1 row)
```

See Also

Analytic Functions (page 120)

Using SQL for Analytics in the Programmer's Guide

STDDEV_SAMP [Aggregate]

Evaluates the statistical sample standard deviation for each member of the group. The `STDDEV_SAMP()` return value is the same as the square root of the `VAR_SAMP()` function:

`STDDEV_SAMP(`*expression*`) = SQRT(VAR_SAMP(`*expression*`))`

When `VAR_SAMP()` returns null, this function returns null.

Behavior Type:

Immutable

Syntax

`STDDEV_SAMP ( `*expression*` )`

Parameters

expression	Any `NUMERIC` ***data type*** (page 92) or any non-numeric data type that can be implicitly converted to a numeric data type. The function returns the same data type as the numeric data type of the argument.

Notes

- `STDDEV_SAMP()` is semantically identical to the non-standard function, `STDDEV()` (page 113), which is provided for compatibility with other databases.
- The `STDDEV_SAMP()` aggregate function is different from the `STDDEV_SAMP()` analytic function, which computes the statistical sample standard deviation of the current row with respect to the group of rows within a window.

Examples

The following example returns the statistical sample standard deviation for each household ID from the `customer` dimension table.

```
=> SELECT STDDEV_SAMP(household_id) FROM customer_dimension; stddev_samp
------------------
 8651.50842400771
```

```
(1 row)
```

See Also

Analytic Functions (page 120)

STDDEV (page 113)

Using SQL Analytics in the Programmer's Guide

SUM [Aggregate]

Computes the sum of an expression over a group of rows. It returns a `DOUBLE PRECISION` value for a floating-point expression. Otherwise, the return value is the same as the expression data type.

Behavior Type

Immutable

Syntax

`SUM ( [ ALL | DISTINCT ] expression )`

Parameters

`ALL`	Invokes the aggregate function for all rows in the group (default)
`DISTINCT`	Invokes the aggregate function for all distinct non-null values of the expression found in the group
expression	Any `NUMERIC` ***data type*** (page 92) or any non-numeric data type that can be implicitly converted to a numeric data type. The function returns the same data type as the numeric data type of the argument.

Notes

- The `SUM()` aggregate function is different from the `SUM()` analytic function, which returns the minimum value of an expression within a window.
- If you encounter data overflow when using `SUM()`, use `SUM_FLOAT()` (page 117) which converts the data to a floating point.

Example

This example returns the total sum of the `product_cost` column.

```
=> SELECT SUM(product_cost) AS cost FROM product_dimension; cost
---------
 9042850
(1 row)
```

See Also

AVG (page 107)

COUNT (page 108)

Numeric Data Types (page 92)

Using SQL Analytics in the Programmer's Guide

SUM_FLOAT [Aggregate]

Computes the sum of an expression over a group of rows. It returns a `DOUBLE PRECISION` value for the expression, regardless of the expression type.

Behavior Type

Immutable

Syntax

```
SUM_FLOAT ( [ ALL | DISTINCT ] expression )
```

Parameters

`ALL`	Invokes the aggregate function for all rows in the group (default).
`DISTINCT`	Invokes the aggregate function for all distinct non-null values of the expression found in the group.
`expression`	Can be any expression resulting in `DOUBLE PRECISION`.

Example

The following example returns the floating point sum of the average price from the product table:

```
=> SELECT SUM_FLOAT(average_competitor_price) AS cost FROM product_dimension;
cost
----------
 18181102
(1 row)
```

VAR_POP [Aggregate]

Evaluates the population variance for each member of the group. This is defined as the sum of squares of the difference of *expression* from the mean of *expression,* divided by the number of rows remaining.

```
(SUM(expression*expression) - SUM(expression)*SUM(expression) /
COUNT(expression)) / COUNT(expression)
```

Behavior Type

Immutable

Syntax

```
VAR_POP ( expression )
```

Parameters

expression	Any NUMERIC ***data type*** (page 92) or any non-numeric data type that can be implicitly converted to a numeric data type. The function returns the same data type as the numeric data type of the argument.

Notes

The VAR_POP() aggregate function is different from the VAR_POP() analytic function, which computes the population variance of the current row with respect to the group of rows within a window.

Examples

The following example returns the population variance for each household ID in the customer table.

```
=> SELECT VAR_POP(household_id) FROM customer_dimension; var_pop
------------------
 74847050.0168393
(1 row)
```

VAR_SAMP [Aggregate]

Evaluates the sample variance for each row of the group. This is defined as the sum of squares of the difference of *expression* from the mean of *expression,* divided by the number of rows remaining minus 1 (one).

```
(SUM(expression*expression) - SUM(expression) *SUM(expression) /
COUNT(expression)) / (COUNT(expression) -1)
```

Behavior Type

Immutable

Syntax

```
VAR_SAMP ( expression )
```

Parameters

expression	Any NUMERIC ***data type*** (page 92) or any non-numeric data type that can be implicitly converted to a numeric data type. The function returns the same data type as the numeric data type of the argument.

Notes

- VAR_SAMP() is semantically identical to the non-standard function, VARIANCE (page 119)(), which is provided for compatibility with other databases.

- The VAR_SAMP() aggregate function is different from the VAR_SAMP() analytic function, which computes the sample variance of the current row with respect to the group of rows within a window.

Examples

The following example returns the sample variance for each household ID in the customer table.

```
=> SELECT VAR_SAMP(household_id) FROM customer_dimension; var_samp
------------------
 74848598.0106764
(1 row)
```

See Also

Analytic Functions (page 120)

VARIANCE (page 119)

Using SQL Analytics in the Programmer's Guide

VARIANCE [Aggregate]

Note: The non-standard function VARIANCE() is provided for compatibility with other databases. It is semantically identical to VAR_SAMP() (page 118).

Evaluates the sample variance for each row of the group. This is defined as the sum of squares of the difference of *expression* from the mean of *expression,* divided by the number of rows remaining minus 1 (one).

```
(SUM(expression*expression) - SUM(expression) *SUM(expression) /
COUNT(expression)) / (COUNT(expression) -1)
```

Behavior Type

Immutable

Syntax

```
VARIANCE ( expression )
```

Parameters

expression	Any NUMERIC ***data type*** (page 92) or any non-numeric data type that can be implicitly converted to a numeric data type. The function returns the same data type as the numeric data type of the argument.

Notes

The VARIANCE() aggregate function is different from the VARIANCE() analytic function, which computes the sample variance of the current row with respect to the group of rows within a window.

Examples

The following example returns the sample variance for each household ID in the `customer` table.

```
=> SELECT VARIANCDE(household_id) FROM customer_dimension; variance
------------------
 74848598.0106764
(1 row)
```

See Also

Analytic Functions (page 120)

VAR_SAMP (page 118)

Using SQL Analytics in the Programmer's Guide

Analytic Functions

Note: All analytic functions in this section that have an aggregate counterpart are appended with [Analytics] in the heading to avoid confusion between the two.

The ANSI SQL 99 standard introduced a set of functionality, called SQL analytic functions, that handle complex analysis and reporting, for example, a moving average of retail volume over a specified time frame or a running total.

Analytic aggregate functions differ from standard aggregate functions in that, rather than return a single summary value, they return the same number of rows as the input. Moreover, unlike standard aggregate functions, the groups of rows on which the analytic aggregate function operates are not defined by a GROUP BY clause, but by window partitioning and frame clauses. You can sort these partitions using a window `ORDER BY` clause, but the order affects only the function result set, not the entire query result set. This ordering concept is described more fully later.

The windowing components (partitioning, ordering, and framing) are specified in the analytic `OVER()` clause. For example, window framing defines the unique construct of a moving window, whose size is based on either logical intervals (such as time) or on a physical number of rows. For each row, a window is computed in relation to the current row. As the current row advances, the window moves along with it.

Analytic Function Syntax

```
ANALYTIC_FUNCTION( argument-1, ..., argument-n )
  OVER( [ window_partition_clause (on page 121) ]
        [ window_order_clause (on page 123) ]
        [ window_frame_clause (on page 125) ] )
```

Analytic Syntactic Construct

`OVER(...)`	Specifies partitioning, ordering, and window framing for the function—important elements that determine what data the analytic function takes as input with respect to the current row. The `OVER()` clause is evaluated after the `FROM`, `WHERE`, `GROUP BY`, and `HAVING` clauses. The

	SQL `OVER()` clause must follow the analytic function.
`window_partition_clause`	Divides the rows in the input table by a given list of columns or expressions. If the `window_partition_clause` is omitted, all input rows are treated as a single partition. See `window_partition_clause` (page 121).
`window_order_clause`	Sorts the rows specified by the `window_partition_clause` and supplies an ordered set of rows to the analytic function. See `window_order_clause` (page 123).
`window_frame_clause`	Allowed for some analytic function, the window_frame_clause represents a moving window, defined in the analytic `OVER()` clause, and specifies the beginning and end of the window relative to the current row. See `window_frame_clause`**.** (page 125)

Notes

Analytic functions:

- Require the `OVER()` clause. However, depending on the analytic function, the `window_frame_clause` and `window_order_clause` might not apply.

  Note: When used with analytic aggregate functions, `OVER()` may be used without supplying any of the windowing clauses; in this case, the aggregate returns the same aggregated value for each row of the result set.
- Are allowed only in the `SELECT` and `ORDER BY` clauses.
- Can be used in a subquery or in the parent query.
- Cannot be nested; for example, the following is not allowed:
  ```
  => SELECT MEDIAN(RANK() OVER(ORDER BY sal) OVER().
  ```

See Also

Performance Optimization for Analytic Sort Computation (page 169)

Using SQL Analytics in the Programmer's Guide

Named Windows

window_partition_clause

The `window_partition_clause` is an optional clause that, when specified, divides the rows in the input by a given list of columns or expressions. If the clause is omitted, all input rows are treated as a single partition. Window partitioning is similar to `GROUP BY` operation, except the function returns only one result row per input row.

The analytic function is computed per partition and starts over again (resets) at the beginning of each subsequent partition. The `window_partition_clause i`s specified within the `OVER()` clause.

Syntax

```
PARTITION BY expression [ , ... ]
```

Parameters

expression	Expression to sort the partition on. May involve columns, constants or an arbitrary expression formed on columns.

Sample schema

The examples in this topic `use` the following schema:

```
=> CREATE TABLE allsales(
      state VARCHAR(20),
      name VARCHAR(20),
      sales INT);
=> INSERT INTO allsales VALUES('MA', 'A', 60);
=> INSERT INTO allsales VALUES('NY', 'B', 20);
=> INSERT INTO allsales VALUES('NY', 'C', 15);
=> INSERT INTO allsales VALUES('MA', 'D', 20);
=> INSERT INTO allsales VALUES('MA', 'E', 50);
=> INSERT INTO allsales VALUES('NY', 'F', 40);
=> INSERT INTO allsales VALUES('MA', 'G', 10);
=> COMMIT;
```

Create the example allsales table, insert the data, and query the table:

```
=> SELECT * FROM allsales;
 state | name | sales
-------+------+-------
 MA    | A    |    60
 NY    | B    |    20
 NY    | C    |    15
 MA    | D    |    20
 MA    | E    |    50
 NY    | F    |    40
 MA    | G    |    10
(7 rows)
```

Examples

The first example uses the analytic function MEDIAN to partition the results by state and then calculate the median of sales:

```
=> SELECT state, name, sales, MEDIAN(sales)
     OVER (PARTITION BY state) AS MEDIAN from allsales;
 state | name | sales | MEDIAN
-------+------+-------+--------
```

```
 NY    | C    |    15 |     20
 NY    | B    |    20 |     20
 NY    | F    |    40 |     20
 MA    | G    |    10 |     35
 MA    | D    |    20 |     35
 MA    | E    |    50 |     35
 MA    | A    |    60 |     35
(7 rows)
```

Note: In the above results, notice the two partitions for MA and NY under the `state` column.

The next example calculates the median of total sales among states. Note that when you use `OVER()` with no parameters, there is one partition, the entire input:

```
=> SELECT state, SUM(sales), MEDIAN(SUM(sales))
     OVER () AS MEDIAN FROM allsales GROUP BY state;
 state | SUM | MEDIAN
-------+-----+--------
 NY    |  75 |  107.5
 MA    | 140 |  107.5
(2 rows)
```

window_order_clause

Sorts the rows specified by the `window_partition_clause (on page 121)` and supplies an ordered set of rows to the `window_frame_clause` (if present), to the analytic function, or to both. The `window_order_clause` specifies whether data is returned in ascending or descending order and specifies where null values appear in the sorted result as either first or last. The ordering of the data affects the results.

Note: The `window_order_clause` does not guarantee the order of the SQL result. Use the ***SQL ORDER BY clause*** (page 629) to guarantee the ordering of the final result set.

The `window_order_clause` is part of the OVER() clause.

Syntax

```
ORDER BY expression
... [ { ASC | DESC } ]
... [ NULLS { FIRST | LAST | AUTO } ] [,expression ...]
```

Parameters

expression	Expression to sort the partition on. May involve columns, constants or an arbitrary expression formed on columns.
ASC | DESC	Specifies the ordering sequence as ascending (default) or descending.

NULLS { FIRST | LAST | AUTO }	Indicates the position of nulls in the ordered sequence as either first or last. The order makes nulls compare either high or low with respect to non-null values. If the sequence is specified as ascending order, ASC NULLS FIRST implies that nulls are smaller than other non-null values. ASC NULLS LAST implies that nulls are larger than non-null values. The opposite is true for descending order. If you specify NULLS AUTO, Vertica chooses the most efficient placement of nulls (for example, either NULLS FIRST or NULLS LAST) based on your query. The default is ASC NULLS LAST and DESC NULLS FIRST. See also ***Performance Optimization for Analytic Sort Computation*** (page 169).

The following list shows the default ordering, with bold clauses to indicate what is implicit:

- ORDER BY column1 = ORDER BY a ASC NULLS LAST
- ORDER BY column1 ASC = ORDER BY a ASC NULLS LAST
- ORDER BY column1 DESC = ORDER BY a DESC NULLS FIRST

The placement of the ORDER BY clause might not guarantee the final result order. For example, the window_order_clause is different from the final ORDER BY in that the window_order_clause specifies the order within each partition and affects the result of the analytic calculation; it does not guarantee the order of the SQL result. Use the ***SQL ORDER BY clause*** (page 629) to guarantee the ordering of the final result set. See also Null Placement.

The following examples continue with the sample schema introduced in the ***window_partition_clause*** (page 121) topic.

Example 1

In this example, the query orders the sales inside each sales partition:

```
=> SELECT state, sales, name, RANK()
      OVER (PARTITION BY state
   ORDER BY sales) AS RANK
   FROM allsales;

 state | sales | name | RANK
-------+-------+------+----------
 MA    |    10 | G    |        1
 MA    |    20 | D    |        2
 MA    |    50 | E    |        3
 MA    |    60 | A    |        4
 NY    |    15 | C    |        1
 NY    |    20 | B    |        2
 NY    |    40 | F    |        3
(7 rows)
```

Example 2

In this example, the final ORDER BY clause sorts the results by name:

```
=> SELECT state, sales, name, RANK()
      OVER (PARTITION by state
   ORDER BY sales) AS RANK
   FROM allsales ORDER BY name;

 state | sales | name | RANK
-------+-------+------+----------
 MA    |    60 | A    |        4
 NY    |    20 | B    |        2
 NY    |    15 | C    |        1
 MA    |    20 | D    |        2
 MA    |    50 | E    |        3
 NY    |    40 | F    |        3
 MA    |    10 | G    |        1
(7 rows)
```

window_frame_clause

Allowed for some analytic functions, the `window_frame_clause` specifies the beginning and end of the window relative to the current row. Each analytic function is computed based on the data within the window frame boundaries. As Vertica computes an analytic function for each row, the window slides according the the `window_frame_clause`, and rows are excluded or included based on the position (`ROWS`) or value (`RANGE`) relative to the current row. The `CURRENT ROW` is the next row for which the analytic function computes results.

Note: If you omit the `window_frame_clause`, the default window is `RANGE UNBOUNDED PRECEDING AND CURRENT ROW`.

Syntax

```
{ ROWS | RANGE }
{
  {
      BETWEEN
      { UNBOUNDED PRECEDING
      | CURRENT ROW
      | constant-value { PRECEDING | FOLLOWING }
      }
      AND
      { UNBOUNDED FOLLOWING
      | CURRENT ROW
      | constant-value  { PRECEDING | FOLLOWING }
      }
  }
|
  {
      { UNBOUNDED PRECEDING
      | CURRENT ROW
      | constant-value  PRECEDING
      }
  }
}
```

Parameters

`ROWS | RANGE`	The `ROWS` and `RANGE` keywords define the window frame type. `ROWS` specifies a window as a physical offset and defines the window's start and end point by the number of rows before or after the current row. The value can be `INTEGER` data type only. `RANGE` specifies the window as a logical offset, such as time. The range value must match the `window_order_clause` data type, which can be `NUMERIC`, `DATE/TIME`, `FLOAT` or `INTEGER`. **Note**: The value returned by an analytic function with a logical offset is always deterministic. However, the value returned by an analytic function with a physical offset could produce nondeterministic results unless the ordering expression results in a unique ordering. You might have to specify multiple columns in the

	window_order_clause to achieve this unique ordering.
BETWEEN ... AND	Specifies a start point and end point for the window. The first expression (before AND) defines the start point and the second expression (after AND) defines the end point. **Note**: If you use the keyword BETWEEN, you must also use AND.
UNBOUNDED PRECEDING	Indicates that the window starts at the first row of the partition. This start-point specification cannot be used as an end-point specification.
UNBOUNDED FOLLOWING	Indicates that the window ends at the last row of the partition. This end-point specification cannot be used as a start-point specification.
CURRENT ROW	As a start point, CURRENT ROW specifies that the window begins at the current row or value, depending on whether you have specified ROW or RANGE, respectively. In this case, the end point cannot be *constant-value* PRECEDING. As an end point, CURRENT ROW specifies that the window ends at the current row or value, depending on whether you have specified ROW or RANGE, respectively. In this case the start point cannot be *constant-value* FOLLOWING.
constant-value { PRECEDING | FOLLOWING }	For RANGE or ROW: ▪ If *constant-value* FOLLOWING is the start point, the end point must be *constant-value* FOLLOWING. ▪ If *constant-value* PRECEDING is the end point, the start point must be *constant-value* PRECEDING. ▪ If you specify a logical window that is defined by a time interval in NUMERIC format, you might need to use conversion functions. If you specified ROWS: ▪ *constant-value* is a physical offset. It must be a constant or expression and must evaluate to an INTEGER data type value. ▪ If *constant-value* is part of the start point, it must evaluate to a row before the end point. If you specified RANGE: ▪ *constant-value* is a logical offset. It must be a constant or expression that evaluates to a positive numeric value or an INTERVAL literal. ▪ If *constant-value* evaluates to a NUMERIC value, the ORDER BY column type must be a NUMERIC data type.. ▪ If the *constant-value* evaluates to an INTERVAL DAY TO SECOND subtype, the ORDER BY column type can only be TIMESTAMP, TIME, DATE, or INTERVAL DAY TO SECOND. ▪ If the *constant-value* evaluates to an INTERVAL YEAR TO MONTH, the ORDER BY column type can only be TIMESTAMP, DATE, or INTERVAL YEAR TO MONTH.

	▪ You can specify only one expression in the window_order_clause.

named_windows

You can avoid typing long OVER() clause syntax by naming a window using the WINDOW clause, which takes the following form:

```
WINDOW window_name AS ( window_definition_clause );
```

In the following example, RANK() and DENSE_RANK() use the partitioning and ordering specifications in the window definition for w:

```
=> SELECT RANK() OVER w , DENSE_RANK() OVER w
   FROM employee_dimension
   WINDOW w AS (PARTITION BY employee_region ORDER by annual_salary);
```

Though analytic functions can reference a named window to inherit the window_partition_clause (page 121), you can define your own window_order_clause (page 123); for example:

```
=> SELECT RANK() OVER(w ORDER BY annual_salary ASC) ,
       DENSE_RANK() OVER(w ORDER BY annual_salary DESC)
   FROM employee_dimension
   WINDOW w AS (PARTITION BY employee_region);
```

Notes:

- The window_partition_clause is defined in the named window specification, not in the OVER() clause.
- The OVER() clause can specify its own window_order_clause only if the window_definition_clause did not already define it. For example, if the second example above is rewritten as follows, the system returns an error:

  ```
  => SELECT RANK() OVER(w ORDER BY annual_salary ASC) , DENSE_RANK() OVER(w
     ORDER BY annual_salary DESC)
      FROM employee_dimension
      WINDOW w AS (PARTITION BY employee_region ORDER BY annual_salary);
      ERROR:  cannot override ORDER BY clause of window "w"
  ```

- A window definition cannot contain a window_frame_clause.
- Each window defined in the window_definition_clause must have a unique name.

  You can reference window names within their scope only. For example, because named window w1 below is defined before w2, w2 is within the scope of w1:

  ```
  => SELECT RANK() OVER(w1 ORDER BY sal DESC)
         RANK() OVER w2
     FROM EMP AS
     WINDOW w1 AS (PARTITION BY deptno), w2 AS (w1 ORDER BY sal);
  ```

AVG [Analytic]

Computes an average of an expression in a group within a window.

Behavior Type

Immutable

Syntax

```
AVG ( expression ) OVER (
... [ window_partition_clause (page 121) ]
... [ window_order_clause (page 123) ]
... [ window_frame_clause (page 125) ] )
```

Parameters

expression	The value whose average is calculated over a set of rows. Can be any expression resulting in DOUBLE PRECISION.
OVER(...)	See ***Analytic Functions.*** (page 120)

Notes

AVG() takes as an argument any numeric data type or any non-numeric data type that can be implicitly converted to a numeric data type. The function returns the same data type as the argument's numeric data type.

Examples

The following query finds the sales for that calendar month and returns a running/cumulative average (sometimes called a moving average) using the default window of RANGE UNBOUNDED PRECEDING AND CURRENT ROW:

```
=> SELECT calendar_month_number_in_year, SUM(product_price) AS sales,
   AVG(SUM(product_price)) OVER (ORDER BY calendar_month_number_in_year)
   FROM product_dimension, date_dimension, inventory_fact
   WHERE date_dimension.date_key = inventory_fact.date_key
   AND product_dimension.product_key = inventory_fact.product_key
   GROUP BY calendar_month_number_in_year;
 calendar_month_number_in_year |  sales   |     ?column?
-------------------------------+----------+------------------
                             1 | 23869547 |         23869547
                             2 | 19604661 |         21737104
                             3 | 22877913 | 22117373.6666667
                             4 | 22901263 |         22313346
                             5 | 23670676 |         22584812
                             6 | 22507600 | 22571943.3333333
                             7 | 21514089 | 22420821.2857143
                             8 | 24860684 |     22725804.125
                             9 | 21687795 | 22610469.7777778
                            10 | 23648921 |       22714314.9
                            11 | 21115910 | 22569005.3636364
                            12 | 24708317 | 22747281.3333333
```

```
(12 rows)
```

To return a moving average that is not a running (cumulative) average, the window should specify `ROWS BETWEEN 2 PRECEDING AND 2 FOLLOWING`:

```
=> SELECT calendar_month_number_in_year, SUM(product_price) AS sales,
   AVG(SUM(product_price)) OVER (ORDER BY calendar_month_number_in_year
     ROWS BETWEEN 2 PRECEDING AND 2 FOLLOWING)
   FROM product_dimension, date_dimension, inventory_fact
   WHERE date_dimension.date_key = inventory_fact.date_key
   AND product_dimension.product_key = inventory_fact.product_key
   GROUP BY calendar_month_number_in_year;
```

See Also

AVG (page 107) aggregate function

COUNT (page 131) and ***SUM*** (page 164) analytic functions

Using SQL Analytics in the Programmer's Guide

CONDITIONAL_CHANGE_EVENT [Analytic]

Assigns an event window number to each row, starting from 0, and increments by 1 when the result of evaluating the argument expression on the current row differs from that on the previous row.

Behavior Type

Immutable

Syntax

```
CONDITIONAL_CHANGE_EVENT ( expression ) OVER (
... [ window_partition_clause (page 121) ]
... window_order_clause (page 123)  )
```

Parameters

expression	Is a SQL scalar expression that is evaluated on an input record. The result of *expression* can be of any data type.
`OVER(...)`	See ***Analytic Functions.*** (page 120)

Notes

The analytic `window_order_clause` is required but the `window_partition_clause` is optional.

Example

```
=> SELECT CONDITIONAL_CHANGE_EVENT(bid)
   OVER (PARTITION BY symbol ORDER BY ts) AS cce
   FROM TickStore;
```

The system returns an error when no `ORDER BY` is present:

```
=> SELECT CONDITIONAL_CHANGE_EVENT(bid)
   OVER (PARTITION BY symbol) AS cce
   FROM TickStore;

   ERROR:  conditional_change_event must contain an ORDER BY clause within
   its analytic clause
```

For more examples, see Event-based Windows in the Programmer's Guide.

See Also

CONDITIONAL_TRUE_EVENT (page 130)

ROW_NUMBER (page 159)

Using Time Series Analytics and Event-based Windows in the Programmer's Guide

CONDITIONAL_TRUE_EVENT [Analytic]

Assigns an event window number to each row, starting from 0, and increments the number by 1 when the result of the boolean argument expression evaluates true. For example, given a sequence of values for column a:

`( 1, 2, 3, 4, 5, 6 )`

`CONDITIONAL_TRUE_EVENT(a > 3)` returns `0, 0, 0, 1, 2, 3`.

Behavior Type:

Immutable

Syntax

```
CONDITIONAL_TRUE_EVENT ( boolean-expression ) OVER
... ( [ window_partition_clause (page 121) ]
... window_order_clause (page 123)  )
```

Parameters

boolean-expression	Is a SQL scalar expression that is evaluated on an input record. The result of *boolean-expression* is boolean type.
`OVER(...)`	See ***Analytic Functions*** (page 120).

Notes

The analytic `window_order_clause` is required but the `window_partition_clause` is optional.

Example

```
=> SELECT CONDITIONAL_TRUE_EVENT(bid > 10.6)
     OVER(PARTITION BY bid ORDER BY ts) AS cte
   FROM Tickstore;
```

The system returns an error if the `ORDER BY` clause is omitted:

```
=> SELECT CONDITIONAL_TRUE_EVENT(bid > 10.6)
```

```
    OVER(PARTITION BY bid) AS cte
  FROM Tickstore;
  ERROR:  conditional_true_event must contain an ORDER BY clause within its
  analytic clause
```

For more examples, see Event-based Windows in the Programmer's Guide.

See Also

CONDITIONAL_CHANGE_EVENT (page 129)

Using Time Series Analytics and Event-based Windows in the Programmer's Guide

COUNT [Analytic]

Counts occurrences within a group within a window. If you specify * or some non-null constant, `COUNT()` counts all rows.

Behavior Type

Immutable

Syntax

```
COUNT ( expression ) OVER (
... [ window_partition_clause (page 121) ]
... [ window_order_clause (page 123) ]
... [ window_frame_clause (page 125) ] )
```

Parameters

expression	Returns the number of rows in each group for which the *expression* is not null. Can be any expression resulting in BIGINT.
`OVER(...)`	See ***Analytic Functions.*** (page 120)

Example

The following query finds the number of employees who make less than or equivalent to the hourly rate of the current employee. The query returns a running/cumulative average (sometimes called a moving average) using the default window of `RANGE UNBOUNDED PRECEDING AND CURRENT ROW`:

```
=> SELECT employee_last_name AS "last_name", hourly_rate, COUNT(*)
   OVER (ORDER BY hourly_rate) AS moving_count from employee_dimension;
 last_name  | hourly_rate | moving_count
------------+-------------+--------------
 Gauthier   |           6 |            4
 Taylor     |           6 |            4
 Jefferson  |           6 |            4
 Nielson    |           6 |            4
 McNulty    |        6.01 |           11
 Robinson   |        6.01 |           11
 Dobisz     |        6.01 |           11
```

```
 Williams   |        6.01 |           11
 Kramer     |        6.01 |           11
 Miller     |        6.01 |           11
 Wilson     |        6.01 |           11
 Vogel      |        6.02 |           14
 Moore      |        6.02 |           14
 Vogel      |        6.02 |           14
 Carcetti   |        6.03 |           19
...
```

To return a moving average that is not also a running (cumulative) average, the window should specify `ROWS BETWEEN 2 PRECEDING AND 2 FOLLOWING`:

```
=> SELECT employee_last_name AS "last_name", hourly_rate, COUNT(*)
      OVER (ORDER BY hourly_rate ROWS BETWEEN 2 PRECEDING AND 2 FOLLOWING)
   AS moving_count from employee_dimension;
```

See Also

COUNT (page 108) aggregate function

AVG (page 128) and ***SUM*** (page 164) analytic functions

Using SQL Analytics in the Programmer's Guide

CUME_DIST [Analytic]

Calculates the cumulative distribution, or relative rank, of the current row with regard to other rows in the same partition witihn a window.

`CUME_DIST()` returns a number greater then 0 and less then or equal to 1, where the number represents the relative position of the specified row within a group of *N* rows. For a row `x` (assuming `ASC` ordering), the `CUME_DIST` of `x` is the number of rows with values lower than or equal to the value of `x`, divided by the number of rows in the partition. In a group of three rows, for example, the cumulative distribution values returned would be 1/3, 2/3, and 3/3.

Note: Because the result for a given row depends on the number of rows preceding that row in the same partition, Vertica recommends that you always specify a `window_order_clause` when you call this function.

Behavior Type

Immutable

Syntax

```
CUME_DIST ( ) OVER (
... [ window_partition_clause (page 121) ]
... window_order_clause (page 123)  )
```

Parameters

`OVER(...)`	See ***Analytic Functions.*** (page 120)

Notes

The analytic `window_order_clause` is required but the `window_partition_clause` is optional.

Examples

The following example returns the cumulative distribution of sales for different transaction types within each month of the first quarter.

```
=> SELECT calendar_month_name AS month, tender_type, SUM(sales_quantity),
      CUME_DIST()
   OVER (PARTITION BY calendar_month_name ORDER BY SUM(sales_quantity)) AS
CUME_DIST
   FROM store.store_sales_fact JOIN date_dimension
   USING(date_key) WHERE calendar_month_name IN ('January','February','March')
   AND tender_type NOT LIKE 'Other'
   GROUP BY calendar_month_name, tender_type;

  month   | tender_type |  SUM   | CUME_DIST
----------+-------------+--------+-----------
 March    | Credit      | 469858 |      0.25
 March    | Cash        | 470449 |       0.5
 March    | Check       | 473033 |      0.75
 March    | Debit       | 475103 |         1
 January  | Cash        | 441730 |      0.25
 January  | Debit       | 443922 |       0.5
 January  | Check       | 446297 |      0.75
 January  | Credit      | 450994 |         1
 February | Check       | 425665 |      0.25
 February | Debit       | 426726 |       0.5
 February | Credit      | 430010 |      0.75
 February | Cash        | 430767 |         1
(12 rows)
```

See Also

PERCENT_RANK (page 151)

PERCENTILE_DISC (page 156)

Using SQL Analytics in the Programmer's Guide

DENSE_RANK [Analytic]

Computes the relative rank of each row returned from a query with respect to the other rows, based on the values of the expressions in the window `ORDER BY` clause.

The data within a group is sorted by the `ORDER BY` clause and then a numeric ranking is assigned to each row in turn starting with 1 and continuing from there. The rank is incremented every time the values of the `ORDER BY` expressions change. Rows with equal values receive the same rank (nulls are considered equal in this comparison). A `DENSE_RANK()` function returns a ranking number without any gaps, which is why it is called "DENSE."

Behavior Type

Immutable

Syntax

```
DENSE_RANK ( ) OVER (
... [ window_partition_clause (page 121) ]
... window_order_clause (page 123)  )
```

Parameters

OVER(...)	See ***Analytic Functions.*** (page 120)

Notes

- The analytic window_order_clause is required but the window_partition_clause is optional.
- The ranks are consecutive integers beginning with 1. The largest rank value is the number of unique values returned by the query.
- The primary difference between DENSE_RANK() and RANK() (page 157) is that RANK leaves gaps when ranking records whereas DENSE_RANK leaves no gaps. For example, N records occupy a particular position (say, a tie for rank X), RANK assigns all those records with rank X and skips the next N ranks, therefore the next assigned rank is X+N. DENSE_RANK places all the records in that position only—it does not skip any ranks.

  If there is a tie at the third position with two records having the same value, RANK and DENSE_RANK place both the records in the third position, but RANK places the next record at the fifth position, while DENSE_RANK places the next record at the fourth position.
- If you omit NULLS FIRST | LAST | AUTO, the ordering of the NULL values depends on the ASC or DESC arguments. NULL values are considered larger than any other value. If the ordering sequence is ASC, then nulls appear last; nulls appear first otherwise. Nulls are considered equal to other nulls and, therefore, the order in which nulls are presented is non-deterministic.

Examples

The following example shows the difference between RANK and DENSE_RANK when ranking customers by their annual income. Notice that RANK has a tie at 10 and skips 11, while DENSE_RANK leaves no gaps in the ranking sequence:

```
=> SELECT customer_name, SUM(annual_income),
   RANK () OVER (ORDER BY TO_CHAR(SUM(annual_income),'100000') DESC) rank,
   DENSE_RANK () OVER (ORDER BY TO_CHAR(SUM(annual_income),'100000') DESC)
dense_rank
   FROM customer_dimension GROUP BY customer_name LIMIT 15;
    customer_name    |  sum  | rank | dense_rank
---------------------+-------+------+------------
 Brian M. Garnett    | 99838 |    1 |          1
 Tanya A. Brown      | 99834 |    2 |          2
 Tiffany P. Farmer   | 99826 |    3 |          3
```

```
 Jose V. Sanchez     | 99673 |    4 |          4
 Marcus D. Rodriguez | 99631 |    5 |          5
 Alexander T. Nguyen | 99604 |    6 |          6
 Sarah G. Lewis      | 99556 |    7 |          7
 Ruth Q. Vu          | 99542 |    8 |          8
 Theodore T. Farmer  | 99532 |    9 |          9
 Daniel P. Li        | 99497 |   10 |         10
 Seth E. Brown       | 99497 |   10 |         10
 Matt X. Gauthier    | 99402 |   12 |         11
 Rebecca W. Lewis    | 99296 |   13 |         12
 Dean L. Wilson      | 99276 |   14 |         13
 Tiffany A. Smith    | 99257 |   15 |         14
(15 rows)
```

See Also

RANK (page 157)

Using SQL Analytics in the Programmer's Guide

EXPONENTIAL_MOVING_AVERAGE [Analytic]

Calculates the exponential moving average of expression E with smoothing factor X.

The exponential moving average (EMA) is calculated by adding the previous EMA value to the current data point scaled by the smoothing factor, as in the following formula, where EMA0 is the previous row's EMA value, X is the smoothing factor, and E is the current data point: EMA = EMA0 + (X * (E - EMA0)).

Behavior Type

Immutable

Syntax

```
EXPONENTIAL_MOVING_AVERAGE ( E , X ) OVER (
... [ window_partition_clause (page 121) ]
... window_order_clause (page 123)  )
```

Parameters

E	The value whose average is calculated over a set of rows. Can be `INTEGER`, `FLOAT` or `NUMERIC` type and must be a constant.
X	A positive `FLOAT` value between 0 and 1 that is used as the smoothing factor.
`OVER(...)`	See ***Analytic Functions.*** (page 120)

Notes

- The analytic `window_order_clause` is required but the `window_partition_clause` is optional.
- There is no [Aggregate] equivalent of this function because of its unique semantics.

- EXPONENTIAL_MOVING_AVERAGE() is different from a simple moving average in that it provides a more stable picture of changes to data over time.
- The EXPONENTIAL_MOVING_AVERAGE() function also works at the row level; for example, it assumes the data in a given column is sampled at uniform intervals. If the users' data points are sampled at non-uniform intervals, they should run the time series gap filling and interpolation (GFI) operations before EMA(). See the Example section below.

Examples

The following example uses time series gap filling and interpolation (GFI) first in a subquery, and then performs an EXPONENTIAL_MOVING_AVERAGE operation on the subquery result.

Create a simple 4-column table:

```
=> CREATE TABLE ticker(
     time TIMESTAMP,
     symbol VARCHAR(8),
     bid1 FLOAT,
     bid2 FLOAT );
```

Now insert some data, including nulls, so GFI can do its interpolation and gap filling:

```
=> INSERT INTO ticker VALUES ('2009-07-12 03:00:00', 'ABC', 60.45, 60.44);
=> INSERT INTO ticker VALUES ('2009-07-12 03:00:01', 'ABC', 60.49, 65.12);
=> INSERT INTO ticker VALUES ('2009-07-12 03:00:02', 'ABC', 57.78, 59.25);
=> INSERT INTO ticker VALUES ('2009-07-12 03:00:03', 'ABC', null, 65.12);
=> INSERT INTO ticker VALUES ('2009-07-12 03:00:04', 'ABC', 67.88, null);
=> INSERT INTO ticker VALUES ('2009-07-12 03:00:00', 'XYZ', 47.55, 40.15);
=> INSERT INTO ticker VALUES ('2009-07-12 03:00:01', 'XYZ', 44.35, 46.78);
=> INSERT INTO ticker VALUES ('2009-07-12 03:00:02', 'XYZ', 71.56, 75.78);
=> INSERT INTO ticker VALUES ('2009-07-12 03:00:03', 'XYZ', 85.55, 70.21);
=> INSERT INTO ticker VALUES ('2009-07-12 03:00:04', 'XYZ', 45.55, 58.65);
=> COMMIT;
```

Note: During gap filling and interpolation, Vertica takes the closest non null value on either side of the time slice and uses that value. For example, if you use a linear interpolation scheme and you do not specify IGNORE NULLS, and your data has one real value and one null, the result is null. If the value on either side is null, the result is null. See When Time Series Data Contains Nulls in the Programmer's Guide for details.

Query the table you just created to you can see the output:

```
=> SELECT * FROM ticker;
        time          | symbol | bid1  | bid2
----------------------+--------+-------+-------
 2009-07-12 03:00:00 | ABC    | 60.45 | 60.44
 2009-07-12 03:00:01 | ABC    | 60.49 | 65.12
 2009-07-12 03:00:02 | ABC    | 57.78 | 59.25
 2009-07-12 03:00:03 | ABC    |       | 65.12
 2009-07-12 03:00:04 | ABC    | 67.88 |
 2009-07-12 03:00:00 | XYZ    | 47.55 | 40.15
 2009-07-12 03:00:01 | XYZ    | 44.35 | 46.78
 2009-07-12 03:00:02 | XYZ    | 71.56 | 75.78
 2009-07-12 03:00:03 | XYZ    | 85.55 | 70.21
 2009-07-12 03:00:04 | XYZ    | 45.55 | 58.65
```

```
(10 rows)
```

The following query processes the first and last values that belong to each 2-second time slice in table `trades`' column `a`. The query then calculates the exponential moving average of expression fv and lv with a smoothing factor of 5%:

```
=> SELECT symbol, slice_time, fv, lv,
     EXPONENTIAL_MOVING_AVERAGE(fv, 0.5)
       OVER (PARTITION BY symbol ORDER BY slice_time) AS ema_first,
   EXPONENTIAL_MOVING_AVERAGE(lv, 0.5)
       OVER (PARTITION BY symbol ORDER BY slice_time) AS ema_last
   FROM (
     SELECT symbol, slice_time,
        TS_FIRST_VALUE(bid1 IGNORE NULLS) as fv,
        TS_LAST_VALUE(bid2 IGNORE NULLS) AS lv
      FROM ticker TIMESERIES slice_time AS '2 seconds'
      OVER (PARTITION BY symbol ORDER BY time) ) AS sq;
 symbol |     slice_time      |  fv   |  lv   | ema_first | ema_last
--------+---------------------+-------+-------+-----------+----------
 ABC    | 2009-07-12 03:00:00 | 60.45 | 65.12 |     60.45 |    65.12
 ABC    | 2009-07-12 03:00:02 | 57.78 | 65.12 |    59.115 |    65.12
 ABC    | 2009-07-12 03:00:04 | 67.88 | 65.12 |   63.4975 |    65.12
 XYZ    | 2009-07-12 03:00:00 | 47.55 | 46.78 |     47.55 |    46.78
 XYZ    | 2009-07-12 03:00:02 | 71.56 | 70.21 |    59.555 |   58.495
 XYZ    | 2009-07-12 03:00:04 | 45.55 | 58.65 |   52.5525 |  58.5725
(6 rows)
```

See Also

TIMESERIES Clause (page 623)

Using Time Series Analytics and Using SQL Analytics in the Programmer's Guide

FIRST_VALUE [Analytic]

Returns values of the expression from the first row of a window for the current row. If no window is specified for the current row, the default window is `UNBOUNDED PRECEDING AND CURRENT ROW`.

Behavior Type

Immutable

Syntax

```
FIRST_VALUE ( expression [ IGNORE NULLS ] ) OVER (
... [ window_partition_clause (page 121) ]
... [ window_order_clause (page 123) ]
... [ window_frame_clause (page 125) ] )
```

Parameters

expression	Is the expression to evaluate; for example, a constant, column, nonanalytic function, function expression, or expressions involving any of these.

IGNORE NULLS	Returns the first non-null value in the set, or NULL if all values are NULL.
OVER(...)	See ***Analytic Functions.*** (page 120)

Notes

- The FIRST_VALUE() function lets you select a table's first value (determined by the window_order_clause) without having to use a self join. This function is useful when you want to use the first value as a baseline in calculations.
- Vertica recommends that you use FIRST_VALUE with the window_order_clause to produce deterministic results.
- If the first value in the set is null, then the function returns NULL unless you specify IGNORE NULLS. If you specify IGNORE NULLS, FIRST_VALUE returns the first non-null value in the set, or NULL if all values are null.

Examples

The following query, which asks for the first value in the partitioned day of week, illustrates the potential nondeterministic nature of the FIRST_VALUE function:

```
=> SELECT calendar_year, date_key, day_of_week, full_date_description,
   FIRST_VALUE(full_date_description)
     OVER(PARTITION BY calendar_month_number_in_year ORDER BY day_of_week) AS "first_value"
   FROM date_dimension
   WHERE calendar_year=2003 AND calendar_month_number_in_year=1;
```

The first value returned is January 31, 2003; however, the next time the same query is run, the first value could be January 24 or January 3, or the 10th or 17th. The reason is because the analytic ORDER BY column (day_of_week) returns rows that contain ties (multiple Fridays). These repeated values make the ORDER BY evaluation result nondeterministic, because rows that contain ties can be ordered in any way, and any one of those rows qualifies as being the first value of day_of_week.

```
 calendar_year | date_key | day_of_week | full_date_description |   first_value
---------------+----------+-------------+-----------------------+-------------
-----
          2003 |       31 | Friday      | January 31, 2003      | January 31, 2003
          2003 |       24 | Friday      | January 24, 2003      | January 31, 2003
          2003 |        3 | Friday      | January 3, 2003       | January 31, 2003
          2003 |       10 | Friday      | January 10, 2003      | January 31, 2003
          2003 |       17 | Friday      | January 17, 2003      | January 31, 2003
          2003 |        6 | Monday      | January 6, 2003       | January 31, 2003
          2003 |       27 | Monday      | January 27, 2003      | January 31, 2003
          2003 |       13 | Monday      | January 13, 2003      | January 31, 2003
          2003 |       20 | Monday      | January 20, 2003      | January 31, 2003
          2003 |       11 | Saturday    | January 11, 2003      | January 31, 2003
          2003 |       18 | Saturday    | January 18, 2003      | January 31, 2003
          2003 |       25 | Saturday    | January 25, 2003      | January 31, 2003
          2003 |        4 | Saturday    | January 4, 2003       | January 31, 2003
          2003 |       12 | Sunday      | January 12, 2003      | January 31, 2003
          2003 |       26 | Sunday      | January 26, 2003      | January 31, 2003
```

```
           2003 |         5 | Sunday      | January 5, 2003       | January 31, 2003
           2003 |        19 | Sunday      | January 19, 2003      | January 31, 2003
           2003 |        23 | Thursday    | January 23, 2003      | January 31, 2003
           2003 |         2 | Thursday    | January 2, 2003       | January 31, 2003
           2003 |         9 | Thursday    | January 9, 2003       | January 31, 2003
           2003 |        16 | Thursday    | January 16, 2003      | January 31, 2003
           2003 |        30 | Thursday    | January 30, 2003      | January 31, 2003
           2003 |        21 | Tuesday     | January 21, 2003      | January 31, 2003
           2003 |        14 | Tuesday     | January 14, 2003      | January 31, 2003
           2003 |         7 | Tuesday     | January 7, 2003       | January 31, 2003
           2003 |        28 | Tuesday     | January 28, 2003      | January 31, 2003
           2003 |        22 | Wednesday   | January 22, 2003      | January 31, 2003
           2003 |        29 | Wednesday   | January 29, 2003      | January 31, 2003
           2003 |        15 | Wednesday   | January 15, 2003      | January 31, 2003
           2003 |         1 | Wednesday   | January 1, 2003       | January 31, 2003
           2003 |         8 | Wednesday   | January 8, 2003       | January 31, 2003
(31 rows)
```

Note: The `day_of_week` results are returned in alphabetical order because of lexical rules. The fact that each day does not appear ordered by the 7-day week cycle (for example, starting with Sunday followed by Monday, Tuesday, and so on) has no affect on results.

To return deterministic results, modify the query so that it performs its analytic `ORDER BY` operations on a **unique** field, such as `date_key`:

```
=> SELECT calendar_year, date_key, day_of_week, full_date_description,
   FIRST_VALUE(full_date_description) OVER
     (PARTITION BY calendar_month_number_in_year ORDER BY date_key) AS "first_value"
   FROM date_dimension WHERE calendar_year=2003;
```

Notice that the results return a first value of January 1 for the January partition and the first value of February 1 for the February partition. Also, there are no ties in the `full_date_description` column:

```
 calendar_year | date_key | day_of_week | full_date_description |    first_value
---------------+----------+-------------+-----------------------+-------------
------
           2003 |        1 | Wednesday   | January 1, 2003       | January 1, 2003
           2003 |        2 | Thursday    | January 2, 2003       | January 1, 2003
           2003 |        3 | Friday      | January 3, 2003       | January 1, 2003
           2003 |        4 | Saturday    | January 4, 2003       | January 1, 2003
           2003 |        5 | Sunday      | January 5, 2003       | January 1, 2003
           2003 |        6 | Monday      | January 6, 2003       | January 1, 2003
           2003 |        7 | Tuesday     | January 7, 2003       | January 1, 2003
           2003 |        8 | Wednesday   | January 8, 2003       | January 1, 2003
           2003 |        9 | Thursday    | January 9, 2003       | January 1, 2003
           2003 |       10 | Friday      | January 10, 2003      | January 1, 2003
           2003 |       11 | Saturday    | January 11, 2003      | January 1, 2003
           2003 |       12 | Sunday      | January 12, 2003      | January 1, 2003
           2003 |       13 | Monday      | January 13, 2003      | January 1, 2003
           2003 |       14 | Tuesday     | January 14, 2003      | January 1, 2003
           2003 |       15 | Wednesday   | January 15, 2003      | January 1, 2003
           2003 |       16 | Thursday    | January 16, 2003      | January 1, 2003
           2003 |       17 | Friday      | January 17, 2003      | January 1, 2003
           2003 |       18 | Saturday    | January 18, 2003      | January 1, 2003
           2003 |       19 | Sunday      | January 19, 2003      | January 1, 2003
```

```
          2003 |       20 | Monday      | January 20, 2003      | January 1, 2003
          2003 |       21 | Tuesday     | January 21, 2003      | January 1, 2003
          2003 |       22 | Wednesday   | January 22, 2003      | January 1, 2003
          2003 |       23 | Thursday    | January 23, 2003      | January 1, 2003
          2003 |       24 | Friday      | January 24, 2003      | January 1, 2003
          2003 |       25 | Saturday    | January 25, 2003      | January 1, 2003
          2003 |       26 | Sunday      | January 26, 2003      | January 1, 2003
          2003 |       27 | Monday      | January 27, 2003      | January 1, 2003
          2003 |       28 | Tuesday     | January 28, 2003      | January 1, 2003
          2003 |       29 | Wednesday   | January 29, 2003      | January 1, 2003
          2003 |       30 | Thursday    | January 30, 2003      | January 1, 2003
          2003 |       31 | Friday      | January 31, 2003      | January 1, 2003
          2003 |       32 | Saturday    | February 1, 2003      | February 1, 2003
          2003 |       33 | Sunday      | February 2, 2003      | February 1, 2003
          ...
(365 rows)
```

See Also

LAST_VALUE (page 143)

TIME_SLICE (page 205)

Using SQL Analytics in the Programmer's Guide

LAG [Analytic]

Returns the value of the input expression at the given offset *before* the current row within a window.

Behavior Type

Immutable

Syntax

```
LAG ( expression [, offset ] [, default ] ) OVER (
... [ window_partition_clause (page 121) ]
... window_order_clause (page 123)  )
```

Parameters

expression	Is the expression to evaluate; for example, a constant, column, nonanalytic function, function expression, or expressions involving any of these.
offset	Is an optional parameter that defaults to 1 (the previous row). The *offset* parameter must be (or can be evaluated to) a constant positive integer.
default	Is NULL. This optional parameter is the value returned if *offset* falls outside the bounds of the table or partition. **Note:** The third input argument must be a constant value or an expression that can be evaluated to a constant; its data type is coercible to that of the first argument.

`OVER(...)`	See ***Analytic Functions.*** (page 120)

Notes

- The analytic `window_order_clause` is required but the `window_partition_clause` is optional.
- The `LAG()` function returns values from the row before the current row, letting you access more than one row in a table at the same time. This is useful for comparing values when the relative positions of rows can be reliably known. It also lets you avoid the more costly self join, which enhances query processing speed.
- See ***LEAD()*** (page 144) for how to get the *next* rows.
- Analytic functions, such as `LAG()`, cannot be nested within aggregate functions.

Examples

This example sums the current balance by date in a table and also sums the previous balance from the last day. Given the inputs that follow, the data satisfies the following conditions:

- For each `some_id`, there is exactly 1 row for each date represented by `month_date`.
- For each `some_id`, the set of dates is consecutive; that is, if there is a row for February 24 and a row for February 26, there would also be a row for February 25.
- Each `some_id` has the same set of dates.

```
=> CREATE TABLE balances (
       month_date DATE,
       current_bal INT,
       some_id INT);
=> INSERT INTO balances values ('2009-02-24', 10, 1);
=> INSERT INTO balances values ('2009-02-25', 10, 1);
=> INSERT INTO balances values ('2009-02-26', 10, 1);
=> INSERT INTO balances values ('2009-02-24', 20, 2);
=> INSERT INTO balances values ('2009-02-25', 20, 2);
=> INSERT INTO balances values ('2009-02-26', 20, 2);
=> INSERT INTO balances values ('2009-02-24', 30, 3);
=> INSERT INTO balances values ('2009-02-25', 20, 3);
=> INSERT INTO balances values ('2009-02-26', 30, 3);
```

Now run the `LAG()` function to sum the current balance for each date and sum the previous balance from the last day:

```
=> SELECT month_date,
     SUM(current_bal) as current_bal_sum,
     SUM(previous_bal) as previous_bal_sum FROM
       (SELECT month_date, current_bal,
     LAG(current_bal, 1, 0) OVER
       (PARTITION BY some_id ORDER BY month_date)
     AS previous_bal FROM balances) AS subQ
     GROUP BY month_date ORDER BY month_date;

month_date  | current_bal_sum | previous_bal_sum
------------+-----------------+------------------
```

```
 2009-02-24 |              60 |                0
 2009-02-25 |              50 |               60
 2009-02-26 |              60 |               50
(3 rows)
```

Using the same example data, the following query would not be allowed because `LAG()` is nested inside an aggregate function:

```
=> SELECT month_date,
   SUM(current_bal) as current_bal_sum,
   SUM(LAG(current_bal, 1, 0) OVER
      (PARTITION BY some_id ORDER BY month_date)) AS previous_bal_sum
   FROM some_table GROUP BY month_date ORDER BY month_date;
```

In the next example, which uses the VMart example database, the `LAG()` function first returns the annual income from the previous row, and then it calculates the difference between the income in the current row from the income in the previous row. Note: The vmart example database returns over 50,000 rows, so we'll limit the results to 20 records:

```
=> SELECT occupation, customer_key, customer_name, annual_income,
   LAG(annual_income, 1, 0) OVER (PARTITION BY occupation  ORDER BY annual_income) AS prev_income,
annual_income -
   LAG(annual_income, 1, 0) OVER (PARTITION BY occupation  ORDER BY annual_income) AS difference
   FROM customer_dimension ORDER BY occupation, customer_key LIMIT 20;
 occupation | customer_key |    customer_name     | annual_income | prev_income | difference
------------+--------------+----------------------+---------------+-------------+------------
 Accountant |           15 | Midori V. Peterson   |        692610 |      692535 |         75
 Accountant |           43 | Midori S. Rodriguez  |        282359 |      280976 |       1383
 Accountant |           93 | Robert P. Campbell   |        471722 |      471355 |        367
 Accountant |          102 | Sam T. McNulty       |        901636 |      901561 |         75
 Accountant |          134 | Martha B. Overstreet |        705146 |      704335 |        811
 Accountant |          165 | James C. Kramer      |        376841 |      376474 |        367
 Accountant |          225 | Ben W. Farmer        |         70574 |       70449 |        125
 Accountant |          270 | Jessica S. Lang      |        684204 |      682274 |       1930
 Accountant |          273 | Mark X. Lampert      |        723294 |      722737 |        557
 Accountant |          295 | Sharon K. Gauthier   |         29033 |       28412 |        621
 Accountant |          338 | Anna S. Jackson      |        816858 |      815557 |       1301
 Accountant |          377 | William I. Jones     |        915149 |      914872 |        277
 Accountant |          438 | Joanna A. McCabe     |        147396 |      144482 |       2914
 Accountant |          452 | Kim P. Brown         |        126023 |      124797 |       1226
 Accountant |          467 | Meghan K. Carcetti   |        810528 |      810284 |        244
 Accountant |          478 | Tanya E. Greenwood   |        639649 |      639029 |        620
 Accountant |          511 | Midori P. Vogel      |        187246 |      185539 |       1707
 Accountant |          525 | Alexander K. Moore   |        677433 |      677050 |        383
 Accountant |          550 | Sam P. Reyes         |        735691 |      735355 |        336
 Accountant |          577 | Robert U. Vu         |        616101 |      615439 |        662
(20 rows)
```

Continuing with the Vmart database, the next example uses both `LEAD()` and `LAG()` to return the third row after the salary in the current row and fifth salary before the salary in the current row.

```
=> SELECT hire_date, employee_key, employee_last_name,
   LEAD(hire_date, 1) OVER (ORDER BY hire_date) AS "next_hired" ,
   LAG(hire_date, 1) OVER (ORDER BY hire_date) AS "last_hired"
   FROM employee_dimension ORDER BY hire_date, employee_key;
 hire_date  | employee_key | employee_last_name | next_hired | last_hired
------------+--------------+--------------------+------------+------------
 1956-04-11 |         2694 | Farmer             | 1956-05-12 |
 1956-05-12 |         5486 | Winkler            | 1956-09-18 | 1956-04-11
 1956-09-18 |         5525 | McCabe             | 1957-01-15 | 1956-05-12
 1957-01-15 |          560 | Greenwood          | 1957-02-06 | 1956-09-18
 1957-02-06 |         9781 | Bauer              | 1957-05-25 | 1957-01-15
```

```
 1957-05-25 |         9506 | Webber             | 1957-07-04 | 1957-02-06
 1957-07-04 |         6723 | Kramer             | 1957-07-07 | 1957-05-25
 1957-07-07 |         5827 | Garnett            | 1957-11-11 | 1957-07-04
 1957-11-11 |          373 | Reyes              | 1957-11-21 | 1957-07-07
 1957-11-21 |         3874 | Martin             | 1958-02-06 | 1957-11-11
(10 rows)
```

The following example specifies arguments that use different data types; for example `annual_income(INT) and occupation(VARCHAR)`. The query returns an error:

```
=> SELECT customer_key, customer_name, occupation, annual_income,
   LAG (annual_income, 1, occupation) OVER
      (PARTITION BY occupation ORDER BY customer_key) LAG1
   FROM customer_dimension ORDER BY 3, 1;
   ERROR:  Third argument of lag could not be converted from type character varying
to type int8
   HINT:  You may need to add explicit type cast.
```

See Also

LEAD (page 144)

Using SQL Analytics in the Programmer's Guide

LAST_VALUE [Analytic]

Returns values of the expression from the last row of a window for the current row. If no window is specified for the current row, the default window is `UNBOUNDED PRECEDING AND CURRENT ROW`.

Behavior Type

Immutable

Syntax

```
LAST_VALUE ( expression [ IGNORE NULLS ] ) OVER (
... [ window_partition_clause (page 121) ]
... [ window_order_clause (page 123) ]
... [ window_frame_clause (page 125) ] )
```

Parameters

expression	Is the expression to evaluate; for example, a constant, column, nonanalytic function, function expression, or expressions involving any of these.
`IGNORE NULLS`	Returns the last non-null value in the set, or NULL if all values are NULL.
`OVER(...)`	See ***Analytic Functions.*** (page 120)

Notes

- The `LAST_VALUE()` function lets you select a window's last value (determined by the `window_order_clause`), without having to use a self join. This function is useful when you want to use the last value as a baseline in calculations.

- LAST_VALUE() takes the last record from the partition after the analytic window_order_clause. The expression is then computed against the last record, and results are returned.
- Vertica recommends that you use LAST_VALUE with the window_order_clause to produce deterministic results.

  Note: Due to default window semantics, LAST_VALUE does not always return the last value of a partition. If the *window_frame_clause* is omitted from the analytic clause, LAST_VALUE operates on this default window. Results, therefore, can seem non-intuitive because the function does not return the bottom of the current partition. It returns the bottom of the window, which continues to change along with the current input row being processed. If you want to return the last value of a partition, use UNBOUNDED PRECEDING AND UNBOUNDED FOLLOWING.
- If the last value in the set is null, then the function returns NULL unless you specify IGNORE NULLS. If you specify IGNORE NULLS, LAST_VALUE returns the fist non-null value in the set, or NULL if all values are null.
- For examples, see FIRST_VALUE() (page 137).

See Also

FIRST_VALUE (page 137)

TIME_SLICE (page 205)

Using SQL for Analytics in the Programmer's Guide

LEAD [Analytic]

Returns the value of the input expression at the given offset *after* the current row within a window.

Behavior Type

Immutable

Syntax

```
LEAD ( expression [, offset ] [, default ] ) OVER (
... [ window_partition_clause (page 121) ]
... window_order_clause (page 123)  )
```

Parameters

expression	Is the expression to evaluate; for example, a constant, column, nonanalytic function, function expression, or expressions involving any of these.
offset	Is an optional parameter that defaults to 1 (the next row). The *offset* parameter must be (or can be evaluated to) a constant positive integer.
default	Is NULL. This optional parameter is the value returned if *offset* falls outside the bounds of the table or partition. **Note:** The third input argument must be a constant value or an

	expression that can be evaluated to a constant; its data type is coercible to that of the first argument.
`OVER(...)`	See ***Analytic Functions.*** (page 120)

Notes

- The analytic `window_order_clause` is required but the `window_partition_clause` is optional.
- The `LEAD()` function returns values from the row after the current row, letting you access more than one row in a table at the same time. This is useful for comparing values when the relative positions of rows can be reliably known. It also lets you avoid the more costly self join, which enhances query processing speed.
- Analytic functions, such as `LEAD()`, cannot be nested within aggregate functions.

Examples

In this example, the `LEAD()` function finds the hire date of the employee hired just after the current row:

```
=> SELECT employee_region, hire_date, employee_key, employee_last_name,
   LEAD(hire_date, 1) OVER (PARTITION BY employee_region ORDER BY hire_date) AS "next_hired"
   FROM employee_dimension ORDER BY employee_region, hire_date, employee_key;
  employee_region   | hire_date  | employee_key | employee_last_name | next_hired
--------------------+------------+--------------+--------------------+---------
---
 East               | 1956-04-08 |         9218 | Harris             | 1957-02-06
 East               | 1957-02-06 |         7799 | Stein              | 1957-05-25
 East               | 1957-05-25 |         3687 | Farmer             | 1957-06-26
 East               | 1957-06-26 |         9474 | Bauer              | 1957-08-18
 East               | 1957-08-18 |          570 | Jefferson          | 1957-08-24
 East               | 1957-08-24 |         4363 | Wilson             | 1958-02-17
 East               | 1958-02-17 |         6457 | McCabe             | 1958-06-26
 East               | 1958-06-26 |         6196 | Li                 | 1958-07-16
 East               | 1958-07-16 |         7749 | Harris             | 1958-09-18
 East               | 1958-09-18 |         9678 | Sanchez            | 1958-11-10
(10 rows)
```

The next example uses both `LEAD()` and `LAG()` to return the third row after the salary in the current row and fifth salary before the salary in the current row.

```
=> SELECT hire_date, employee_key, employee_last_name,
   LEAD(hire_date, 1) OVER (ORDER BY hire_date) AS "next_hired" ,
   LAG(hire_date, 1) OVER (ORDER BY hire_date) AS "last_hired"
   FROM employee_dimension ORDER BY hire_date, employee_key;
 hire_date  | employee_key | employee_last_name | next_hired | last_hired
------------+--------------+--------------------+------------+------------
 1956-04-11 |         2694 | Farmer             | 1956-05-12 |
 1956-05-12 |         5486 | Winkler            | 1956-09-18 | 1956-04-11
 1956-09-18 |         5525 | McCabe             | 1957-01-15 | 1956-05-12
 1957-01-15 |          560 | Greenwood          | 1957-02-06 | 1956-09-18
 1957-02-06 |         9781 | Bauer              | 1957-05-25 | 1957-01-15
 1957-05-25 |         9506 | Webber             | 1957-07-04 | 1957-02-06
 1957-07-04 |         6723 | Kramer             | 1957-07-07 | 1957-05-25
```

```
 1957-07-07 |         5827 | Garnett            | 1957-11-11 | 1957-07-04
 1957-11-11 |          373 | Reyes              | 1957-11-21 | 1957-07-07
 1957-11-21 |         3874 | Martin             | 1958-02-06 | 1957-11-11
(10 rows)
```

The following example returns employee name and salary, along with the next highest and lowest salaries.

```
=> SELECT employee_last_name, annual_salary,
       NVL(LEAD(annual_salary) OVER (ORDER BY annual_salary),
         MIN(annual_salary) OVER()) "Next Highest",
       NVL(LAG(annual_salary) OVER (ORDER BY annual_salary),
         MAX(annual_salary)  OVER()) "Next Lowest"
   FROM employee_dimension;
 employee_last_name | annual_salary | Next Highest | Next Lowest
--------------------+---------------+--------------+-------------
 Nielson            |          1200 |         1200 |      995533
 Lewis              |          1200 |         1200 |        1200
 Harris             |          1200 |         1202 |        1200
 Robinson           |          1202 |         1202 |        1200
 Garnett            |          1202 |         1202 |        1202
 Weaver             |          1202 |         1202 |        1202
 Nielson            |          1202 |         1202 |        1202
 McNulty            |          1202 |         1204 |        1202
 Farmer             |          1204 |         1204 |        1202
 Martin             |          1204 |         1204 |        1204
(10 rows)
```

The next example returns, for each assistant director in the employees table, the hire date of the director hired just after the director on the current row. For example, Jackson was hired on 2007-12-28, and the next director hired was Bauer:

```
=> SELECT employee_last_name, hire_date,
      LEAD(hire_date, 1) OVER (ORDER BY hire_date DESC) as "NextHired"
   FROM employee_dimension WHERE job_title = 'Assistant Director';
 employee_last_name | hire_date  | NextHired
--------------------+------------+------------
 Jackson            | 2007-12-28 | 2007-12-26
 Bauer              | 2007-12-26 | 2007-12-11
 Miller             | 2007-12-11 | 2007-12-07
 Fortin             | 2007-12-07 | 2007-11-27
 Harris             | 2007-11-27 | 2007-11-15
 Goldberg           | 2007-11-15 |

(5 rows)
```

See Also

LAG (page 140)

Using SQL for Analytics in the Programmer's Guide

MAX [Analytic]

Returns the maximum value of an expression within a window. The return value is the same as the expression data type.

Behavior Type

Immutable

Syntax

```
MAX ( [ DISTINCT ] expression ) OVER (
... [ window_partition_clause (page 121) ]
... [ window_order_clause (page 123) ]
... [ window_frame_clause (page 125) ] )
```

Parameters

`DISTINCT`	Is meaningless in this context.
`expression`	Can be any expression for which the maximum value is calculated, typically a ***column reference*** (see "***Column References***" on page 45).
`OVER(...)`	See ***Analytic Functions.*** (page 120)

Example

The following query computes the deviation between the employees' annual salary and the maximum annual salary in Massachusetts:

```
=> SELECT employee_state, annual_salary,
     MAX(annual_salary)
       OVER(PARTITION BY employee_state ORDER BY employee_key) max,
          annual_salary- MAX(annual_salary)
       OVER(PARTITION BY employee_state ORDER BY employee_key) diff
   FROM employee_dimension
   WHERE employee_state = 'MA';

 employee_state | annual_salary |  max   |  diff
----------------+---------------+--------+---------
 MA             |          1918 | 995533 | -993615
 MA             |          2058 | 995533 | -993475
 MA             |          2586 | 995533 | -992947
 MA             |          2500 | 995533 | -993033
 MA             |          1318 | 995533 | -994215
 MA             |          2072 | 995533 | -993461
 MA             |          2656 | 995533 | -992877
 MA             |          2148 | 995533 | -993385
 MA             |          2366 | 995533 | -993167
 MA             |          2664 | 995533 | -992869
(10 rows)
```

See Also

MAX (page 112) aggregate function

MIN (page 149) analytic function

Using SQL Analytics in the Programmer's Guide

MEDIAN [Analytic]

Returns the middle value of an expression in a result set within a window. A median value has the same number of records below it as above it. If there are an even number of elements, `MEDIAN()` returns the average of the two.

`MEDIAN()` is an alias for 50% `PERCENTILE()`:

```
PERCENTILE_CONT(0.5) WITHIN GROUP(ORDER BY expression)
```

Behavior Type

Immutable

Syntax

`MEDIAN ( expression ) OVER ( [ window_partition_clause` (page 121) `] )`

Parameters

expression	Any `NUMERIC` ***data type*** (page 92) or any non-numeric data type that can be implicitly converted to a numeric data type. The function returns the middle value or an interpolated value that would be the middle value once the values are sorted. Null values are ignored in the calculation.
`OVER(...)`	See ***Analytic Functions.*** (page 120)

Notes

- For each row, `MEDIAN()` returns the value that would fall in the middle of a value set within each partition.
- Vertica determines the argument with the highest numeric precedence, implicitly converts the remaining arguments to that data type, and returns that data type.
- `MEDIAN()` does not allow the `window_order_clause` or `window_frame_clause`.

Examples

The following query computes the median annual income for first 500 customers in Wisconsin and in the District of Columbia. Note that median is reported for every row in the result set:

```
=> SELECT customer_state, annual_income,
     MEDIAN(annual_income) OVER (PARTITION BY customer_state) AS MEDIAN
   FROM customer_dimension
   WHERE customer_state IN ('DC','WI')
   ORDER BY customer_state;

 customer_state | customer_key | annual_income | MEDIAN
----------------+--------------+---------------+----------
 DC             |          120 |        299768 |   535413
```

```
 DC             |          113 |        535413 |   535413
 DC             |          130 |        848360 |   535413
 WI             |          372 |         34962 |   668147
 WI             |          437 |         47128 |   668147
 WI             |          435 |         67770 |   668147
 WI             |          282 |        638054 |   668147
 WI             |          314 |        668147 |   668147
 WI             |          128 |        675608 |   668147
 WI             |          179 |        825304 |   668147
 WI             |          302 |        827618 |   668147
 WI             |           29 |        922760 |   668147
(12 rows)
```

See Also

PERCENTILE_CONT (page 154)

Using SQL Analytics in the Programmer's Guide

MIN [Analytic]

Returns the minimum value of an expression within a window. The return value is the same as the expression data type.

Behavior Type

Immutable

Syntax

```
MIN ( [ DISTINCT ] expression ) OVER (
... [ window_partition_clause (page 121) ]
... [ window_order_clause (page 123) ]
... [ window_frame_clause (page 125) ] )
```

Parameters

`DISTINCT`	Is meaningless in this context.
`expression`	Can be any expression for which the minimum value is calculated, typically a ***column reference*** (see "***Column References***" on page 45).
`OVER(...)`	See ***Analytic Functions.*** (page 120)

Examples

The following query computes the deviation between the employees' annual salary and the minimum annual salary in Massachusetts:

```
=> SELECT employee_state, annual_salary,
      MIN(annual_salary)
      OVER(PARTITION BY employee_state ORDER BY employee_key) min,
        annual_salary- MIN(annual_salary)
      OVER(PARTITION BY employee_state ORDER BY employee_key) diff
```

```
   FROM employee_dimension
   WHERE employee_state = 'MA';

 employee_state | annual_salary | min  | diff
----------------+---------------+------+------
 MA             |          1918 | 1204 |  714
 MA             |          2058 | 1204 |  854
 MA             |          2586 | 1204 | 1382
 MA             |          2500 | 1204 | 1296
 MA             |          1318 | 1204 |  114
 MA             |          2072 | 1204 |  868
 MA             |          2656 | 1204 | 1452
 MA             |          2148 | 1204 |  944
 MA             |          2366 | 1204 | 1162
 MA             |          2664 | 1204 | 1460
(10 rows)
```

See Also

MIN (page 112) aggregate function

MAX (page 146) analytic function

Using SQL Analytics in the Programmer's Guide

NTILE [Analytic]

Divides an ordered data set (partition) into buckets within a window, with the buckets numbered 1 through *constant-value*. For example, if *constant-value* = 4, then each row in the partition is assigned a number from 1 to 4. If the partition contains 20 rows, the first 5 would be assigned 1, the next 5 would be assigned 2, and so on.

Behavior Type

Immutable

Syntax

```
NTILE ( constant-value ) OVER (
... [ window_partition_clause (page 121) ]
... window_order_clause (page 123) )
```

Parameters

constant-value	Represents the number of buckets and must resolve to a positive constant for each partition.
`OVER(...)`	See ***Analytic Functions.*** (page 120)

Notes

- The analytic `window_order_clause` is required but the `window_partition_clause` is optional.

- If the number of buckets is greater than the number of rows, then a number of buckets equal to the number of rows is filled, and the remaining buckets are empty.
- In the event the cardinality of the partition is not evenly divisible by the number of buckets, the rows are distributed so no bucket has more than 1 row more then any other bucket, and the lowest buckets are the ones that have extra rows. For example, using constant-value = 4 again and the number of rows = 21, bucket = 1 has 6 rows, bucket = 2 has 5, and so on.
- Analytic functions, such as `NTILE()`, cannot be nested within aggregate functions.

Examples

The following query assigns each month's sales total into one of four buckets:

```
=> SELECT calendar_month_name AS MONTH, SUM(sales_quantity),
     NTILE(4) OVER (ORDER BY SUM(sales_quantity)) AS NTILE
   FROM store.store_sales_fact JOIN date_dimension
   USING(date_key)
   GROUP BY calendar_month_name
   ORDER BY NTILE;

   MONTH    | SUM  | NTILE
------------+------+-------
 February   |  755 |     1
 June       |  842 |     1
 September  |  849 |     1
 January    |  881 |     2
 May        |  882 |     2
 July       |  894 |     2
 August     |  921 |     3
 April      |  952 |     3
 March      |  987 |     3
 October    | 1010 |     4
 November   | 1026 |     4
 December   | 1094 |     4
(12 rows)
```

See Also

PERCENTILE_CONT (page 154)

WIDTH_BUCKET (page 246)

Using SQL Analytics in the Programmer's Guide

PERCENT_RANK [Analytic]

Calculates the relative rank of a row for a given row in a group within a window by dividing that row's rank less 1 by the number of rows in the partition, also less 1. This function always returns values from 0 to 1 inclusive. The first row in any set has a `PERCENT_RANK()` of 0. The return value is `NUMBER`.

```
( rank - 1 ) / ( [ rows ] - 1 )
```

In the above formula, `rank` is the rank position of a row in the group and `rows` is the total number of rows in the partition defined by the `OVER()` clause.

Behavior Type

Immutable

Syntax

```
PERCENT_RANK ( ) OVER (
... [ window_partition_clause (page 121) ]
... window_order_clause (page 123)  )
```

Parameters

`OVER(...)`	See ***Analytic Functions.*** (page 120)

Notes

The `window_order_clause is required but the window_partition_clause` is optional.

Examples

The following example finds the percent rank of gross profit for different states within each month of the first quarter:

```
=> SELECT calendar_month_name AS MONTH, store_state ,
      SUM(gross_profit_dollar_amount),
      PERCENT_RANK() OVER (PARTITION BY calendar_month_name
      ORDER BY SUM(gross_profit_dollar_amount)) AS PERCENT_RANK
   FROM store.store_sales_fact JOIN date_dimension
   USING(date_key)
   JOIN store.store_dimension
   USING (store_key)
   WHERE calendar_month_name IN ('January','February','March')
   AND store_state IN ('OR','IA','DC','NV','WI')
   GROUP BY calendar_month_name, store_state
   ORDER BY calendar_month_name, PERCENT_RANK;

  MONTH   | store_state | SUM  |   PERCENT_RANK
----------+-------------+------+------------------
 February | OR          |   16 |                0
 February | IA          |   47 |             0.25
 February | DC          |   94 |              0.5
 February | NV          |  113 |             0.75
 February | WI          |  119 |                1
 January  | IA          | -263 |                0
 January  | OR          |   91 | 0.333333333333333
 January  | NV          |  372 | 0.666666666666667
 January  | DC          |  497 |                1
 March    | NV          | -141 |                0
 March    | OR          |  224 |                1

(11 rows)
```

The following example calculates, for each employee, the percent rank of the employee's salary by their job title:

```
=> SELECT job_title, employee_last_name, annual_salary,
      PERCENT_RANK()
      OVER (PARTITION BY job_title ORDER BY annual_salary DESC) AS percent_rank
   FROM employee_dimension
   ORDER BY percent_rank, annual_salary;

  job_title         | employee_last_name | annual_salary |   PERCENT_RANK
--------------------+--------------------+---------------+--------------------
-
 CEO                | Campbell           |        963914 |                  0
 Co-Founder         | Nguyen             |        968625 |                  0
 Founder            | Overstreet         |        995533 |                  0
 Greeter            | Peterson           |          3192 | 0.00113895216400911
 Greeter            | Greenwood          |          3192 | 0.00113895216400911
 Customer Service   | Peterson           |          3190 | 0.00121065375302663
 Delivery Person    | Rodriguez          |          3192 | 0.00121065375302663
 Shelf Stocker      | Martin             |          3194 | 0.00125786163522013
 Shelf Stocker      | Vu                 |          3194 | 0.00125786163522013
 Marketing          | Li                 |         99711 | 0.00190114068441065
 Assistant Director | Sanchez            |         99913 | 0.00190839694656489
 Branch Manager     | Perkins            |         99901 | 0.00192307692307692
 Advertising        | Lampert            |         99809 | 0.00204918032786885
 Sales              | Miller             |         99727 | 0.00211416490486258
 Shift Manager      | King               |         99904 | 0.00215982721382289
 Custodian          | Bauer              |          3196 | 0.00235849056603774
 Custodian          | Goldberg           |          3196 | 0.00235849056603774
 Customer Service   | Fortin             |          3184 | 0.00242130750605327
 Delivery Person    | Greenwood          |          3186 | 0.00242130750605327
 Cashier            | Overstreet         |          3178 | 0.00243605359317905
 Regional Manager   | McCabe             |        199688 | 0.00306748466257669
 VP of Sales        | Li                 |        199309 | 0.00313479623824451
 Director of HR     | Goldberg           |        199592 | 0.00316455696202532
 Head of Marketing  | Stein              |        199941 | 0.00317460317460317
 VP of Advertising  | Goldberg           |        199036 | 0.00323624595469256
 Head of PR         | Stein              |        199767 | 0.00323624595469256
 Customer Service   | Rodriguez          |          3180 |  0.0036319612590799
 Delivery Person    | King               |          3184 |  0.0036319612590799
 Cashier            | Dobisz             |          3174 | 0.00365408038976857
 Cashier            | Miller             |          3174 | 0.00365408038976857
 Marketing          | Dobisz             |         99655 | 0.00380228136882129
 Branch Manager     | Gauthier           |         99082 |               0.025
 Branch Manager     | Moore              |         98415 |                0.05
...
```

See Also

CUME_DIST (page 132)

Using SQL Analytics in the Programmer's Guide

PERCENTILE_CONT [Analytic]

An inverse distribution function where, for each row, PERCENTILE_CONT() returns the value that would fall into the specified percentile among a set of values in each partition within a window. For example, if the argument to the function is 0.5, the result of the function is the median of the data set (the 50th percentile). PERCENTILE_CONT() assumes a continuous distribution data model. Nulls are ignored.

Behavior Type

Immutable

Syntax

```
PERCENTILE_CONT ( %_number ) WITHIN GROUP (
... ORDER BY expression [ ASC | DESC ] ) OVER (
... [ window_partition_clause (page 121) ] )
```

Parameters

%_number	Is the percentile value, which must be a FLOAT constant ranging from 0 to 1 (inclusive).
WITHIN GROUP(ORDER BY *expression*)	Specifies how the data is sorted within each group. ORDER BY takes only one column/expression that must be INTEGER, FLOAT, INTERVAL, or NUMERIC data type. Nulls are discarded. **Note:** The WITHIN GROUP(ORDER BY) clause does not guarantee the order of the SQL result. Use the ***SQL ORDER BY clause*** (page 629) to guarantee the ordering of the final result set.
ASC | DESC	Specifies the ordering sequence as ascending (default) or descending.
OVER(...)	See ***Analytic Functions.*** (page 120)

Notes

- Vertica computes the percentile by first computing the row number where the percentile row would exist; for example:
  ROW_NUMBER = 1 + PERCENTILE_VALUE * (NUMBER_OF_ROWS_IN_PARTITION -1)
  If the CEILING(ROW_NUMBER) = FLOOR(ROW_NUMBER), then the percentile is the value *at* the ROW_NUMBER. Otherwise there was an even number of rows, and Vertica interpolates the value between the rows. In this case, the percentile CEILING_VAL = get the value at the CEILING(ROW_NUMBER). FLOOR_VAL = get the value at the FLOOR(ROW_NUMBER) would be (CEILING(ROW_NUMBER) - ROW_NUMBER) * CEILING_VAL + (ROW_NUMBER - FLOOR(ROW_NUMBER) * FLOOR+VAL.
  If CEIL(num) = FLOOR(num) = num, then retrieve the value in that row. Otherwise compute values at [CEIL(num) + FLOOR(num)] / 2
- Specifying ASC or DESC in the WITHIN GROUP clause affects results as long as the percentile parameter is not .5.

- The MEDIAN() function is a specific case of PERCENTILE_CONT() where the percentile value defaults to 0.5. For more information, see MEDIAN() (page 148).

Examples

This query computes the median annual income per group for the first 500 customers in Wisconsin and the District of Columbia.

```
=> SELECT customer_state, customer_key, annual_income,
      PERCENTILE_CONT(.5) WITHIN GROUP(ORDER BY annual_income)
      OVER (PARTITION BY customer_state) AS PERCENTILE_CONT
   FROM customer_dimension
   WHERE customer_state IN ('DC','WI')
   AND customer_key < 300
   ORDER BY customer_state, customer_key;

 customer_state | customer_key | annual_income | PERCENTILE_CONT
----------------+--------------+---------------+-----------------
 DC             |          104 |        658383 |          658383
 DC             |          168 |        417092 |          658383
 DC             |          245 |        670205 |          658383
 WI             |          106 |        227279 |          458607
 WI             |          127 |        703889 |          458607
 WI             |          209 |        458607 |          458607
(6 rows)
```

The median value for DC is 65838, and the median value for WI is 458607. Note that with a %_number of .5 in the above query, PERCENTILE_CONT() returns the same result as MEDIAN() in the following query:

```
=> SELECT customer_state, customer_key, annual_income,
      MEDIAN(annual_income)
      OVER (PARTITION BY customer_state) AS MEDIAN
   FROM customer_dimension
   WHERE customer_state IN ('DC','WI')
   AND customer_key < 300
   ORDER BY customer_state, customer_key;

 customer_state | customer_key | annual_income | MEDIAN
----------------+--------------+---------------+--------
 DC             |          104 |        658383 | 658383
 DC             |          168 |        417092 | 658383
 DC             |          245 |        670205 | 658383
 WI             |          106 |        227279 | 458607
 WI             |          127 |        703889 | 458607
 WI             |          209 |        458607 | 458607
(6 rows)
```

See Also

MEDIAN (page 148)

Using SQL Analytics in the Programmer's Guide

PERCENTILE_DISC [Analytic]

An inverse distribution function where, for each row, PERCENTILE_DISC() returns the value that would fall into the specified percentile among a set of values in each partition within a window. PERCENTILE_DISC() assumes a discrete distribution data model. Nulls are ignored.

Behavior Type

Immutable

Syntax

```
PERCENTILE_DISC ( %_number ) WITHIN GROUP (
... ORDER BY expression [ ASC | DESC ] ) OVER (
... [ window_partition_clause (page 121) ] )
```

Parameters

%_number	Is the percentile value, which must be a FLOAT constant ranging from 0 to 1 (inclusive).
WITHIN GROUP(ORDER BY *expression*)	Specifies how the data is sorted within each group. ORDER BY takes only one column/expression that must be INTEGER, FLOAT, INTERVAL, or NUMERIC data type. Nulls are discarded. **Note:** The WITHIN GROUP(ORDER BY) clause does not guarantee the order of the SQL result. Use the ***SQL ORDER BY clause*** (page 629) to guarantee the ordering of the final result set.
ASC | DESC	Specifies the ordering sequence as ascending (default) or descending.
OVER(...)	See ***Analytic Functions.*** (page 120)

Notes

- PERCENTILE_DISC(%_number) examines the cumulative distribution values in each group until it finds one that is greater than or equal to *%_number*.
- Vertica computes the percentile where, for each row, PERCENTILE_DISC outputs the first value of the WITHIN GROUP(ORDER BY) column whose CUME_DIST (cumulative distribution) value is >= the argument FLOAT value (for example, .4). Specifically:

  ```
  PERCENTILE_DIST(.4) WITHIN GROUP (ORDER BY salary) OVER(PARTITION By
     deptno) ...
  ```

  If you write, for example, SELECT CUME_DIST() OVER(ORDER BY salary) FROM table; you notice that the smallest CUME_DIST value that is greater than .4 is also the PERCENTILE_DISC.

Examples

This query computes the 20th percentile annual income by group for first 500 customers in Wisconsin and the District of Columbia.

```
=> SELECT customer_state, customer_key, annual_income,
      PERCENTILE_DISC(.2) WITHIN GROUP(ORDER BY annual_income)
```

```
      OVER (PARTITION BY customer_state) AS PERCENTILE_DISC
   FROM customer_dimension
   WHERE customer_state IN ('DC','WI')
   AND customer_key < 300
   ORDER BY customer_state, customer_key;

 customer_state | customer_key | annual_income | PERCENTILE_DISC
----------------+--------------+---------------+-----------------
 DC             |          104 |        658383 |          417092
 DC             |          168 |        417092 |          417092
 DC             |          245 |        670205 |          417092
 WI             |          106 |        227279 |          227279
 WI             |          127 |        703889 |          227279
 WI             |          209 |        458607 |          227279
(6 rows)
```

See Also

CUME_DIST (page 132)

PERCENTILE_CONT (page 154)

Using SQL Analytics in the Programmer's Guide

RANK [Analytic]

Assigns a rank to each row returned from a query with respect to the other rows, based on the values of the expressions in the window `ORDER BY` clause. The data within a group is sorted by the `ORDER BY` clause and then a numeric ranking is assigned to each row in turn, starting with 1, and continuing up. Rows with the same values of the `ORDER BY` expressions receive the same rank; however, if two rows receive the same rank (a tie), `RANK()` skips the ties. If, for example, two rows are numbered 1, `RANK()` skips number 2 and assigns 3 to the next row in the group. This is in contrast to `DENSE_RANK()` (page 133), which does not skip values.

Behavior Type

Immutable

Syntax

```
RANK ( ) OVER (
... [ window_partition_clause (page 121) ]
... window_order_clause (page 123)  )
```

Parameters

`OVER(...)`	See ***Analytic Functions.*** (page 120)

Notes

- Ranking functions return a rank value for each row in a result set based on the order specified in the query. For example, a territory sales manager might want to identify the top or bottom ranking sales associates in a department or the highest/lowest-performing sales offices by region.
- `RANK()` requires an `OVER()` clause. The `window_partition_clause` is optional.
- In ranking functions, `OVER()` specifies the measures *expression* on which ranking is done and defines the order in which rows are sorted in each group (or partition). Once the data is sorted within each partition, ranks are given to each row starting from 1.
- The primary difference between `RANK` and `DENSE_RANK` is that `RANK` leaves gaps when ranking records; `DENSE_RANK` leaves no gaps. For example, if more than one record occupies a particular position (a tie), `RANK` places all those records in that position and it places the next record after a gap of the additional records (it skips one). `DENSE_RANK` places all the records in that position only—it does not leave a gap for the next rank.

  If there is a tie at the third position with two records having the same value, `RANK` and `DENSE_RANK` place both the records in the third position only, but `RANK` has the next record at the fifth position — leaving a gap of 1 position—while `DENSE_RANK` places the next record at the forth position (no gap).
- If you omit `NULLS FIRST | LAST | AUTO`, the ordering of the null values depends on the `ASC` or `DESC` arguments. Null values are considered larger than any other values. If the ordering sequence is `ASC`, then nulls appear last; nulls appear first otherwise. Nulls are considered equal to other nulls and, therefore, the order in which nulls are presented is non-deterministic.

Examples

This example ranks the longest-standing customers in Massachusetts. The query first computes the `customer_since` column by region, and then partitions the results by customers with businesses in MA. Then within each region, the query ranks customers over the age of 70.

```
=> SELECT customer_type, customer_name,
      RANK() OVER (PARTITION BY customer_region ORDER BY customer_since) as rank
   FROM customer_dimension
   WHERE customer_state = 'MA'
   AND customer_age > '70';

 customer_type | customer_name | rank
---------------+---------------+------
 Company       | Virtadata     |    1
 Company       | Evergen       |    2
 Company       | Infocore      |    3
 Company       | Goldtech      |    4
 Company       | Veritech      |    5
 Company       | Inishop       |    6
 Company       | Intracom      |    7
 Company       | Virtacom      |    8
 Company       | Goldcom       |    9
 Company       | Infostar      |   10
 Company       | Golddata      |   11
```

```
 Company       | Everdata      |   12
 Company       | Goldcorp      |   13
(13 rows)
```

The following example shows the difference between RANK and DENSE_RANK when ranking customers by their annual income. Notice that RANK has a tie at 10 and skips 11, while DENSE_RANK leaves no gaps in the ranking sequence:

```
=> SELECT customer_name, SUM(annual_income),
      RANK () OVER (ORDER BY TO_CHAR(SUM(annual_income),'100000') DESC) rank,
      DENSE_RANK () OVER (ORDER BY TO_CHAR(SUM(annual_income),'100000') DESC)
dense_rank
   FROM customer_dimension
   GROUP BY customer_name
   LIMIT 15;
    customer_name    |  sum   | rank | dense_rank
---------------------+--------+------+------------
 Brian M. Garnett    | 99838 |    1 |          1
 Tanya A. Brown      | 99834 |    2 |          2
 Tiffany P. Farmer   | 99826 |    3 |          3
 Jose V. Sanchez     | 99673 |    4 |          4
 Marcus D. Rodriguez | 99631 |    5 |          5
 Alexander T. Nguyen | 99604 |    6 |          6
 Sarah G. Lewis      | 99556 |    7 |          7
 Ruth Q. Vu          | 99542 |    8 |          8
 Theodore T. Farmer  | 99532 |    9 |          9
 Daniel P. Li        | 99497 |   10 |         10
 Seth E. Brown       | 99497 |   10 |         10
 Matt X. Gauthier    | 99402 |   12 |         11
 Rebecca W. Lewis    | 99296 |   13 |         12
 Dean L. Wilson      | 99276 |   14 |         13
 Tiffany A. Smith    | 99257 |   15 |         14
(15 rows)
```

See Also

DENSE_RANK (page 133)

Using SQL Analytics in the Programmer's Guide

ROW_NUMBER [Analytic]

Assigns a unique number, sequentially, starting from 1, to each row in a partition within a window.

Behavior Type

Immutable

Syntax

```
ROW_NUMBER ( ) OVER (
... [ window_partition_clause (page 121) ]
... window_order_clause (page 123)  )
```

Parameters

`OVER(...)`	See ***Analytic Functions.*** (page 120)

Notes

- `ROW_NUMBER()` is a Vertica extension, not part of the SQL-99 standard. It requires an OVER() clause. The `window_partition_clause` is optional.
- You can use the optional partition clause to group data into partitions before operating on it; for example:
  `SUM OVER (PARTITION BY col1, col2, ...)`
- You can substitute any `RANK()` example for `ROW_NUMBER()`. The difference is that `ROW_NUMBER` assigns a unique ordinal number, starting with 1, to each row in the ordered set.

Examples

The following query first partitions customers in the customer_dimension table by occupation and then ranks those customers based on the ordered set specified by the analytic partition_clause.

```
=> SELECT occupation, customer_key, customer_since, annual_income,
      ROW_NUMBER() OVER (PARTITION BY occupation) AS customer_since_row_num
   FROM public.customer_dimension
   ORDER BY occupation, customer_since_row_num;
```

```
     occupation     | customer_key | customer_since | annual_income | customer_since_row_num
--------------------+--------------+----------------+---------------+------------------------
 Accountant         |        19453 | 1973-11-06     |        602460 |                      1
 Accountant         |        42989 | 1967-07-09     |        850814 |                      2
 Accountant         |        24587 | 1995-05-18     |        180295 |                      3
 Accountant         |        26421 | 2001-10-08     |        126490 |                      4
 Accountant         |        37783 | 1993-03-16     |        790282 |                      5
 Accountant         |        39170 | 1980-12-21     |        823917 |                      6
 Banker             |        13882 | 1998-04-10     |         15134 |                      1
 Banker             |        14054 | 1989-03-16     |        961850 |                      2
 Banker             |        15850 | 1996-01-19     |        262267 |                      3
 Banker             |        29611 | 2004-07-14     |        739016 |                      4
 Doctor             |          261 | 1969-05-11     |        933692 |                      1
 Doctor             |         1264 | 1981-07-19     |        593656 |                      2
 Psychologist       |         5189 | 1999-05-04     |        397431 |                      1
 Psychologist       |         5729 | 1965-03-26     |        339319 |                      2
 Software Developer |         2513 | 1996-09-22     |        920003 |                      1
 Software Developer |         5927 | 2001-03-12     |        633294 |                      2
 Software Developer |         9125 | 1971-10-06     |        198953 |                      3
 Software Developer |        16097 | 1968-09-02     |        748371 |                      4
 Software Developer |        23137 | 1988-12-07     |         92578 |                      5
 Software Developer |        24495 | 1989-04-16     |        149371 |                      6
 Software Developer |        24548 | 1994-09-21     |        743788 |                      7
 Software Developer |        33744 | 2005-12-07     |        735003 |                      8
 Software Developer |         9684 | 1970-05-20     |        246000 |                      9
 Software Developer |        24278 | 2001-11-14     |        122882 |                     10
 Software Developer |        27122 | 1994-02-05     |        810044 |                     11
 Stock Broker       |         5950 | 1965-01-20     |        752120 |                      1
 Stock Broker       |        12517 | 2003-06-13     |        380102 |                      2
 Stock Broker       |        33010 | 1984-05-07     |        384463 |                      3
 Stock Broker       |        46196 | 1972-11-28     |        497049 |                      4
 Stock Broker       |         8710 | 2005-02-11     |         79387 |                      5
 Writer             |         3149 | 1998-11-17     |        643972 |                      1
 Writer             |        17124 | 1965-01-18     |        444747 |                      2
```

```
 Writer             |        20100 | 1994-08-13     |        106097 |                     3
 Writer             |        23317 | 2003-05-27     |        511750 |                     4
 Writer             |        42845 | 1967-10-23     |        433483 |                     5
 Writer             |        47560 | 1997-04-23     |        515647 |                     6
(39 rows)
```

See Also

RANK (page 157)

Using SQL for Analytics in the Programmer's Guide

STDDEV [Analytic]

Note: The non-standard function `STDDEV()` is provided for compatibility with other databases. It is semantically identical to `STDDEV_SAMP()` (page 163).

Computes the statistical sample standard deviation of the current row with respect to the group within a window. The `STDDEV_SAMP()` return value is the same as the square root of the variance defined for the `VAR_SAMP()` function:

```
STDDEV(expression) = SQRT(VAR_SAMP(expression))
```

When `VAR_SAMP()` returns null, this function returns null.

Behavior Type

Immutable

Syntax

```
STDDEV ( expression ) OVER (
... [ window_partition_clause (page 121) ]
... [ window_order_clause (page 123) ]
... [ window_frame_clause (page 125) ] )
```

Parameters

expression	Any `NUMERIC` ***data type*** (page 92) or any non-numeric data type that can be implicitly converted to a numeric data type. The function returns the same data type as the numeric data type of the argument.
`OVER(...)`	See ***Analytic Functions.*** (page 120)

Example

The following example returns the standard deviations of salaries in the employee dimension table by job title Assistant Director:

```
=> SELECT employee_last_name, annual_salary,
      STDDEV(annual_salary) OVER (ORDER BY hire_date) as "stddev"
   FROM employee_dimension
   WHERE job_title =  'Assistant Director';

 employee_last_name | annual_salary |      stddev
--------------------+---------------+------------------
```

```
 Goldberg           |         61859 |              NaN
 Miller             |         79582 | 12532.0534829692
 Goldberg           |         74236 | 9090.97147357388
 Campbell           |         66426 |  7909.9541665339
 Moore              |         66630 | 7068.30282316761
 Nguyen             |         53530 | 9154.14713486005
 Harris             |         74115 | 8773.54346886142
 Lang               |         59981 | 8609.60471031374
 Farmer             |         60597 | 8335.41158418579
 Nguyen             |         78941 | 8812.87941405456
 Smith              |         55018 |  9179.7672390773
...
```

See Also

STDDEV (page 113) and ***STDDEV_SAMP*** (page 115) aggregate functions

STDDEV_SAMP (page 163) analytic function

Using SQL Analytics in the Programmer's Guide

STDDEV_POP [Analytic]

Computes the statistical population standard deviation and returns the square root of the population variance within a window. The `STDDEV_POP()` return value is the same as the square root of the `VAR_POP()` function:

`STDDEV_POP(`*expression*`) = SQRT(VAR_POP(`*expression*`))`

When `VAR_POP` returns null, this function returns null.

Behavior Type

Immutable

Syntax

```
STDDEV_POP ( expression ) OVER (
... [ window_partition_clause (page 121) ]
... [ window_order_clause (page 123) ]
... [ window_frame_clause (page 125) ] )
```

Parameters

expression	Any `NUMERIC` ***data type*** (page 92) or any non-numeric data type that can be implicitly converted to a numeric data type. The function returns the same data type as the numeric data type of the argument.
`OVER(...)`	See ***Analytic Functions.*** (page 120)

Examples

The following example returns the population standard deviations of salaries in the employee dimension table by job title Assistant Director:

```
=> SELECT employee_last_name, annual_salary,
      STDDEV_POP(annual_salary) OVER (ORDER BY hire_date) as "stddev_pop"
   FROM employee_dimension WHERE job_title =  'Assistant Director';
 employee_last_name | annual_salary |    stddev_pop
--------------------+---------------+------------------
 Goldberg           |         61859 |                0
 Miller             |         79582 |           8861.5
 Goldberg           |         74236 | 7422.74712548456
 Campbell           |         66426 | 6850.22125098891
 Moore              |         66630 | 6322.08223926257
 Nguyen             |         53530 | 8356.55480080699
 Harris             |         74115 | 8122.72288970008
 Lang               |         59981 | 8053.54776538731
 Farmer             |         60597 | 7858.70140687825
 Nguyen             |         78941 | 8360.63150784682
```

See Also

STDDEV_POP (page 114) aggregate functions

Using SQL Analytics in the Programmer's Guide

STDDEV_SAMP [Analytic]

Computes the statistical sample standard deviation of the current row with respect to the group within a window. The `STDDEV_SAMP()` return value is the same as the square root of the variance defined for the `VAR_SAMP()` function:

`STDDEV(`*expression*`) = SQRT(VAR_SAMP(`*expression*`))`

When `VAR_SAMP()` returns null, this function returns null.

Behavior Type

Immutable

Syntax

```
STDDEV_SAMP ( expression ) OVER (
... [ window_partition_clause (page 121) ]
... [ window_order_clause (page 123) ]
... [ window_frame_clause (page 125) ] )
```

Parameters

expression	Any `NUMERIC` ***data type*** (page 92) or any non-numeric data type that can be implicitly converted to a numeric data type. The function returns the same data type as the numeric data type of the argument..
`OVER(...)`	See ***Analytic Functions.*** (page 120)

Notes

`STDDEV_SAMP()` is semantically identical to the non-standard function, `STDDEV()` (page 113).

Examples

The following example returns the sample standard deviations of salaries in the `employee` dimension table by job title Assistant Director:

```
=> SELECT employee_last_name, annual_salary,
      STDDEV(annual_salary) OVER (ORDER BY hire_date) as "stddev_samp"
      FROM employee_dimension WHERE job_title =  'Assistant Director';
 employee_last_name | annual_salary |   stddev_samp
--------------------+---------------+-----------------
 Goldberg           |         61859 |              NaN
 Miller             |         79582 | 12532.0534829692
 Goldberg           |         74236 | 9090.97147357388
 Campbell           |         66426 |  7909.9541665339
 Moore              |         66630 | 7068.30282316761
 Nguyen             |         53530 | 9154.14713486005
 Harris             |         74115 | 8773.54346886142
 Lang               |         59981 | 8609.60471031374
 Farmer             |         60597 | 8335.41158418579
 Nguyen             |         78941 | 8812.87941405456
...
```

See Also

Analytic Functions (page 120)

STDDEV (page 161) analytic function

STDDEV (page 113) and ***STDDEV_SAMP*** (page 115) aggregate functions

Using SQL Analytics in the Programmer's Guide

SUM [Analytic]

Computes the sum of an expression over a group of rows within a window. It returns a `DOUBLE PRECISION` value for a floating-point expression. Otherwise, the return value is the same as the expression data type.

Behavior Type

Immutable

Syntax

```
SUM ( expression ) OVER (
... [ window_partition_clause (page 121) ]
... [ window_order_clause (page 123) ]
... [ window_frame_clause (page 125) ] )
```

Parameters

expression	Any `NUMERIC` ***data type*** (page 92) or any non-numeric data type that can be implicitly converted to a numeric data type. The function returns the same data type as the numeric data type of the argument.

`OVER(...)`	See ***Analytic Functions.*** (page 120)

Notes

- If you encounter data overflow when using `SUM()`, use `SUM_FLOAT()` (page 117) which converts data to a floating point.
- `SUM()` returns the sum of values of an expression.

Examples

The following query returns the cumulative sum all of the returns made to stores in January:

```
=> SELECT calendar_month_name AS month, transaction_type, sales_quantity,
      SUM(sales_quantity)
     OVER (PARTITION BY calendar_month_name ORDER BY date_dimension.date_key) AS
SUM
   FROM store.store_sales_fact JOIN date_dimension
   USING(date_key) WHERE calendar_month_name IN ('January')
   AND transaction_type= 'return';

  month  | transaction_type | sales_quantity | SUM
---------+------------------+----------------+------
 January | return           |              4 | 2338
 January | return           |              3 | 2338
 January | return           |              1 | 2338
 January | return           |              5 | 2338
 January | return           |              8 | 2338
 January | return           |              3 | 2338
 January | return           |              5 | 2338
 January | return           |             10 | 2338
 January | return           |              9 | 2338
 January | return           |             10 | 2338
(10 rows)
```

See Also

SUM (page 116) aggregate function

Numeric Data Types (page 92)

Using SQL Analytics in the Programmer's Guide

VAR_POP [Analytic]

Returns the statistical population variance of a non-null set of numbers (nulls are ignored) in a group within a window. Results are calculated by the sum of squares of the difference of *expression* from the mean of *expression,* divided by the number of rows remaining:

```
(SUM(expression*expression) - SUM(expression)*SUM(expression) /
  COUNT(expression)) / COUNT(expression)
```

Behavior Type

Immutable

Syntax

```
VAR_POP ( expression ) OVER (
... [ window_partition_clause (page 121) ]
... [ window_order_clause (page 123) ]
... [ window_frame_clause (page 125) ] )
```

Parameters

expression	Any NUMERIC ***data type*** (page 92) or any non-numeric data type that can be implicitly converted to a numeric data type. The function returns the same data type as the numeric data type of the argument
OVER(...)	See ***Analytic Functions.*** (page 120)

Examples

The following example calculates the cumulative population in the store orders fact table of sales in December 2007:

```
=> SELECT date_ordered,
      VAR_POP(SUM(total_order_cost))
      OVER (ORDER BY date_ordered) "var_pop"
   FROM store.store_orders_fact s
   WHERE date_ordered BETWEEN '2007-12-01' AND '2007-12-31'
   GROUP BY s.date_ordered;
 date_ordered |     var_pop
--------------+-----------------
 2007-12-01   |               0
 2007-12-02   |       1129564881
 2007-12-03   | 1206008121.55542
 2007-12-04   | 26353624176.1875
 2007-12-05   | 21315288023.4402
 2007-12-06   | 21619271028.3333
 2007-12-07   | 19867030477.6328
 2007-12-08   |    19197735288.5
 2007-12-09   | 19100157155.2097
 2007-12-10   | 19369222968.0896
(10 rows)
```

See Also

VAR_POP (page 117) aggregate function

Using SQL Analytics in the Programmer's Guide

VAR_SAMP [Analytic]

Returns the sample variance of a non-null set of numbers (nulls in the set are ignored) for each row of the group within a window. Results are calculated by the sum of squares of the difference of *expression* from the mean of *expression,* divided by the number of rows remaining minus 1:

```
(SUM(expression*expression) - SUM(expression)*SUM(expression) /
```

```
  COUNT(expression)) / (COUNT(expression) - 1)
```

Behavior Type

Immutable

Syntax

```
VAR_SAMP ( expression ) OVER (
... [ window_partition_clause (page 121) ]
... [ window_order_clause (page 123) ]
... [ window_frame_clause (page 125) ] )
```

Parameters

expression	Any NUMERIC ***data type*** (page 92) or any non-numeric data type that can be implicitly converted to a numeric data type. The function returns the same data type as the numeric data type of the argument
OVER(...)	See ***Analytic Functions.*** (page 120)

Notes

- VAR_SAMP() returns the sample variance of a set of numbers after it discards the nulls in the set.
- If the function is applied to an empty set, then it returns null.
- This function is similar to VARIANCE(), except that given an input set of one element, VARIANCE() returns 0 and VAR_SAMP() returns null.

Examples

The following example calculates the sample variance in the store orders fact table of sales in December 2007:

```
=> SELECT date_ordered,
      VAR_SAMP(SUM(total_order_cost))
      OVER (ORDER BY date_ordered) "var_samp"
   FROM store.store_orders_fact s
   WHERE date_ordered BETWEEN '2007-12-01' AND '2007-12-31'
   GROUP BY s.date_ordered;
 date_ordered |     var_samp
--------------+------------------
 2007-12-01   |              NaN
 2007-12-02   |       2259129762
 2007-12-03   | 1809012182.33301
 2007-12-04   |   35138165568.25
 2007-12-05   | 26644110029.3003
 2007-12-06   |      25943125234
 2007-12-07   | 23178202223.9048
 2007-12-08   | 21940268901.1431
 2007-12-09   | 21487676799.6108
 2007-12-10   | 21521358853.4331
(10 rows)
```

See Also

VARIANCE (page 168) analytic function

VAR_SAMP (page 118) aggregate function

Using SQL Analytics in the Programmer's Guide

VARIANCE [Analytic]

Note: The non-standard function `VARIANCE()` is provided for compatibility with other databases. It is semantically identical to `VAR_SAMP()` (page 166).

Returns the sample variance of a non-null set of numbers (nulls in the set are ignored) for each row of the group within a window. Results are calculated by the sum of squares of the difference of *expression* from the mean of *expression,* divided by the number of rows remaining minus 1:

```
(SUM(expression*expression) - SUM(expression)*SUM(expression) /
  COUNT(expression)) / (COUNT(expression) - 1)
```

Behavior Type

Immutable

Syntax

```
VAR_SAMP ( expression ) OVER (
... [ window_partition_clause (page 121) ]
... [ window_order_clause (page 123) ]
... [ window_frame_clause (page 125) ] )
```

Parameters

expression	Any ***NUMERIC data type*** (page 92) or any non-numeric data type that can be implicitly converted to a numeric data type. The function returns the same data type as the numeric data type of the argument.
`OVER(...)`	See ***Analytic Functions.*** (page 120)

Notes

- `VARIANCE()` returns the variance of *expression*.
- The variance of expression is calculated as follows:
  - 0 if the number of rows in *expression* = 1
  - `VAR_SAMP()` if the number of rows in *expression* > 1

Examples

The following example calculates the cumulative variance in the store orders fact table of sales in December 2007:

```
=> SELECT date_ordered,
```

```
      VARIANCE(SUM(total_order_cost))
      OVER (ORDER BY date_ordered) "variance"
   FROM store.store_orders_fact s
   WHERE date_ordered BETWEEN '2007-12-01' AND '2007-12-31'
   GROUP BY s.date_ordered;
 date_ordered |     variance
--------------+------------------
 2007-12-01   |              NaN
 2007-12-02   |       2259129762
 2007-12-03   | 1809012182.33301
 2007-12-04   |   35138165568.25
 2007-12-05   | 26644110029.3003
 2007-12-06   |      25943125234
 2007-12-07   | 23178202223.9048
 2007-12-08   | 21940268901.1431
 2007-12-09   | 21487676799.6108
 2007-12-10   | 21521358853.4331
(10 rows)
```

See Also

VAR_SAMP (page 166) analytic function

VARIANCE (page 119) and ***VAR_SAMP*** (page 118) aggregate functions

Using SQL Analytics in the Programmer's Guide

Performance Optimization for Analytic Sort Computation

Vertica stores data in projections that is sorted in a specific way. All columns are stored in `ASC` (ascending) order, but the placement of nulls depends on the column's data type.

The analytic `ORDER BY` (`window_order_clause`) and the SQL `ORDER BY` clause also perform slightly different sort operations:

- The analytic `window_order_clause` sorts data that is used by the analytic function as either ascending (`ASC`) or descending (`DESC`) and specifies where null values appear in the sorted result as either `NULLS FIRST` or `NULLS LAST`. The following is the default sort order:
  - `ASC + NULLS LAST`. Null values are placed at the end of the sorted result
  - `DESC + NULLS FIRST`. Null values are placed at the beginning of the sorted result
- The SQL `ORDER BY` clause specifies only ascending or descending order; however, the following is the default for null placement in Vertica:
  - `NUMERIC, INTEGER, DATE, TIME, TIMESTAMP`, and `INTERVAL` columns. `NULLS FIRST` (null values are stored at the beginning of a sorted projection).
  - `FLOAT, STRING`, and `BOOLEAN` columns. `NULLS LAST` (null values are stored at the end of a sorted projection).
  - No matter what the data type, if you specify `NULLS AUTO`, Vertica chooses the most efficient placement of nulls (for example, either `NULLS FIRST` or `NULLS LAST`) based on your query.

If you do not care about null placement in queries that involve analytics computation, or if you know that columns contain no null values, specify NULLS AUTO, and Vertica chooses the placement that gives the fastest performance. Otherwise you can specify NULLS FIRST or NULLS LAST.

You can also carefully formulate queries so Vertica can avoid sorting the data and can process the query more quickly, as illustrated by the following example.

Example

In the following example, Vertica sorts inputs from table t on column x, as specified in the OVER(ORDER BY) clause. Then it evaluates RANK():

```
=> CREATE TABLE t (
    x FLOAT,
    y FLOAT );
=> CREATE PROJECTION t_p (x, y) AS SELECT * FROM t
   ORDER BY x, y UNSEGMENTED ALL NODES;
=> SELECT x, RANK() OVER (ORDER BY x) FROM t;
```

In the above SELECT statement, Vertica can eliminate the ORDER BY clause and run the query quickly because column x is a FLOAT data type; thus, the projection sort order matches the analytic default ordering (ASC + NULLS LAST). Vertica can also avoid having to sort the data when the underlying projection is already sorted.

Assume, however, that column x had been defined as INTEGER. Vertica cannot avoid sorting the data because the projection sort order for INTEGER data types (ASC + NULLS FIRST) does not match default analytic ordering (ASC + NULLS LAST). To help Vertica eliminate the sort, specify the placement of nulls to match default ordering:

```
=> SELECT x, RANK() OVER (ORDER BY x NULLS FIRST) FROM t;
```

If column x is defined as a STRING, the following query would eliminate the sort:

```
=> SELECT x, RANK() OVER (ORDER BY x NULLS LAST) FROM t;
```

Note that omitting NULLS LAST in the above query still eliminates the sort because ASC + NULLS LAST is the default sort specification for both the analytic ORDER BY clause and for string-related columns in Vertica.

Data Types and their Default Sorting

The following tables summarizes the data types supported by Vertica, as well as the default placement of null values in projections. The Size column is shown in uncompressed bytes.

Type	Size	Description	NULL Sorting
Binary types			
BINARY	1 to 65000	Fixed-length binary string	NULLS LAST
VARBINARY	1 to 65000	Variable-length binary string	NULLS LAST
BYTEA	1 to 65000	Variable-length binary string (synonym for VARBINARY)	NULLS LAST

RAW	1 to 65000	Variable-length binary string (synonym for VARBINARY)	NULLS LAST
Boolean types			
BOOLEAN	1	True or False or NULL	NULLS LAST
Character types			
CHAR	1 to 65000	Fixed-length character string	NULLS LAST
VARCHAR	1 to 65000	Variable-length character string	NULLS LAST
Date/time types			
DATE	8	Represents a month, day, and year	NULLS FIRST
DATETIME	8	Represents a date and time with or without timezone (synonym for TIMESTAMP)	NULLS FIRST
SMALLDATETIME	8	Represents a date and time with or without timezone (synonym for TIMESTAMP)	NULLS FIRST
TIME	8	Represents a time of day without timezone	NULLS FIRST
TIME WITH TIMEZONE	8	Represents a time of day with timezone	NULLS FIRST
TIMESTAMP	8	Represents a date and time without timezone	NULLS FIRST
TIMESTAMP WITH TIMEZONE	8	Represents a date and time with timezone	NULLS FIRST
INTERVAL	8	Measures the difference between two points in time	NULLS FIRST
Approximate numeric types			
DOUBLE PRECISION	8	Signed 64-bit IEEE floating point number, requiring 8 bytes of storage	NULLS LAST
FLOAT	8	Signed 64-bit IEEE floating point number, requiring 8 bytes of storage	NULLS LAST
FLOAT(n)	8	Signed 64-bit IEEE floating point number, requiring 8 bytes of storage	NULLS LAST
FLOAT8	8	Signed 64-bit IEEE floating point number, requiring 8 bytes of storage	NULLS LAST
REAL	8	Signed 64-bit IEEE floating point number, requiring 8 bytes of storage	NULLS LAST
Exact numeric types			

INTEGER	8	Signed 64-bit integer, requiring 8 bytes of storage	NULLS FIRST
INT	8	Signed 64-bit integer, requiring 8 bytes of storage	NULLS FIRST
BIGINT	8	Signed 64-bit integer, requiring 8 bytes of storage	NULLS FIRST
INT8	8	Signed 64-bit integer, requiring 8 bytes of storage	NULLS FIRST
SMALLINT	8	Signed 64-bit integer, requiring 8 bytes of storage	NULLS FIRST
TINYINT	8	Signed 64-bit integer, requiring 8 bytes of storage	NULLS FIRST
DECIMAL	8+	8 bytes for the first 18 digits of precision, plus 8 bytes for each additional 19 digits	NULLS FIRST
NUMERIC	8+	8 bytes for the first 18 digits of precision, plus 8 bytes for each additional 19 digits	NULLS FIRST
NUMBER	8+	8 bytes for the first 18 digits of precision, plus 8 bytes for each additional 19 digits	NULLS FIRST
MONEY	8+	8 bytes for the first 18 digits of precision, plus 8 bytes for each additional 19 digits	NULLS FIRST

See Also

Using SQL Analytics in the Programmer's Guide

Boolean Functions

BIT_AND

Takes the bitwise AND of all non-null input values. If the input parameter is NULL, the return value is also NULL.

Behavior Type

Immutable

Syntax

```
BIT_AND ( expression )
```

Parameters

expression	The [BINARY |VARBINARY] input value to be evaluated. BIT_AND() operates on VARBINARY types explicitly and

	on BINARY types implicitly through ***casts*** (page 104).

Notes

- The function returns the same value as the argument data type.
- For each bit compared, if **all** bits are 1, the function returns 1; otherwise it returns 0.
- If the columns are different lengths, the return values are treated as though they are all equal in length and are right-extended with zero bytes. For example, given a group containing the hex values `'ff', null,` and `'f'`, the function ignores the null value and extends the value `'f'` to `'f0'`..

Example

This examples uses the following schema, which creates table `t` with a single column of `VARBINARY` data type:

```
=> CREATE TABLE t (
      c VARBINARY(2) );
=> INSERT INTO t values(HEX_TO_BINARY('0xFF00'));
=> INSERT INTO t values(HEX_TO_BINARY('0xFFFF'));
=> INSERT INTO t values(HEX_TO_BINARY('0xF00F'));
```

Query table `t` to see column `c` output:

```
=> SELECT TO_HEX(c) FROM t;
 TO_HEX
--------
 ff00
 ffff
 f00f
(3 rows)
```

Query table `t` to get the AND value for column `c`:

```
SELECT TO_HEX(BIT_AND(c)) FROM t;
 TO_HEX
--------
 f000
(1 row)
```

The function is applied pairwise to all values in the group, resulting in `f000`, which is determined as follows:

1. `ff00` (record 1) is compared with `ffff` (record 2), which results in `ff00`.
2. The result from the previous comparison is compared with `f00f` (record 3), which results in `f000`.

See Also

Binary Data Types (page 61)

BIT_OR

Takes the bitwise `OR` of all non-null input values. If the input parameter is `NULL`, the return value is also `NULL`.

Behavior Type

Immutable

Syntax

```
BIT_OR ( expression )
```

Parameters

expression	The [BINARY |VARBINARY] input value to be evaluated. BIT_OR() operates on VARBINARY types explicitly and on BINARY types implicitly through ***casts*** (page 104).

Notes

- The function returns the same value as the argument data type.
- For each bit compared, if **any** bit is 1, the function returns 1; otherwise it returns 0.
- If the columns are different lengths, the return values are treated as though they are all equal in length and are right-extended with zero bytes. For example, given a group containing the hex values 'ff', null, and 'f', the function ignores the null value and extends the value 'f' to 'f0'.

Example

This examples uses the following schema, which creates table t with a single column of VARBINARY data type:

```
=> CREATE TABLE t (
      c VARBINARY(2) );
=> INSERT INTO t values(HEX_TO_BINARY('0xFF00'));
=> INSERT INTO t values(HEX_TO_BINARY('0xFFFF'));
=> INSERT INTO t values(HEX_TO_BINARY('0xF00F'));
```

Query table t to see column c output:

```
=> SELECT TO_HEX(c) FROM t;
 TO_HEX
--------
 ff00
 ffff
 f00f
(3 rows)
```

Query table t to get the OR value for column c:

```
SELECT TO_HEX(BIT_OR(c)) FROM t;
 TO_HEX
--------
 ffff
(1 row)
```

The function is applied pairwise to all values in the group, resulting in ffff, which is determined as follows:

1 ff00 (record 1) is compared with ffff, which results in ffff.

2 The `ff00` result from the previous comparison is compared with `f00f` (record 3), which results in `ffff`.

See Also

Binary Data Types (page 61)

BIT_XOR

Takes the bitwise `XOR` of all non-null input values. If the input parameter is `NULL`, the return value is also `NULL`.

Behavior Type

Immutable

Syntax

`BIT_XOR ( expression )`

Parameters

expression	The `[BINARY |VARBINARY]` input value to be evaluated. `BIT_XOR()` operates on `VARBINARY` types explicitly and on `BINARY` types implicitly through ***casts*** (page 104).

Notes

- The function returns the same value as the argument data type.
- For each bit compared, if there are an odd number of arguments with set bits, the function returns 1; otherwise it returns 0.
- If the columns are different lengths, the return values are treated as though they are all equal in length and are right-extended with zero bytes. For example, given a group containing the hex values `'ff', null,` and `'f'`, the function ignores the null value and extends the value `'f'` to `'f0'`.

Example

First create a sample table and projections with binary columns:

This examples uses the following schema, which creates table `t` with a single column of `VARBINARY` data type:

```
=> CREATE TABLE t (
      c VARBINARY(2) );
=> INSERT INTO t values(HEX_TO_BINARY('0xFF00'));
=> INSERT INTO t values(HEX_TO_BINARY('0xFFFF'));
=> INSERT INTO t values(HEX_TO_BINARY('0xF00F'));
```

Query table `t` to see column `c` output:

```
=> SELECT TO_HEX(c) FROM t;
 TO_HEX
--------
 ff00
```

```
 ffff
 f00f
(3 rows)
```

Query table `t` to get the XOR value for column `c`:

```
SELECT TO_HEX(BIT_XOR(c)) FROM t;
 TO_HEX
--------
 f0f0
(1 row)
```

See Also

Binary Data Types (page 61)

Date/Time Functions

Date and time functions perform conversion, extraction, or manipulation operations on date and time data types and can return date and time information.

Usage

Functions that take `TIME` or `TIMESTAMP` inputs come in two variants:

- `TIME WITH TIME ZONE` or `TIMESTAMP WITH TIME ZONE`

`TIME WITHOUT TIME ZONE` or `TIMESTAMP WITHOUT TIME ZONE` For brevity, these variants are not shown separately.

The + and * operators come in commutative pairs; for example, both `DATE + INTEGER` and `INTEGER + DATE`. We show only one of each such pair.

Daylight Savings Time Considerations

When adding an `INTERVAL` value to (or subtracting an `INTERVAL` value from) a `TIMESTAMP WITH TIME ZONE` value, the days component advances (or decrements) the date of the `TIMESTAMP WITH TIME ZONE` by the indicated number of days. Across daylight saving time changes (with the session time zone set to a time zone that recognizes DST), this means `INTERVAL '1 day'` does not necessarily equal `INTERVAL '24 hours'`.

For example, with the session time zone set to `CST7CDT`:

```
TIMESTAMP WITH TIME ZONE '2005-04-02 12:00-07' + INTERVAL '1 day'
```

produces

```
TIMESTAMP WITH TIME ZONE '2005-04-03 12:00-06'
```

Adding `INTERVAL '24 hours'` to the same initial `TIMESTAMP WITH TIME ZONE` produces

```
TIMESTAMP WITH TIME ZONE '2005-04-03 13:00-06',
```

as there is a change in daylight saving time at `2005-04-03 02:00` in time zone `CST7CDT`.

Date/Time Functions in Transactions

`CURRENT_TIMESTAMP()` and related functions return the start time of the current transaction; their values do not change during the transaction. The intent is to allow a single transaction to have a consistent notion of the "current" time, so that multiple modifications within the same transaction bear the same timestamp. However, `TIMEOFDAY()` returns the wall-clock time and advances during transactions.

See Also

Template Patterns for Date/Time Formatting (page 219)

ADD_MONTHS

Takes a DATE, TIMESTAMP, or TIMESTAMPTZ argument and a number of months and returns a date. TIMESTAMPTZ arguments are implicitly cast to TIMESTAMP.

Behavior Type

Immutable if called with DATE or TIMESTAMP but stable with TIMESTAMPTZ in that its results can change based on TIMEZONE settings

Syntax

```
ADD_MONTHS ( d , n );
```

Parameters

d	Is the incoming DATE, TIMESTAMP, or TIMESTAMPZ. If the start date falls on the last day of the month, or if the resulting month has fewer days than the given day of the month, then the result is the last day of the resulting month. Otherwise, the result has the same start day.
n	Can be any INTEGER.

Examples

The following example's results include a leap year:

```
SELECT ADD_MONTHS('31-Jan-08', 1) "Months";
   Months
------------
 2008-02-29
(1 row)
```

The next example adds four months to January and returns a date in May:

```
SELECT ADD_MONTHS('31-Jan-08', 4) "Months";
   Months
------------
 2008-05-31
(1 row)
```

This example subtracts 4 months from January, returning a date in September:

```
SELECT ADD_MONTHS('31-Jan-08', -4) "Months";
```

```
   Months
------------
 2007-09-30
(1 row)
```

Because the following example specifies NULL, the result set is empty:

```
SELECT ADD_MONTHS('31-Jan-03', NULL) "Months";
 Months
--------

(1 row)
```

This example provides no date argument, so even though the number of months specified is 1, the result set is empty:

```
SELECT ADD_MONTHS(NULL, 1) "Months";
 Months
--------

(1 row)
```

In this example, the date field defaults to a timestamp, so the PST is ignored. Notice that even though it is already the next day in Pacific time, the result falls on the same date in New York (two years later):

```
SET TIME ZONE 'America/New_York';
SELECT ADD_MONTHS('2008-02-29 23:30 PST', 24);
 add_months
------------
 2010-02-28
(1 row)
```

This example specifies a timestamp with time zone, so the PST is taken into account:

```
SET TIME ZONE 'America/New_York';
SELECT ADD_MONTHS('2008-02-29 23:30 PST'::TIMESTAMPTZ, 24);
 add_months
------------
 2010-03-01
(1 row)
```

AGE_IN_MONTHS

Returns an INTEGER value representing the difference in months between two TIMESTAMP, DATE or TIMESTAMPTZ values.

Behavior Type

Stable if second argument is omitted or if either argument is TIMESTAMPTZ. Immutable otherwise.

Syntax

```
AGE_IN_MONTHS ( expression1 [ , expression2 ] )
```

Parameters

expression1	specifies the beginning of the period.
expression2	specifies the end of the period. The default is the ***CURRENT_DATE*** (page 181).

Notes

The inputs can be TIMESTAMP, TIMESTAMPTZ, or DATE.

Examples

The following example returns the age in months of a person born on March 2, 1972 on the date June 21, 1990, with a time elapse of 18 years, 3 months, and 19 days:

```
SELECT AGE_IN_MONTHS(TIMESTAMP '1990-06-21', TIMESTAMP '1972-03-02');
 AGE_IN_MONTHS
---------------
           219
(1 row)
```

The next example shows the age in months of the same person (born March 2, 1972) as of March 16, 2010:

```
SELECT AGE_IN_MONTHS(TIMESTAMP 'March 16, 2010', TIMESTAMP '1972-03-02');
  AGE_IN_MONTHS
---------------
            456
(1 row)
```

This example returns the age in months of a person born on November 21, 1939:

```
SELECT AGE_IN_MONTHS(TIMESTAMP '1939-11-21');
 AGE_IN_MONTHS
---------------
           844
(1 row)
```

In the above form, the result changes as time goes by.

See Also

AGE_IN_YEARS (page 179)

INTERVAL (page 70)

AGE_IN_YEARS

Returns an INTEGER value representing the difference in years between two TIMESTAMP, DATE or TIMESTAMPTZ values.

Behavior Type

Stable if second argument is omitted or if either argument is TIMESTAMPTZ. Immutable otherwise.

Syntax

```
AGE_IN_YEARS ( expression1 [ , expression2 ] )
```

Parameters

expression1	specifies the beginning of the period.
expression2	specifies the end of the period. The default is the ***CURRENT_DATE*** (page 181).

Notes

- The AGE_IN_YEARS() function was previously called AGE. AGE() is not supported.
- Inputs can be TIMESTAMP, TIMESTAMPTZ, or DATE.

Examples

The following example returns the age in years of a person born on March 2, 1972 on the date June 21, 1990, with a time elapse of 18 years, 3 months, and 19 days:

```
SELECT AGE_IN_YEARS(TIMESTAMP '1990-06-21', TIMESTAMP '1972-03-02');
 AGE_IN_YEARS
--------------
           18
(1 row)
```

The next example shows the age in years of the same person (born March 2, 1972) as of February 24, 2009:

```
SELECT AGE_IN_YEARS(TIMESTAMP '2009-02-24', TIMESTAMP '1972-03-02');
 AGE_IN_YEARS
--------------
           36
(1 row)
```

This example returns the age in years of a person born on November 21, 1939:

```
SELECT AGE_IN_YEARS(TIMESTAMP '1939-11-21');
 AGE_IN_YEARS
--------------
           70
(1 row)
```

See Also

AGE_IN_MONTHS (page 178)

INTERVAL (page 70)

CLOCK_TIMESTAMP

Returns a value of type TIMESTAMP WITH TIMEZONE representing the current system-clock time.

Behavior Type

Volatile

Syntax

```
CLOCK_TIMESTAMP()
```

Notes

This function uses the date and time supplied by the operating system on the server to which you are connected, which should be the same across all servers. The value changes each time you call it.

Examples

The following command returns the current time on your system:

```
SELECT CLOCK_TIMESTAMP() "Current Time";
         Current Time
------------------------------
 2010-09-23 11:41:23.33772-04
(1 row)
```

Each time you call the function, you get a different result. The difference in this example is in microseconds:

```
SELECT CLOCK_TIMESTAMP() "Time 1", CLOCK_TIMESTAMP() "Time 2";
            Time 1             |            Time 2
-------------------------------+-------------------------------
 2010-09-23 11:41:55.369201-04 | 2010-09-23 11:41:55.369202-04
(1 row)
```

See Also

STATEMENT_TIMESTAMP (page 204)

TRANSACTION_TIMESTAMP (page 210)

CURRENT_DATE

Returns the date (date-type value) on which the current transaction started.

Behavior Type

Stable

Syntax

```
CURRENT_DATE
```

Notes

The CURRENT_DATE function does not require parentheses.

Examples

```
SELECT CURRENT_DATE;
  ?column?
```

```
------------
 2010-09-23
(1 row)
```

CURRENT_TIME

Returns a value of type TIME WITH TIMEZONE representing the time of day.

Behavior Type

Stable

Syntax

```
CURRENT_TIME [ ( precision ) ]
```

Parameters

precision	(INTEGER) causes the result to be rounded to the specified number of fractional digits in the seconds field.

Notes

- This function returns the start time of the current transaction; the value does not change during the transaction. The intent is to allow a single transaction to have a consistent notion of the current time, so that multiple modifications within the same transaction bear the same timestamp.
- The CURRENT_TIME function does not require parentheses.

Examples

```
SELECT CURRENT_TIME "Current Time";
    Current Time
--------------------
 12:45:12.186089-05
(1 row)
```

CURRENT_TIMESTAMP

Returns a value of type TIMESTAMP WITH TIME ZONE representing the start of the current transaction.

Behavior Type

Stable

Syntax

```
CURRENT_TIMESTAMP [ ( precision ) ]
```

Parameters

precision	(INTEGER) causes the result to be rounded to the specified number of fractional digits in the seconds field. Range of INTEGER is 0-6.

Notes

This function returns the start time of the current transaction; the value does not change during the transaction. The intent is to allow a single transaction to have a consistent notion of the "current" time, so that multiple modifications within the same transaction bear the same timestamp.

Examples

```
SELECT CURRENT_TIMESTAMP;
           ?column?
-------------------------------
 2010-09-23 11:37:22.354823-04
(1 row)
SELECT CURRENT_TIMESTAMP(2);
         ?column?
--------------------------
 2010-09-23 11:37:22.35-04
(1 row)
```

DATE_PART

Is modeled on the traditional Ingres equivalent to the SQL-standard function EXTRACT.Internally DATE_PART is used by the EXTRACT function.

Behavior Type

Stable when source is of type TIMESTAMPTZ, Immutable otherwise.

Syntax

```
DATE_PART ( field , source )
```

Parameters

field	Is a single-quoted string value that specifies the field to extract. **Note:** The *field* parameter values are the same for the ***EXTRACT*** (page 193) function.
source	Is a ***date/time*** (page 68) expression

Field Values

CENTURY	The century number.
	`SELECT EXTRACT(CENTURY FROM TIMESTAMP '2000-12-16 12:21:13');`
	Result: 20
	`SELECT EXTRACT(CENTURY FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 21
	The first century starts at 0001-01-01 00:00:00 AD. This definition applies to all Gregorian calendar countries. There is no century number 0, you go from -1 to 1.

DAY	The day (of the month) field (1 - 31).
	`SELECT EXTRACT(DAY FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 16
	`SELECT EXTRACT(DAY FROM DATE '2001-02-16');`

	Result: 16

DECADE	The year field divided by 10.
	`SELECT EXTRACT(DECADE FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 200
	`SELECT EXTRACT(DECADE FROM DATE '2001-02-16');`
	Result: 200

DOQ	The day within the current quarter. `SELECT EXTRACT(DOQ FROM CURRENT_DATE);` *Result*: 89 The result is calculated as follows: Current date = June 28, current quarter = 2 (April, May, June). 30 (April) + 31 (May) + 28 (June current day) = 89. DOQ recognizes leap year days.

DOW	The day of the week (0 - 6; Sunday is 0).
	`SELECT EXTRACT(DOW FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 5
	`SELECT EXTRACT(DOW FROM DATE '2001-02-16');`
	Result: 5
	Note that `EXTRACT`'s day of the week numbering is different from that of the `TO_CHAR` function.

DOY	The day of the year (1 - 365/366)
	`SELECT EXTRACT(DOY FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 47
	`SELECT EXTRACT(DOY FROM DATE '2001-02-16');`
	Result: 5

EPOCH	For `DATE` and `TIMESTAMP` values, the number of seconds since 1970-01-01 00:00:00-00 (can be negative); for `INTERVAL` values, the total number of seconds in the interval.
	`SELECT EXTRACT(EPOCH FROM TIMESTAMP WITH TIME ZONE '2001-02-16 20:38:40-08');`
	Result: 982384720
	`SELECT EXTRACT(EPOCH FROM INTERVAL '5 days 3 hours');`
	Result: 442800
	Here is how you can convert an epoch value back to a timestamp:
	`SELECT TIMESTAMP WITH TIME ZONE 'epoch' + 982384720 * INTERVAL '1 second';`

HOUR	The hour field (0 - 23).
	`SELECT EXTRACT(HOUR FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 20
	`SELECT EXTRACT(HOUR FROM TIME '13:45:59');`
	Result: 13

ISODOW	The ISO day of the week (1 - 7; Monday is 1). `SELECT EXTRACT(ISODOW FROM DATE '2010-09-27');` *Result*: 1

ISOYEAR	The ISO year, which is 52 or 53 weeks (Monday - Sunday).
	`SELECT EXTRACT(ISOYEAR FROM DATE '2006-01-01');`
	Result: 2005
	`SELECT EXTRACT(ISOYEAR FROM DATE '2006-01-02');`
	Result: 2006
	`SELECT EXTRACT(ISOYEAR FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 2001

MICROSECONDS	The seconds field, including fractional parts, multiplied by 1,000,000. This includes full seconds. `SELECT EXTRACT(MICROSECONDS FROM TIME '17:12:28.5');` *Result*: 28500000
MILLENNIUM	The millennium number. `SELECT EXTRACT(MILLENNIUM FROM TIMESTAMP '2001-02-16 20:38:40');` *Result*: 3 Years in the 1900s are in the second millennium. The third millennium starts January 1, 2001.
MILLISECONDS	The seconds field, including fractional parts, multiplied by 1000. Note that this includes full seconds. `SELECT EXTRACT(MILLISECONDS FROM TIME '17:12:28.5');` *Result*: 28500

MINUTE	The minutes field (0 - 59).
	`SELECT EXTRACT(MINUTE FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 38
	`SELECT EXTRACT(MINUTE FROM TIME '13:45:59');`
	Result: 45

MONTH	For `timestamp` values, the number of the month within the year (1 - 12) ; for `interval` values the number of months, modulo 12 (0 - 11).
	`SELECT EXTRACT(MONTH FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 2
	`SELECT EXTRACT(MONTH FROM INTERVAL '2 years 3 months');`
	Result: 3
	`SELECT EXTRACT(MONTH FROM INTERVAL '2 years 13 months');`
	Result: 1

QUARTER	The quarter of the year (1 - 4) that the day is in (for `timestamp` values only). `SELECT EXTRACT(QUARTER FROM TIMESTAMP '2001-02-16 20:38:40');` *Result*: 1

SECOND	The seconds field, including fractional parts (0 - 59) (60 if leap seconds are implemented by the operating system).
	`SELECT EXTRACT(SECOND FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 40
	`SELECT EXTRACT(SECOND FROM TIME '17:12:28.5');`
	Result: 28.5

TIME ZONE	The time zone offset from UTC, measured in seconds. Positive values correspond to time zones east of UTC, negative values to zones west of UTC.
TIMEZONE_HOUR	The hour component of the time zone offset.
TIMEZONE_MINUTE	The minute component of the time zone offset.

WEEK	The number of the week of the year that the day is in. By definition, the ISO-8601 week starts on Monday, and the first week of a year contains January 4 of that year. In other words, the first Thursday of a year is in week 1 of that year.
	Because of this, it is possible for early January dates to be part of the 52nd or 53rd week of the previous year. For example, `2005-01-01` is part of the 53rd week of year 2004, and `2006-01-01` is part of the 52nd week of year 2005.
	`SELECT EXTRACT(WEEK FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 7
	`SELECT EXTRACT(WEEK FROM DATE '2001-02-16');`
	Result: 7

YEAR	The year field. Keep in mind there is no `0 AD`, so subtract `BC` years from `AD`

	years with care. `SELECT EXTRACT(YEAR FROM TIMESTAMP '2001-02-16 20:38:40');` *Result:* 2001

Examples

The following example extracts the day value from the input parameters:

```
SELECT DATE_PART('day', TIMESTAMP '2009-02-24 20:38:40') "Day";
 Day
-----
  24
(1 row)
```

The following example extracts the month value from the input parameters:

```
SELECT DATE_PART('month', TIMESTAMP '2009-02-24 20:38:40') "Month";
 Month
-------
     2
(1 row)
```

The following example extracts the year value from the input parameters:

```
SELECT DATE_PART('year', TIMESTAMP '2009-02-24 20:38:40') "Year";
 Year
------
 2009
(1 row)
```

The following example extracts the hours from the input parameters:

```
SELECT DATE_PART('hour', TIMESTAMP '2009-02-24 20:38:40') "Hour";
 Hour
------
   20
(1 row)
```

The following example extracts the minutes from the input parameters:

```
SELECT DATE_PART('minutes', TIMESTAMP '2009-02-24 20:38:40') "Minutes";
 Minutes
---------
      38
(1 row)
```

The following example extracts the seconds from the input parameters:

```
SELECT DATE_PART('seconds', TIMESTAMP '2009-02-24 20:38:40') "Seconds";
 Seconds
---------
      40
(1 row)
```

The following example extracts the day of quarter (DOQ) from the input parameters:

```
SELECT DATE_PART('DOQ', TIMESTAMP '2009-02-24 20:38:40') "DOQ";
 DOQ
-----
  55
```

```
(1 row)

SELECT DATE_PART('day', INTERVAL '29 days 23 hours');
 date_part
-----------
        29
(1 row)
```

Notice what happens to the above query if you add an hour:

```
SELECT DATE_PART('day', INTERVAL '29 days 24 hours');
 date_part
-----------
        30
(1 row)
```

The following example returns 0 because an interval in hours is up to 24 only:

```
SELECT DATE_PART('hour', INTERVAL '24 hours 45 minutes');
 date_part
-----------
         0
(1 row)
```

See Also

EXTRACT (page 193)

DATE_TRUNC

Is conceptually similar to the ***TRUNC*** (page 245) function for numbers. The return value is of type TIMESTAMP or INTERVAL with all fields that are less significant than the selected one set to zero (or one, for day and month).

Behavior Type

Stable when source is of type TIMESTAMPTZ, Immutable otherwise.

Syntax

```
DATE_TRUNC ( field , source )
```

Parameters

field	Is a string constant that selects the precision to which truncate the input value. Valid values for *field* are: century milliseconds day minute decade month hour second microseconds week millennium year
source	Is a value expression of type `TIMESTAMP` or `INTERVAL`.

	Values of type `DATE` and `TIME` are cast automatically, to `TIMESTAMP` or `INTERVAL`, respectively.

Examples

The following example returns the hour and truncates the minutes and seconds:

```
SELECT DATE_TRUNC('hour', TIMESTAMP '2009-02-24 13:38:40') AS hour;
        hour
---------------------
 2009-02-24 13:00:00
(1 row)
```

The following example returns the year and defaults month and day to January 1, truncating the rest of the string:

```
SELECT DATE_TRUNC('year', TIMESTAMP '2009-02-24 13:38:40') AS year;
        year
---------------------
 2009-01-01 00:00:00
(1 row)
```

The following example returns the year and month and defaults day of month to 1, truncating the rest of the string:

```
SELECT DATE_TRUNC('month', TIMESTAMP '2009-02-24 13:38:40') AS year;
        year
---------------------
 2009-02-01 00:00:00
(1 row)
```

DATEDIFF

Returns the difference between two date or time values, based on the specified start and end arguments.

Behavior Type

Immutable, except for TIMESTAMPTZ arguments where it is Stable.

Syntax 1

```
DATEDIFF ( datepart , startdate , enddate );
```

Syntax 2

```
DATEDIFF ( datepart , starttime , endtime );
```

Parameters

datepart	Returns the number of specified datepart boundaries between the specified startdate and enddate.
	Can be an unquoted identifier, a quoted string, or an expression in parentheses, which evaluates to the datepart as a character string.
	The following table lists the valid *datepart* arguments.
	
	`datepart  abbreviation`
	`---------  ------------`
	`year  yy, yyyy`
	`quarter  qq, q`
	`month  mm, m`
	`day  dd, d, dy, dayofyear, y`
	`week  wk, ww`
	`hour  hh`
	`minute  mi, n`
	`second  ss, s`
	`millisecond  ms`
	`microsecond  mcs, us`

startdate	Is the start date for the calculation and is an expression that returns a ***TIMESTAMP*** (page 87), ***DATE*** (page 69), or TIMESTAMPTZ value. The *startdate* value is not included in the count.
enddate	Is the end date for the calculation and is an expression that returns a ***TIMESTAMP*** (page 87), ***DATE*** (page 69), or TIMESTAMPTZ value. The *enddate* value is included in the count.
starttime	Is the start time for the calculation and is an expression that returns an ***INTERVAL*** (page 70) or ***TIME*** (page 85) data type. ▪ The *starttime* value is not included in the count. ▪ Year, quarter, or month *dateparts* are not allowed.
endtime	Is the end time for the calculation and is an expression that returns an ***INTERVAL*** (page 70) or ***TIME*** (page 85) data type. ▪ The *endtime* value is included in the count. ▪ Year, quarter, or month *dateparts* are not allowed.

Notes

- DATEDIFF() is an immutable function with a default type of TIMESTAMP. It also takes DATE. If TIMESTAMPTZ is specified, the function is stable.
- Vertica accepts statements written in any of the following forms:

```
DATEDIFF(year, s, e);
DATEDIFF('year', s, e);
```

If you use an expression, the expression must be enclosed in parentheses:
`DATEDIFF((expression), s, e);`

- Starting arguments are not included in the count, but end arguments are included.

The datepart boundaries

DATEDIFF calculates results according to ticks—or boundaries—within the date range or time range. Results are calculated based on the specified *datepart*. Let's examine the following statement and its results:

```
SELECT DATEDIFF('year', TO_DATE('01-01-2005','MM-DD-YYYY'),
TO_DATE('12-31-2008','MM-DD-YYYY'));
 datediff
----------
        3
(1 row)
```

In the above example, we specified a *datepart* of year, a *startdate* of January 1, 2005 and an *enddate* of December 31, 2008. DATEDIFF returns 3 by counting the year intervals as follows:

```
 [1] January 1, 2006 + [2] January 1, 2007 + [3] January 1, 2008 = 3
```

The function returns 3, and not 4, because *startdate* (January 1, 2005) is not counted in the calculation. DATEDIFF also ignores the months between January 1, 2008 and December 31, 2008 because the *datepart* specified is year and only the start of each year is counted.

Sometimes the *enddate* occurs earlier in the ending year than the *startdate* in the starting year. For example, assume a *datepart* of year, a *startdate* of August 15, 2005, and an *enddate* of January 1, 2009. In this scenario, less than three years have elapsed, but DATEDIFF counts the same way it did in the previous example, returning 3 because it returns the number of January 1s between the limits:

```
 [1] January 1, 2006 + [2] January 1, 2007 + [3] January 1, 2008 = 3
```

In the following query, Vertica recognizes the full year 2005 as the starting year and 2009 as the ending year.

```
SELECT DATEDIFF('year', TO_DATE('08-15-2005','MM-DD-YYYY'),
TO_DATE('01-01-2009','MM-DD-YYYY'));
```

The count occurs as follows:

```
 [1] January 1, 2006 + [2] January 1, 2007 + [3] January 1, 2008 + [4] January 1,
2009 = 4
```

Even though August 15 has not yet occurred in the *enddate*, the function counts the entire *enddate* year as one tick or boundary because of the year *datepart*.

Examples

Year: In this example, the *startdate* and *enddate* are adjacent. The difference between the dates is one time boundary (second) of its datepart, so the result set is 1.

```
SELECT DATEDIFF('year', TIMESTAMP '2008-12-31 23:59:59',
  '2009-01-01 00:00:00');
 datediff
----------
       1
```

```
(1 row)
```

Quarters start on January, April, July, and October.

In the following example, the result is 0 because the difference from January to February in the same calendar year does not span a quarter:

```
SELECT DATEDIFF('qq', TO_DATE('01-01-1995','MM-DD-YYYY'),
  TO_DATE('02-02-1995','MM-DD-YYYY'));
 datediff
----------
        0
(1 row)
```

The next example, however, returns 8 quarters because the difference spans two full years. The extra month is ignored:

```
SELECT DATEDIFF('quarter', TO_DATE('01-01-1993','MM-DD-YYYY'),
  TO_DATE('02-02-1995','MM-DD-YYYY'));
 datediff
----------
        8
(1 row)
```

Months are based on real calendar months.

The following statement returns 1 because there is month difference between January and February in the same calendar year:

```
SELECT DATEDIFF('mm', TO_DATE('01-01-2005','MM-DD-YYYY'),
  TO_DATE('02-02-2005','MM-DD-YYYY'));
 datediff
----------
        1
(1 row)
```

The next example returns a negative value of 1:

```
SELECT DATEDIFF('month', TO_DATE('02-02-1995','MM-DD-YYYY'),
  TO_DATE('01-01-1995','MM-DD-YYYY'));
 datediff
----------
       -1
(1 row)
```

And this third example returns 23 because there are 23 months difference between

```
SELECT DATEDIFF('m', TO_DATE('02-02-1993','MM-DD-YYYY'),
  TO_DATE('01-01-1995','MM-DD-YYYY'));
 datediff
----------
       23
(1 row)
```

Weeks start on Sunday at midnight.

The first example returns 0 because, even though the week starts on a Sunday, it is not a full calendar week:

```
SELECT DATEDIFF('ww', TO_DATE('02-22-2009','MM-DD-YYYY'),
```

```
  TO_DATE('02-28-2009','MM-DD-YYYY'));
 datediff
----------
        0
(1 row)
```

The following example returns 1 (week); January 1, 2000 fell on a Saturday.

```
SELECT DATEDIFF('week', TO_DATE('01-01-2000','MM-DD-YYYY'),
  TO_DATE('01-02-2000','MM-DD-YYYY'));
 datediff
----------
        1
(1 row)
```

In the next example, DATEDIFF() counts the weeks between January 1, 1995 and February 2, 1995 and returns 4 (weeks):

```
SELECT DATEDIFF('wk', TO_DATE('01-01-1995','MM-DD-YYYY'),
  TO_DATE('02-02-1995','MM-DD-YYYY'));
 datediff
----------
        4
(1 row)
```

The next example returns a difference of 100 weeks:

```
SELECT DATEDIFF('ww', TO_DATE('02-02-2006','MM-DD-YYYY'),
  TO_DATE('01-01-2008','MM-DD-YYYY'));
 datediff
----------
      100
(1 row)
```

Days are based on real calendar days.

The first example returns 31, the full number of days in the month of July 2008.

```
SELECT DATEDIFF('day', 'July 1, 2008', 'Aug 1, 2008'::date);
 datediff
----------
       31
(1 row)
```

Just over two years of days:

```
SELECT DATEDIFF('d', TO_TIMESTAMP('01-01-1993','MM-DD-YYYY'),
  TO_TIMESTAMP('02-02-1995','MM-DD-YYYY'));
 datediff
----------
      762
(1 row)
```

Hours, minutes, and **seconds** are based on clock time.

The first example counts backwards from March 2 to February 14 and returns -384 hours:

```
SELECT DATEDIFF('hour', TO_DATE('03-02-2009','MM-DD-YYYY'),
  TO_DATE('02-14-2009','MM-DD-YYYY'));
 datediff
```

```
----------
     -384
(1 row)
```

Another hours example:

```
SELECT DATEDIFF('hh', TO_TIMESTAMP('01-01-1993','MM-DD-YYYY'),
  TO_TIMESTAMP('02-02-1995','MM-DD-YYYY'));
 datediff
----------
    18288
(1 row)
```

This example counts the minutes backwards:

```
SELECT DATEDIFF('mi', TO_TIMESTAMP('01-01-1993 03:00:45','MM-DD-YYYY HH:MI:SS'),
  TO_TIMESTAMP('01-01-1993 01:30:21',' MM-DD-YYYY  HH:MI:SS'));
 datediff
----------
      -90
(1 row)
```

And this example counts the minutes forward:

```
SELECT DATEDIFF('minute', TO_DATE('01-01-1993','MM-DD-YYYY'),
  TO_DATE('02-02-1995','MM-DD-YYYY'));
 datediff
----------
  1097280
(1 row)
```

In the following example, the query counts the difference in seconds, beginning at a start time of 4:44 and ending at 5:55 with an interval of 2 days:

```
SELECT DATEDIFF('ss', TIME '04:44:42.315786',
  INTERVAL '2 05:55:52.963558');
 datediff
----------
   177070
(1 row)
```

See Also

Date/Time Expressions (page 47)

EXTRACT

Retrieves subfields such as year or hour from date/time values and returns values of type ***DOUBLE PRECISION*** (page 94). EXTRACT is primarily intended for computational processing, rather than for formatting date/time values for display.

Internally EXTRACT uses the DATE_PART function.

Behavior Type

Stable when source is of type TIMESTAMPTZ, Immutable otherwise.

Syntax

```
EXTRACT ( field FROM source )
```

Parameters

field	Is an identifier or string that selects what field to extract from the source value. **Note:** The field parameter is the same for the DATE_PART() (page 183) function.
source	Is an expression of type DATE, TIMESTAMP, TIME, or INTERVAL. **Note:** Expressions of type DATE are cast to TIMESTAMP.

Field Values

CENTURY	The century number.
	`SELECT EXTRACT(CENTURY FROM TIMESTAMP '2000-12-16 12:21:13');`
	Result: 20
	`SELECT EXTRACT(CENTURY FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 21
	The first century starts at 0001-01-01 00:00:00 AD. This definition applies to all Gregorian calendar countries. There is no century number 0, you go from -1 to 1.

DAY	The day (of the month) field (1 - 31).
	`SELECT EXTRACT(DAY FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 16
	`SELECT EXTRACT(DAY FROM DATE '2001-02-16');`
	Result: 16

DECADE	The year field divided by 10.
	`SELECT EXTRACT(DECADE FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 200
	`SELECT EXTRACT(DECADE FROM DATE '2001-02-16');`
	Result: 200

DOQ	The day within the current quarter. `SELECT EXTRACT(DOQ FROM CURRENT_DATE);` *Result*: 89 The result is calculated as follows: Current date = June 28, current quarter = 2 (April, May, June). 30 (April) + 31 (May) + 28 (June current day) = 89. DOQ recognizes leap year days.

DOW	The day of the week (0 - 6; Sunday is 0).
	`SELECT EXTRACT(DOW FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 5
	`SELECT EXTRACT(DOW FROM DATE '2001-02-16');`
	Result: 5
	Note that EXTRACT's day of the week numbering is different from that of the TO_CHAR function.

DOY	The day of the year (1 - 365/366)
	`SELECT EXTRACT(DOY FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 47
	`SELECT EXTRACT(DOY FROM DATE '2001-02-16');`
	Result: 5

EPOCH	For DATE and TIMESTAMP values, the number of seconds since 1970-01-01 00:00:00-00 (can be negative); for INTERVAL values, the total number of seconds in the interval.
	`SELECT EXTRACT(EPOCH FROM TIMESTAMP WITH TIME ZONE '2001-02-16 20:38:40-08');`
	Result: 982384720
	`SELECT EXTRACT(EPOCH FROM INTERVAL '5 days 3 hours');`
	Result: 442800
	Here is how you can convert an epoch value back to a timestamp:
	`SELECT TIMESTAMP WITH TIME ZONE 'epoch' + 982384720 * INTERVAL '1 second';`

HOUR	The hour field (0 - 23).
	`SELECT EXTRACT(HOUR FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 20
	`SELECT EXTRACT(HOUR FROM TIME '13:45:59');`
	Result: 13

ISODOW	The ISO day of the week (1 - 7; Monday is 1). `SELECT EXTRACT(ISODOW FROM DATE '2010-09-27');` *Result*: 1

ISOYEAR	The ISO year, which is 52 or 53 weeks (Monday - Sunday).
	`SELECT EXTRACT(ISOYEAR FROM DATE '2006-01-01');`
	Result: 2005
	`SELECT EXTRACT(ISOYEAR FROM DATE '2006-01-02');`
	Result: 2006
	`SELECT EXTRACT(ISOYEAR FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 2001

MICROSECONDS	The seconds field, including fractional parts, multiplied by 1,000,000. This includes full seconds. `SELECT EXTRACT(MICROSECONDS FROM TIME '17:12:28.5');` *Result*: 28500000
MILLENNIUM	The millennium number. `SELECT EXTRACT(MILLENNIUM FROM TIMESTAMP '2001-02-16 20:38:40');` *Result*: 3 Years in the 1900s are in the second millennium. The third millennium starts January 1, 2001.
MILLISECONDS	The seconds field, including fractional parts, multiplied by 1000. Note that this includes full seconds. `SELECT EXTRACT(MILLISECONDS FROM TIME '17:12:28.5');` *Result*: 28500

MINUTE	The minutes field (0 - 59).
	`SELECT EXTRACT(MINUTE FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 38
	`SELECT EXTRACT(MINUTE FROM TIME '13:45:59');`
	Result: 45

MONTH	For timestamp values, the number of the month within the year (1 - 12) ; for interval values the number of months, modulo 12 (0 - 11).
	`SELECT EXTRACT(MONTH FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 2
	`SELECT EXTRACT(MONTH FROM INTERVAL '2 years 3 months');`
	Result: 3
	`SELECT EXTRACT(MONTH FROM INTERVAL '2 years 13 months');`
	Result: 1

QUARTER	The quarter of the year (1 - 4) that the day is in (for timestamp values only). `SELECT EXTRACT(QUARTER FROM TIMESTAMP '2001-02-16 20:38:40');`

	Result: 1

SECOND	The seconds field, including fractional parts (0 - 59) (60 if leap seconds are implemented by the operating system).
	`SELECT EXTRACT(SECOND FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 40
	`SELECT EXTRACT(SECOND FROM TIME '17:12:28.5');`
	Result: 28.5

TIME ZONE	The time zone offset from UTC, measured in seconds. Positive values correspond to time zones east of UTC, negative values to zones west of UTC.
TIMEZONE_HOUR	The hour component of the time zone offset.
TIMEZONE_MINUTE	The minute component of the time zone offset.

WEEK	The number of the week of the year that the day is in. By definition, the ISO-8601 week starts on Monday, and the first week of a year contains January 4 of that year. In other words, the first Thursday of a year is in week 1 of that year.
	Because of this, it is possible for early January dates to be part of the 52nd or 53rd week of the previous year. For example, `2005-01-01` is part of the 53rd week of year 2004, and `2006-01-01` is part of the 52nd week of year 2005.
	`SELECT EXTRACT(WEEK FROM TIMESTAMP '2001-02-16 20:38:40');`
	Result: 7
	`SELECT EXTRACT(WEEK FROM DATE '2001-02-16');`
	Result: 7

YEAR	The year field. Keep in mind there is no `0 AD`, so subtract `BC` years from `AD` years with care. `SELECT EXTRACT(YEAR FROM TIMESTAMP '2001-02-16 20:38:40');` *Result:* 2001

Examples

```
=> SELECT EXTRACT (DAY FROM DATE '2008-12-25');
date_part
-----------
        25
(1 row)
=> SELECT EXTRACT (MONTH FROM DATE '2008-12-25');
date_part
-----------
        12
(1 row
SELECT EXTRACT(DOQ FROM CURRENT_DATE);
 date_part
-----------
        89
(1 row)
```

Remember that internally `EXTRACT()` uses the `DATE_PART()` function:

```
=> SELECT EXTRACT(EPOCH FROM AGE_IN_YEARS(TIMESTAMP '2009-02-24',
   TIMESTAMP '1972-03-02') :: INTERVAL year);

 date_part
-----------
 1136073600
```

```
(1 row)
```

In the above example, AGE_IN_YEARS is 36. The UNIX epoch uses 365.25 days per year:

```
=> SELECT 1136073600.0/36/(24*60*60);
 ?column?
----------
   365.25
(1 row)
```

See Also

DATE_PART (page 183)

GETDATE

Returns the current system date and time as a TIMESTAMP value.

Behavior Type

Stable

Syntax

```
GETDATE();
```

Notes

- GETDATE is a stable function that requires parentheses but accepts no arguments.
- This function uses the date and time supplied by the operating system on the server to which you are connected, which is the same across all servers.
- GETDATE internally converts CLOCK_TIMESTAMP() from TIMESTAMPTZ to TIMESTAMP.
- This function is identical to ***SYSDATE*** (page 204)().

Example

```
SELECT GETDATE();
          getdate
----------------------------
 2009-02-18 16:39:58.628483
(1 row)
```

See Also

Date/Time Expressions (page 47)

GETUTCDATE

Returns the current system date and time as a TIMESTAMP value relative to UTC.

Behavior Type

Stable

Syntax

```
GETUTCDATE();
```

Notes

- GETUTCDATE is a stable function that requires parentheses but accepts no arguments.
- This function uses the date and time supplied by the operating system on the server to which you are connected, which is the same across all servers.
- GETUTCDATE is internally converted to ***CLOCK_TIMESTAMP*** (page 180)() at TIME ZONE 'UTC'.

Example

```
SELECT GETUTCDATE();
          getutcdate
----------------------------
 2009-02-18 16:39:58.628483
(1 row)
```

See Also

Date/Time Expressions (page 47)

ISFINITE

Tests for the special TIMESTAMP constant INFINITY and returns a value of type BOOLEAN.

Behavior Type

Immutable

Syntax

```
ISFINITE ( timestamp )
```

Parameters

timestamp	Is an expression of type TIMESTAMP

Examples

```
SELECT ISFINITE(TIMESTAMP '2009-02-16 21:28:30');
 isfinite
----------
 t
(1 row)
SELECT ISFINITE(TIMESTAMP 'INFINITY');
 isfinite
----------
 f
(1 row)
```

LAST_DAY

Returns the last day of the month based on a TIMESTAMP. The TIMESTAMP can be supplied as a DATE or a TIMESTAMPTZ data type.

Behavior Type

Immutable, unless called with TIMESTAMPTZ, in which case it is Stable.

Syntax

```
LAST_DAY ( date );
```

Examples

The following example returns the last day of the month, February, as 29 because 2008 was a leap year:

```
SELECT LAST_DAY('2008-02-28 23:30 PST') "Last";
    Last
------------
 2008-02-29
(1 row)
```

The following example returns the last day of the month in March, after converting the string value to the specified DATE type:

```
SELECT LAST_DAY('2003/03/15') "Last";
    Last
------------
 2003-03-31
(1 row)
```

The following example returns the last day of February in the specified year (not a leap year):

```
SELECT LAST_DAY('2003/02/03') "Last";
    Last
------------
 2003-02-28
(1 row)
```

LOCALTIME

Returns a value of type TIME representing the time of day.

Behavior Type

Stable

Syntax

```
LOCALTIME [ ( precision ) ]
```

Parameters

precision	Causes the result to be rounded to the specified number of fractional digits in the seconds field.

Notes

This function returns the start time of the current transaction; the value does not change during the transaction. The intent is to allow a single transaction to have a consistent notion of the "current" time, so that multiple modifications within the same transaction bear the same timestamp.

Examples

```
SELECT LOCALTIME;
      time
-----------------
 16:16:06.790771
(1 row)
```

LOCALTIMESTAMP

Returns a value of type TIMESTAMP representing today's date and time of day.

Behavior Type

Stable

Syntax

```
LOCALTIMESTAMP [ ( precision ) ]
```

Parameters

precision	Causes the result to be rounded to the specified number of fractional digits in the seconds field.

Notes

This function returns the start time of the current transaction; the value does not change during the transaction. The intent is to allow a single transaction to have a consistent notion of the "current" time, so that multiple modifications within the same transaction bear the same timestamp.

Examples

```
SELECT LOCALTIMESTAMP;
        timestamp
--------------------------
 2009-02-24 14:47:48.5951
(1 row)
```

MONTHS_BETWEEN

Returns the number of months between *date1* and *date2* as a FLOAT8*.* where the input arguments can be of TIMESTAMP, DATE, or TIMESTAMPTZ type.

Behavior Type

Immutable for TIMESTAMP and Date, Stable for TIMESTAMPTZ

Syntax

```
MONTHS_BETWEEN ( date1 , date2 );
```

Parameters

date1, date2	If *date1* is later than *date2,* then the result is positive. If *date1* is earlier than *date2,* then the result is negative. If *date1* and *date2* are either the same days of the month or both are the last days of their respective month, then the result is always an integer. Otherwise MONTHS_BETWEEN returns a FLOAT8 result based on a 31-day month, which considers the difference between *date1* and *date2.*

Examples

Note the following result is an integral number of days because the dates are on the same day of the month:

```
SELECT MONTHS_BETWEEN('2009-03-07 16:00'::TIMESTAMP, '2009-04-07
15:00'::TIMESTAMP);
 months_between
----------------
             -1
(1 row)
```

The result from the following example returns an integral number of days because the days fall on the last day of their respective months:

```
SELECT MONTHS_BETWEEN('29Feb2000', '30Sep2000') "Months";
     Months
----------------
             -7
(1 row)
```

In this example, and in the example that immediately follows it, `MONTHS_BETWEEN()` returns the number of months between *date1* and *date2* as a fraction because the days do not fall on the same day or on the last day of their respective months:

```
SELECT MONTHS_BETWEEN(TO_DATE('02-02-1995','MM-DD-YYYY'),
                      TO_DATE('01-01-1995','MM-DD-YYYY') ) "Months";
      Months
------------------
 1.03225806451613
(1 row)
SELECT MONTHS_BETWEEN(TO_DATE ('2003/01/01', 'yyyy/mm/dd'),
                      TO_DATE ('2003/03/14', 'yyyy/mm/dd') ) "Months";
      Months
-------------------
 -2.41935483870968
(1 row)
```

The following two examples use the same *date1* and *date2* strings, but they are cast to a different data types (TIMESTAMP and TIMESTAMPTZ). The result set is the same for both statements:

```
SELECT MONTHS_BETWEEN('2008-04-01'::timestamp, '2008-02-29'::timestamp);
```

```
  months_between
------------------
 1.09677419354839
(1 row)
SELECT MONTHS_BETWEEN('2008-04-01'::timestamptz, '2008-02-29'::timestamptz);
  months_between
------------------
 1.09677419354839
(1 row)
```

The following two examples show alternate inputs:

```
SELECT MONTHS_BETWEEN('2008-04-01'::date, '2008-02-29'::timestamp);
  months_between
------------------
 1.09677419354839
(1 row)
SELECT MONTHS_BETWEEN('2008-02-29'::timestamptz, '2008-04-01'::date);
  months_between
-------------------
 -1.09677419354839
(1 row)
```

NOW [Date/Time]

Returns a value of type TIMESTAMP WITH TIME ZONE representing the start of the current transaction. NOW is equivalent to ***CURRENT_TIMESTAMP*** (page 182) except that it does not accept a precision parameter.

Behavior Type

Stable

Syntax

```
NOW()
```

Notes

This function returns the start time of the current transaction; the value does not change during the transaction. The intent is to allow a single transaction to have a consistent notion of the "current" time, so that multiple modifications within the same transaction bear the same timestamp.

Examples

```
SELECT NOW();
              NOW
-------------------------------
 2010-04-01 15:31:12.144584-04
(1 row)
```

See Also

CURRENT_TIMESTAMP (page 182)

OVERLAPS

Returns true when two time periods overlap, false when they do not overlap.

Behavior Type

Stable when TIMESTAMP and TIMESTAMPTZ are both used, or when TIMESTAMPTZ is used with INTERVAL, Immutable otherwise.

Syntax

```
( start, end ) OVERLAPS ( start, end )
( start, interval ) OVERLAPS ( start, interval )
```

Parameters

start	Is a DATE, TIME, or TIME STAMP value that specifies the beginning of a time period.
end	Is a DATE, TIME, or TIME STAMP value that specifies the end of a time period.
interval	Is a value that specifies the length of the time period.

Examples

The first command returns true for an overlap in date range of 2007-02-16 – 2007-12-21 with 2007-10-30 – 2008-10-30.

```
SELECT (DATE '2007-02-16', DATE '2007-12-21')
  OVERLAPS (DATE '2007-10-30', DATE '2008-10-30');
 overlaps
----------
 t
(1 row)
```

The next command returns false for an overlap in date range of 2007-02-16 – 2007-12-21 with 2008-10-30 – 2008-10-30.

```
SELECT (DATE '2007-02-16', DATE '2007-12-21')
  OVERLAPS (DATE '2008-10-30', DATE '2008-10-30');
 overlaps
----------
 f
(1 row)
```

The next command returns false for an overlap in date range of 2007-02-16, 22 hours ago with 2007-10-30, 22 hours ago.

```
SELECT (DATE '2007-02-16', INTERVAL '1 12:59:10')
  OVERLAPS (DATE '2007-10-30', INTERVAL '1 12:59:10');
 overlaps
----------
 f
(1 row)
```

STATEMENT_TIMESTAMP

Is similar to ***TRANSACTION_TIMESTAMP*** (page 210). It returns a value of type TIMESTAMP WITH TIME ZONE representing the start of the current statement.

Behavior Type

Stable

Syntax

```
STATEMENT_TIMESTAMP()
```

Notes

This function returns the start time of the current statement; the value does not change during the statement. The intent is to allow a single statement to have a consistent notion of the "current" time, so that multiple modifications within the same statement bear the same timestamp.

Examples

```
SELECT STATEMENT_TIMESTAMP();
      STATEMENT_TIMESTAMP
-------------------------------
 2010-04-01 15:40:42.223736-04
(1 row)
```

See Also

CLOCK_TIMESTAMP (page 180)

TRANSACTION_TIMESTAMP (page 210)

SYSDATE

Returns the current system date and time as a TIMESTAMP value.

Behavior Type

Stable

Syntax

```
SYSDATE();
```

Notes

- SYSDATE is a stable function (called once per statement) that requires no arguments. Parentheses are optional.
- This function uses the date and time supplied by the operating system on the server to which you are connected, which must be the same across all servers.
- In implementation, SYSDATE converts ***CLOCK_TIMESTAMP*** (page 180) from TIMESTAMPTZ to TIMESTAMP.
- This function is identical to ***GETDATE*** (page 197).

Examples

```
SELECT SYSDATE();
          sysdate
----------------------------
 2010-04-01 15:41:17.087173
(1 row)
SELECT SYSDATE;
          sysdate
----------------------------
 2010-04-01 15:41:17.087173
(1 row)
```

See Also

Date/Time Expressions (page 47)

TIME_SLICE

Aggregates data by different fixed-time intervals and returns a rounded-up input TIMESTAMP value to a value that corresponds with the start or end of the time slice interval.

Given an input TIMESTAMP value, such as '2000-10-28 00:00:01', the start time of a 3-second time slice interval is '2000-10-28 00:00:00', and the end time of the same time slice is '2000-10-28 00:00:03'.

Behavior Type

Immutable

Syntax

```
TIME_SLICE(expression, slice_length,
  [ time_unit = 'SECOND' ],
  [ start_or_end = 'START' ] )
```

Parameters

expression	Is evaluated on each row. Can be either a column of type TIMESTAMP or a (string) constant that can be parsed into a TIMESTAMP value, such as '2004-10-19 10:23:54'.
slice_length	Is the length of the slice specified in integers. Input must be a positive integer.
time_unit	Is the time unit of the slice with a default of SECOND. Domain of possible values: { HOUR, MINUTE, SECOND, MILLISECOND, MICROSECOND }.
start_or_end	Indicates whether the returned value corresponds to the start or end time of the time slice interval. The default is START. Domain of possible values: { START, END }.

Notes

- The returned value's data type is TIMESTAMP.
- The corresponding SQL data type for TIMESTAMP is TIMESTAMP WITHOUT TIME ZONE. Vertica supports TIMESTAMP for TIME_SLICE instead of DATE and TIME data types.
- TIME_SLICE exhibits the following behavior around nulls:
  - The system returns an error when any one of *slice_length*, *time_unit*, or *start_or_end* parameters is null.
  - When *slice_length*, *time_unit*, and *start_or_end* contain legal values, and *expression* is null, the system returns a NULL value, instead of an error.

Usage

The following command returns the (default) start time of a 3-second time slice:

```
SELECT TIME_SLICE('2009-09-19 00:00:01', 3);
     time_slice
---------------------
 2009-09-19 00:00:00
(1 row)
```

The following command returns the end time of a 3-second time slice:

```
SELECT TIME_SLICE('2009-09-19 00:00:01', 3, 'SECOND', 'END');
     time_slice
---------------------
 2009-09-19 00:00:03
(1 row)
```

This command returns results in milliseconds, using a 3-second time slice:

```
   SELECT TIME_SLICE('2009-09-19 00:00:01', 3, 'ms');
          time_slice
   -------------------------
    2009-09-19 00:00:00.999
(1 row)
```

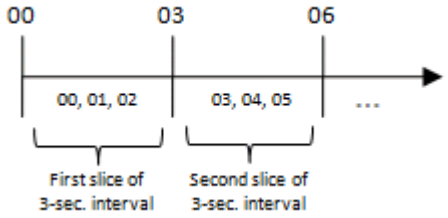
This command returns results in microseconds, using a 9-second time slice:

```
SELECT TIME_SLICE('2009-09-19 00:00:01', 3, 'us');
         time_slice
----------------------------
 2009-09-19 00:00:00.999999
(1 row)
```

The next example uses a 3-second interval with an input value of '00:00:01'. To focus specifically on seconds, the example omits date, though all values are implied as being part of the timestamp with a given input of `'00:00:01'`:

- '00:00:**00**' is the start of the 3-second time slice
- '00:00:**03**' is the end of the 3-second time slice.

- '00:00:03' is also the start of the *second* 3-second time slice. In time slice boundaries, the end value of a time slice does not belong to that time slice; it starts the next one.

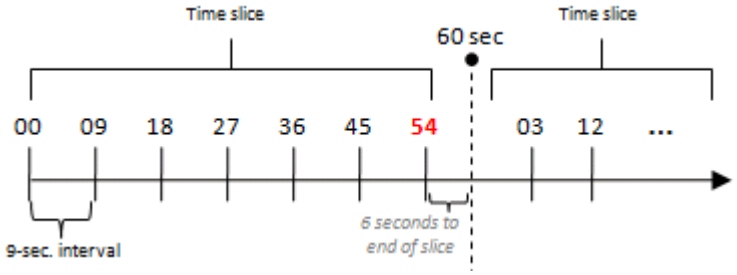


When the time slice interval is not a factor of 60 seconds, such as a given slice length of 9 in the following example, the slice does not always start or end on 00 seconds:

```
SELECT TIME_SLICE('2009-02-14 20:13:01', 9);
     time_slice
---------------------
 2009-02-14 20:12:54
(1 row)
```

This is expected behavior, as the following properties are true for all time slices:

- Equal in length
- Consecutive (no gaps between them)
- Non-overlapping



To force the above example ('2009-02-14 20:13:01') to start at '2009-02-14 20:13:00', adjust the output timestamp values so that the remainder of 54 counts up to 60:

```
SELECT TIME_SLICE('2009-02-14 20:13:01', 9 )+'6 seconds'::INTERVAL AS time;
        time
---------------------
 2009-02-14 20:13:00
(1 row)
```

Alternatively, you could use a different slice length, which is divisible by 60, such as 5:

```
SELECT TIME_SLICE('2009-02-14 20:13:01', 5);
     time_slice
---------------------
 2009-02-14 20:13:00
(1 row)
```

A TIMESTAMPZ value is implicitly cast to TIMESTAMP. For example, the following two statements have the same effect.

```
SELECT TIME_SLICE('2009-09-23 11:12:01'::timestamptz, 3);
     TIME_SLICE
---------------------
 2009-09-23 11:12:00
(1 row)
SELECT TIME_SLICE('2009-09-23 11:12:01'::timestamptz::timestamp, 3);
     TIME_SLICE
---------------------
 2009-09-23 11:12:00
(1 row)
```

Examples

You can use the SQL analytic functions FIRST_VALUE and LAST_VALUE to find the first/last price within each time slice group (set of rows belonging to the same time slice). This structure could be useful if you want to sample input data by choosing one row from each time slice group.

```
SELECT date_key, transaction_time, sales_dollar_amount,
TIME_SLICE(DATE '2000-01-01' + date_key + transaction_time, 3),
FIRST_VALUE(sales_dollar_amount)
OVER (PARTITION BY TIME_SLICE(DATE '2000-01-01' + date_key + transaction_time, 3)
     ORDER BY DATE '2000-01-01' + date_key + transaction_time) AS first_value
FROM store.store_sales_fact
LIMIT 20;
 date_key | transaction_time | sales_dollar_amount |     time_slice      | first_value
----------+------------------+---------------------+---------------------+-------------
        1 | 00:41:16         |                 164 | 2000-01-02 00:41:15 |         164
        1 | 00:41:33         |                 310 | 2000-01-02 00:41:33 |         310
        1 | 15:32:51         |                 271 | 2000-01-02 15:32:51 |         271
        1 | 15:33:15         |                 419 | 2000-01-02 15:33:15 |         419
        1 | 15:33:44         |                 193 | 2000-01-02 15:33:42 |         193
        1 | 16:36:29         |                 466 | 2000-01-02 16:36:27 |         466
        1 | 16:36:44         |                 250 | 2000-01-02 16:36:42 |         250
        2 | 03:11:28         |                  39 | 2000-01-03 03:11:27 |          39
        3 | 03:55:15         |                 375 | 2000-01-04 03:55:15 |         375
        3 | 11:58:05         |                 369 | 2000-01-04 11:58:03 |         369
        3 | 11:58:24         |                 174 | 2000-01-04 11:58:24 |         174
        3 | 11:58:52         |                 449 | 2000-01-04 11:58:51 |         449
        3 | 19:01:21         |                 201 | 2000-01-04 19:01:21 |         201
        3 | 22:15:05         |                 156 | 2000-01-04 22:15:03 |         156
        4 | 13:36:57         |                -125 | 2000-01-05 13:36:57 |        -125
        4 | 13:37:24         |                -251 | 2000-01-05 13:37:24 |        -251
        4 | 13:37:54         |                 353 | 2000-01-05 13:37:54 |         353
        4 | 13:38:04         |                 426 | 2000-01-05 13:38:03 |         426
        4 | 13:38:31         |                 209 | 2000-01-05 13:38:30 |         209
        5 | 10:21:24         |                 488 | 2000-01-06 10:21:24 |         488
(20 rows)
```

Notice how TIME_SLICE rounds the transaction time to the 3-second slice length.

The following example returns the last trading price (the last row ordered by TickTime) in each 3-second time slice partition:

```
SELECT DISTINCT TIME_SLICE(TickTime, 3), LAST_VALUE(price)
OVER (PARTITION BY TIME_SLICE(TickTime, 3)
ORDER BY TickTime ROWS BETWEEN UNBOUNDED PRECEDING AND UNBOUNDED FOLLOWING);
```

While the above example is the most intuitive way to express the query, Vertica does not currently support the windowing clause and ROWS BETWEEN UNBOUNDED PRECEDING AND UNBOUNDED FOLLOWING.

Note: If you omit the windowing clause from an analytic clause, LAST_VALUE defaults to RANGE BETWEEN UNBOUNDED PRECEDING AND CURRENT ROW. Results can seem non-intuitive, because instead of returning the value from the bottom of the current partition, the function returns the bottom of the *window*, which continues to change along with the current input row that is being processed.

You can rewrite the query so Vertica supports it. For example, below FIRST_VALUE is evaluated once for each input record and the data is sorted by ascending values. Use SELECT DISTINCT to remove the duplicates and return only one output record per TIME_SLICE:

```
SELECT DISTINCT TIME_SLICE(TickTime, 3), FIRST_VALUE(price)
OVER (PARTITION BY TIME_SLICE(TickTime, 3)
ORDER BY TickTime ASC)
FROM tick_store;
     TIME_SLICE      | ?column?
---------------------+----------
 2009-09-21 00:00:06 |    20.00
 2009-09-21 00:00:09 |    30.00
 2009-09-21 00:00:00 |    10.00
(3 rows)
```

The information output by the above query can also return MIN, MAX, and AVG of the trading prices within each time slice. Note that the following example is shown for illustration purposes only, as Vertica currently supports simple SQL aggregates only.

```
SELECT DISTINCT TIME_SLICE(TickTime, 3),
FIRST_VALUE(Price) OVER (PARTITION BY TIME_SLICE(TickTime, 3)
ORDER BY TickTime ASC),
  MIN(price) OVER (PARTITION BY TIME_SLICE(TickTime, 3)),
  MAX(price) OVER (PARTITION BY TIME_SLICE(TickTime, 3)),
  AVG(price) OVER (PARTITION BY TIME_SLICE(TickTime, 3))
FROM tick_store;
```

Rewrite query as follows:

```
SELECT fact.ts, fstvalP, minP, maxP, avgP
FROM
  (SELECT DISTINCT TIME_SLICE(TickTime, 3) ts,
   FIRST_VALUE(Price) OVER (PARTITION BY TIME_SLICE(TickTime, 3)
   ORDER BY TickTime ASC) fstvalP
   FROM tick_store) fact
JOIN
  (SELECT TIME_SLICE(TickTime, 3) ts,
   MIN(Price) minP, MAX(Price) maxP, AVG(Price) avgP
   FROM tick_store
GROUP BY TIME_SLICE(TickTime, 3)) dim
ON fact.ts=dim.ts;

         ts          | fstvalP | minP  | maxP  | avgP
---------------------+---------+-------+-------+-------
 2009-09-21 00:00:00 |   10.00 | 10.00 | 11.10 | 10.55
 2009-09-21 00:00:06 |   20.00 | 20.00 | 21.10 | 20.55
 2009-09-21 00:00:09 |   30.00 | 30.00 | 31.10 | 30.55
(3 rows)
```

The query first sort the records within each time slice by TickTime. It next picks the subset of records with the largest TickTime value in that slice, and then it evaluates the minimum price on that subset. If no multiple records exist with the same `ts` value in the input, the output is deterministic. Otherwise, "finding the last value within each slice" is inherently nondeterministic.

See Also

Aggregate Functions (page 107)

FIRST_VALUE (page 137), ***LAST_VALUE*** (page 143), ***TIMESERIES Clause*** (page 623), ***TS_FIRST_VALUE*** (page 314), and ***TS_LAST_VALUE*** (page 316)

Using Time Series Analytics and Using SQL Analytics in the Programmer's Guide

Using Time Zones with Vertica in the Administrator's Guide

TIMEOFDAY

Returns a text string representing the time of day.

Behavior Type

Volatile

Syntax

```
TIMEOFDAY()
```

Notes

`TIMEOFDAY()` returns the wall-clock time and advances during transactions.

Examples

```
SELECT TIMEOFDAY();
              TIMEOFDAY
-----------------------------------
 Thu Apr 01 15:42:04.483766 2010 EDT
(1 row)
```

TRANSACTION_TIMESTAMP

Returns a value of type TIMESTAMP WITH TIME ZONE representing the start of the current transaction. TRANSACTION_TIMESTAMP is equivalent to ***CURRENT_TIMESTAMP*** (page 182) except that it does not accept a precision parameter.

Behavior Type

Stable

Syntax

```
TRANSACTION_TIMESTAMP()
```

Notes

This function returns the start time of the current transaction; the value does not change during the transaction. The intent is to allow a single transaction to have a consistent notion of the "current" time, so that multiple modifications within the same transaction bear the same timestamp.

Examples

```
SELECT TRANSACTION_TIMESTAMP();
     TRANSACTION_TIMESTAMP
-------------------------------
 2010-04-01 15:31:12.144584-04
(1 row)
```

See Also

CLOCK_TIMESTAMP (page 180) and ***STATEMENT_TIMESTAMP*** (page 204)

Formatting Functions

Formatting functions provide a powerful tool set for converting various data types (DATE/TIME, INTEGER, FLOATING POINT) to formatted strings and for converting from formatted strings to specific data types.

These functions all follow a common calling convention:

- The first argument is the value to be formatted.
- The second argument is a template that defines the output or input format.

Exception: The `TO_TIMESTAMP` function can take a single `double precision` argument.

TO_BITSTRING

Returns a VARCHAR that represents the given VARBINARY value in bitstring format

Behavior Type

Immutable

Syntax

```
TO_BITSTRING ( expression )
```

Parameters

expression	(VARCHAR) is the string to return.

Notes

VARCHAR TO_BITSTRING(VARBINARY) converts data from binary type to character type (where the character representation is the bitstring format). This function is the inverse of BITSTRING_TO_BINARY:

```
TO_BITSTRING(BITSTRING_TO_BINARY(x)) = x)
BITSTRING_TO_BINARY(TO_BITSTRING(x)) = x)
```

Examples

```
SELECT TO_BITSTRING('ab'::BINARY(2));
   to_bitstring
------------------
 0110000101100010
(1 row)
SELECT TO_BITSTRING(HEX_TO_BINARY('0x10'));
to_bitstring
--------------
00010000
(1 row)
```

```
SELECT TO_BITSTRING(HEX_TO_BINARY('0xF0'));
to_bitstring
--------------
11110000
(1 row)
```

See Also

BITCOUNT (page 261) and ***BITSTRING_TO_BINARY*** (page 261)

TO_CHAR

Converts various date/time and numeric values into text strings.

Behavior Type

Stable

Syntax

```
TO_CHAR ( expression [, pattern ] )
```

Parameters

expression	(TIMESTAMP, INTERVAL, INTEGER, DOUBLE PRECISION) specifies the value to convert.
pattern	[Optional] (CHAR or VARCHAR) specifies an output pattern string using the ***Template Patterns for Date/Time Formatting*** (page 219) and and/or ***Template Patterns for Numeric Formatting*** (page 221).

Notes

- TO_CHAR(any) casts any type, except BINARY/VARBINARY, to VARCHAR.

  The following example returns an error if you attempt to cast `TO_CHAR` to a binary data type:

  ```
  => SELECT TO_CHAR('abc'::VARBINARY);
  ERROR:  cannot cast type varbinary to varchar
  ```
- Ordinary text is allowed in to_char templates and is output literally. You can put a substring in double quotes to force it to be interpreted as literal text even if it contains pattern key words. For example, in `'"Hello Year "YYYY'`, the *YYYY* is replaced by the year data, but the single Y in Year is not.
- The `TO_CHAR` function's day-of-the-week numbering (see the 'D' ***template pattern*** (page 219)) is different from that of the ***EXTRACT*** (page 193) function.
- Given an INTERVAL type, TO_CHAR formats HH and HH12 as hours in a single day, while HH24 can output hours exceeding a single day, for example, >24.
- To use a double quote character in the output, precede it with a double backslash. This is necessary because the backslash already has a special meaning in a string constant. For example: `'\\"YYYY Month\\"'`
- `TO_CHAR` does not support the use of V combined with a decimal point. For example: 99.9V99 is not allowed.

Examples

Expression	Result
`SELECT TO_CHAR(CURRENT_TIMESTAMP, 'Day, DD  HH12:MI:SS');`	`'Tuesday  , 06  05:39:18'`
`SELECT TO_CHAR(CURRENT_TIMESTAMP, 'FMDay, FMDD  HH12:MI:SS');`	`'Tuesday, 6  05:39:18'`
`SELECT TO_CHAR(-0.1, '99.99');`	`'  -.10'`
`SELECT TO_CHAR(-0.1, 'FM9.99');`	`'-.1'`
`SELECT TO_CHAR(0.1, '0.9');`	`' 0.1'`
`SELECT TO_CHAR(12, '9990999.9');`	`'    0012.0'`
`SELECT TO_CHAR(12, 'FM9990999.9');`	`'0012.'`
`SELECT TO_CHAR(485, '999');`	`' 485'`
`SELECT TO_CHAR(-485, '999');`	`'-485'`
`SELECT TO_CHAR(485, '9 9 9');`	`' 4 8 5'`
`SELECT TO_CHAR(1485, '9,999');`	`' 1,485'`
`SELECT TO_CHAR(1485, '9G999');`	`' 1 485'`
`SELECT TO_CHAR(148.5, '999.999');`	`' 148.500'`
`SELECT TO_CHAR(148.5, 'FM999.999');`	`'148.5'`
`SELECT TO_CHAR(148.5, 'FM999.990');`	`'148.500'`
`SELECT TO_CHAR(148.5, '999D999');`	`' 148,500'`
`SELECT TO_CHAR(3148.5, '9G999D999');`	`' 3 148,500'`
`SELECT TO_CHAR(-485, '999S');`	`'485-'`
`SELECT TO_CHAR(-485, '999MI');`	`'485-'`
`SELECT TO_CHAR(485, '999MI');`	`'485 '`
`SELECT TO_CHAR(485, 'FM999MI');`	`'485'`
`SELECT TO_CHAR(485, 'PL999');`	`'+485'`
`SELECT TO_CHAR(485, 'SG999');`	`'+485'`
`SELECT TO_CHAR(-485, 'SG999');`	`'-485'`
`SELECT TO_CHAR(-485, '9SG99');`	`'4-85'`
`SELECT TO_CHAR(-485, '999PR');`	`'<485>'`
`SELECT TO_CHAR(485, 'L999');`	`'DM 485'`
`SELECT TO_CHAR(485, 'RN');`	`'        CDLXXXV'`
`SELECT TO_CHAR(485, 'FMRN');`	`'CDLXXXV'`
`SELECT TO_CHAR(5.2, 'FMRN');`	`'V'`
`SELECT TO_CHAR(482, '999th');`	`' 482nd'`
`SELECT TO_CHAR(485, '"Good number:"999');`	`'Good number: 485'`
`SELECT TO_CHAR(485.8, '"Pre:"999" Post:" .999');`	`'Pre: 485 Post: .800'`
`SELECT TO_CHAR(12, '99V999');`	`' 12000'`
`SELECT TO_CHAR(12.4, '99V999');`	`' 12400'`
`SELECT TO_CHAR(12.45, '99V9');`	`' 125'`
`SELECT TO_CHAR(-1234.567);`	`-1234.567`
`SELECT TO_CHAR('1999-12-25'::DATE);`	`1999-12-25`
`SELECT TO_CHAR('1999-12-25 11:31'::TIMESTAMP);`	`1999-12-25 11:31:00`
`SELECT TO_CHAR('1999-12-25 11:31 EST'::TIMESTAMPTZ);`	`1999-12-25 11:31:00-05`
`SELECT TO_CHAR('3 days 1000.333 secs'::INTERVAL);`	`3 days 00:16:40.333`

TO_DATE

Converts a string value to a DATE type.

Behavior Type

Stable

Syntax

```
TO_DATE ( expression , pattern )
```

Parameters

expression	(CHAR or VARCHAR) specifies the value to convert
pattern	(CHAR or VARCHAR) specifies an output pattern string using the ***Template Patterns for Date/Time Formatting*** (page 219) and/or ***Template Patterns for Numeric Formatting*** (page 221).

Notes

- To use a double quote character in the output, precede it with a double backslash. This is necessary because the backslash already has a special meaning in a string constant. For example: `'\\"YYYY Month\\"'`
- TO_TIMESTAMP and TO_DATE skip multiple blank spaces in the input string if the FX option is not used. FX must be specified as the first item in the template. For example:
  - For example `TO_TIMESTAMP('2000 JUN', 'YYYY MON')` is correct.
  - `TO_TIMESTAMP('2000 JUN', 'FXYYYY MON')` returns an error, because TO_TIMESTAMP expects one space only.
- The YYYY conversion from string to TIMESTAMP or DATE has a restriction if you use a year with more than four digits. You must use a non-digit character or template after YYYY, otherwise the year is always interpreted as four digits. For example (with the year 20000):

  `TO_DATE('200001131', 'YYYYMMDD')` is interpreted as a four-digit year

  Instead, use a non-digit separator after the year, such as `TO_DATE('20000-1131', 'YYYY-MMDD')` or `TO_DATE('20000Nov31', 'YYYYMonDD')`.
- In conversions from string to TIMESTAMP or DATE, the CC field is ignored if there is a YYY, YYYY or Y,YYY field. If CC is used with YY or Y then the year is computed as (CC-1)*100+YY.

Examples

```
SELECT TO_DATE('13 Feb 2000', 'DD Mon YYYY');
  to_date
------------
 2000-02-13
(1 row)
```

See Also

Template Pattern Modifiers for Date/Time Formatting (page 220)

TO_HEX

Returns a VARCHAR or VARBINARY representing the hexadecimal equivalent of a number.

Behavior Type

Immutable

Syntax

```
TO_HEX ( number )
```

Parameters

number	(INTEGER) is the number to convert to hexadecimal

Notes

VARCHAR TO_HEX(INTEGER) and VARCHAR TO_HEX(VARBINARY) are similar. The function converts data from binary type to character type (where the character representation is in hexadecimal format). This function is the inverse of HEX_TO_BINARY.

```
TO_HEX(HEX_TO_BINARY(x)) = x).
HEX_TO_BINARY(TO_HEX(x)) = x).
```

Examples

```
SELECT TO_HEX(123456789);
 to_hex
---------
 75bcd15
(1 row)
```

For VARBINARY inputs, the returned value is not preceded by "0x". For example:

```
SELECT TO_HEX('ab'::binary(2));
 to_hex
--------
 6162
(1 row)
```

TO_TIMESTAMP

Converts a string value or a UNIX/POSIX epoch value to a `TIMESTAMP WITH TIME ZONE` type.

Behavior Type

Immutable if single argument form, Stable otherwise.

Syntax

```
TO_TIMESTAMP ( expression, pattern )
TO_TIMESTAMP ( unix-epoch )
```

Parameters

expression	(CHAR or VARCHAR) is the string to convert
pattern	(CHAR or VARCHAR) specifies an output pattern string using the ***Template Patterns for Date/Time Formatting*** (page 219) and/or ***Template Patterns for Numeric Formatting*** (page 221).
unix-epoch	(DOUBLE PRECISION) specifies some number of seconds elapsed since midnight UTC of January 1, 1970, not counting leap seconds. `INTEGER` values are implicitly cast to `DOUBLE PRECISION`.

Notes

- For more information about UNIX/POSIX time, see ***Wikipedia http://en.wikipedia.org/wiki/Unix_time***.
- Millisecond (MS) and microsecond (US) values in a conversion from string to TIMESTAMP are used as part of the seconds after the decimal point. For example TO_TIMESTAMP('12:3', 'SS:MS') is not 3 milliseconds, but 300, because the conversion counts it as 12 + 0.3 seconds. This means for the format SS:MS, the input values 12:3, 12:30, and 12:300 specify the same number of milliseconds. To get three milliseconds, use 12:003, which the conversion counts as 12 + 0.003 = 12.003 seconds.

  Here is a more complex example: TO_TIMESTAMP('15:12:02.020.001230', 'HH:MI:SS.MS.US') is 15 hours, 12 minutes, and 2 seconds + 20 milliseconds + 1230 microseconds = 2.021230 seconds.
- To use a double quote character in the output, precede it with a double backslash. This is necessary because the backslash already has a special meaning in a string constant. For example: `'\\"YYYY Month\\"'`
- TO_TIMESTAMP and TO_DATE skip multiple blank spaces in the input string if the FX option is not used. FX must be specified as the first item in the template. For example:
  - For example `TO_TIMESTAMP('2000 JUN', 'YYYY MON')` is correct.
  - `TO_TIMESTAMP('2000 JUN', 'FXYYYY MON')` returns an error, because TO_TIMESTAMP expects one space only.
- The YYYY conversion from string to TIMESTAMP or DATE has a restriction if you use a year with more than four digits. You must use a non-digit character or template after YYYY, otherwise the year is always interpreted as four digits. For example (with the year 20000):

  `TO_DATE('200001131', 'YYYYMMDD')` is interpreted as a four-digit year

  Instead, use a non-digit separator after the year, such as `TO_DATE('20000-1131', 'YYYY-MMDD')` or `TO_DATE('20000Nov31', 'YYYYMonDD')`.
- In conversions from string to TIMESTAMP or DATE, the CC field is ignored if there is a YYY, YYYY or Y,YYY field. If CC is used with YY or Y then the year is computed as (CC-1)*100+YY.

Examples

```
SELECT TO_TIMESTAMP('13 Feb 2009', 'DD Mon YYYY');
      to_timestamp
-----------------------
```

```
 2009-02-13 00:00:00-05
(1 row)
SELECT TO_TIMESTAMP(200120400);
      to_timestamp
-----------------------
 1976-05-05 01:00:00-04
(1 row)
```

See Also

Template Pattern Modifiers for Date/Time Formatting (page 220)

TO_NUMBER

Converts a string value to DOUBLE PRECISION.

Behavior Type

Stable

Syntax

```
TO_NUMBER ( expression, [ pattern ] )
```

Parameters

expression	(CHAR or VARCHAR) specifies the string to convert.
pattern	(CHAR or VARCHAR) Optional parameter specifies an output pattern string using the ***Template Patterns for Date/Time Formatting*** (page 219) and/or ***Template Patterns for Numeric Formatting*** (page 221). If omitted, function returns a floating point.

Notes

To use a double quote character in the output, precede it with a double backslash. This is necessary because the backslash already has a special meaning in a string constant. For example: `'\\"YYYY Month\\"'`

Examples

```
SELECT TO_CHAR(2009, 'rn'), TO_NUMBER('mmix', 'rn');
     to_char     | to_number
-----------------+-----------
            mmix |      2009
(1 row)
```

It the `pattern` parameter is omitted, the function returns a floating point.

```
SELECT TO_NUMBER('-123.456e-01');
 to_number
-----------
  -12.3456
```

Template Patterns for Date/Time Formatting

In an output template string (for `TO_CHAR`), there are certain patterns that are recognized and replaced with appropriately-formatted data from the value to be formatted. Any text that is not a template pattern is copied verbatim. Similarly, in an input template string (for anything other than `TO_CHAR`), template patterns identify the parts of the input data string to be looked at and the values to be found there.

Note: Vertica uses the ISO 8601:2004 style for date/time fields in Vertica `*.log` files. For example,

```
2008-09-16 14:40:59.123 TM Moveout:0x2aaaac002180 [Txn] <INFO>
```

Certain modifiers can be applied to any template pattern to alter its behavior as described in ***Template Pattern Modifiers for Date/Time Formatting*** (page 220).

Pattern	Description
`HH`	Hour of day (00-23)
`HH12`	Hour of day (01-12)
`HH24`	Hour of day (00-23)
`MI`	Minute (00-59)
`SS`	Second (00-59)
`MS`	Millisecond (000-999)
`US`	Microsecond (000000-999999)
`SSSS`	Seconds past midnight (0-86399)
`AM or A.M. or PM or P.M.`	Meridian indicator (uppercase)
`am or a.m. or pm or p.m.`	Meridian indicator (lowercase)
`Y,YYY`	Year (4 and more digits) with comma
`YYYY`	Year (4 and more digits)
`YYY`	Last 3 digits of year
`YY`	Last 2 digits of year
`Y`	Last digit of year
`IYYY`	ISO year (4 and more digits)
`IYY`	Last 3 digits of ISO year
`IY`	Last 2 digits of ISO year
`I`	Last digits of ISO year
`BC or B.C. or AD or A.D.`	Era indicator (uppercase)
`bc or b.c. or ad or a.d.`	Era indicator (lowercase)
`MONTH`	Full uppercase month name (blank-padded to 9 chars)

Month	Full mixed-case month name (blank-padded to 9 chars)
month	Full lowercase month name (blank-padded to 9 chars)
MON	Abbreviated uppercase month name (3 chars)
Mon	Abbreviated mixed-case month name (3 chars)
mon	Abbreviated lowercase month name (3 chars)
MM	Month number (01-12)
DAY	Full uppercase day name (blank-padded to 9 chars)
Day	Full mixed-case day name (blank-padded to 9 chars)
day	full lowercase day name (blank-padded to 9 chars)
DY	Abbreviated uppercase day name (3 chars)
Dy	Abbreviated mixed-case day name (3 chars)
dy	Abbreviated lowercase day name (3 chars)
DDD	Day of year (001-366)
DD	Day of year (001-366)
D	Day of week (1-7; Sunday is 1)
W	Week of month (1-5) (The first week starts on the first day of the month.)
WW	Week number of year (1-53) (The first week starts on the first day of the year.)
IW	ISO week number of year (The first Thursday of the new year is in week 1.)
CC	Century (2 digits)
J	Julian Day (days since January 1, 4712 BC)
Q	Quarter
RM	Month in Roman numerals (I-XII; I=January) (uppercase)
rm	Month in Roman numerals (i-xii; i=January) (lowercase)
TZ	Time-zone name (uppercase)
tz	Time-zone name (lowercase)

Template Pattern Modifiers for Date/Time Formatting

Certain modifiers can be applied to any template pattern to alter its behavior. For example, FMMonth is the Month pattern with the FM modifier.

Modifier	Description
AM	Time is before 12:00

AT	Ignored
JULIAN, JD, J	Next field is Julian Day
FM prefix	Fill mode (suppress padding blanks and zeros) For example: FMMonth
FX prefix	Fixed format global option (see usage notes) For example: FX Month DD Day
ON	Ignored
PM	Time is on or after 12:00
T	Next field is time
TH suffix	Uppercase ordinal number suffix For example: DDTH
th suffix	Lowercase ordinal number suffix For example: DDth
TM prefix	Translation mode (print localized day and month names based on lc_messages). For example: TMMonth

Notes

The FM modifier suppresses leading zeros and trailing blanks that would otherwise be added to make the output of a pattern be fixed width.

Template Patterns for Numeric Formatting

Pattern	Description
9	Value with the specified number of digits
0	Value with leading zeros
. (period)	Decimal point
, (comma)	Group (thousand) separator
PR	Negative value in angle brackets
S	Sign anchored to number (uses locale)
L	Currency symbol (uses locale)
D	Decimal point (uses locale)
G	Group separator (uses locale)
MI	Minus sign in specified position (if number < 0)
PL	Plus sign in specified position (if number > 0)
SG	Plus/minus sign in specified position
RN	Roman numeral (input between 1 and 3999)

TH or th	Ordinal number suffix
V	Shift specified number of digits (see notes)
EEEE	Scientific notation (not implemented yet)

Usage

- A sign formatted using SG, PL, or MI is not anchored to the number; for example:
  - TO_CHAR(-12, 'S9999') produces ' -12'
  - TO_CHAR(-12, 'MI9999') produces '- 12'
- 9 results in a value with the same number of digits as there are 9s. If a digit is not available it outputs a space.
- TH does not convert values less than zero and does not convert fractional numbers.
- V effectively multiplies the input values by 10^*n*, where *n* is the number of digits following V. TO_CHAR does not support the use of V combined with a decimal point. For example: 99.9V99 is not allowed.

IP Conversion Functions

IP functions perform conversion, calculation, and manipulation operations on IP, network, and subnet addresses.

INET_ATON

Returns an integer that represents the value of the address in host byte order, given the dotted-quad representation of a network address as a string.

Behavior Type

Immutable

Syntax

```
INET_ATON ( expression )
```

Parameters

expression	(VARCHAR) is the string to convert.

Notes

The following syntax converts an IPv4 address represented as the string A to an integer I.

INET_ATON trims any spaces from the right of A, calls the Linux function ***inet_pton http://www.opengroup.org/onlinepubs/000095399/functions/inet_ntop.html***, and converts the result from network byte order to host byte order using ***ntohl http://opengroup.org/onlinepubs/007908775/xns/ntohl.html***.

```
INET_ATON(VARCHAR A) -> INT8 I
```

If A is NULL, too long, or inet_pton returns an error, the result is NULL.

Examples

The generated number is always in host byte order. In the following example, the number is calculated as 209×256^3 + 207×256^2 + 224×256 + 40.

```
SELECT INET_ATON('209.207.224.40');
 inet_aton
------------
 3520061480
(1 row)
SELECT INET_ATON('1.2.3.4');
 inet_aton
-----------
  16909060
(1 row)
SELECT TO_HEX(INET_ATON('1.2.3.4'));
 to_hex
---------
 1020304
(1 row)
```

See Also

INET_NTOA (page 223)

INET_NTOA

Returns the dotted-quad representation of the address as a VARCHAR, given a network address as an integer in network byte order.

Behavior Type

Immutable

Syntax

```
INET_NTOA ( expression )
```

Parameters

expression	(INTEGER) is the network address to convert.

Notes

The following syntax converts an IPv4 address represented as integer I to a string A.

INET_NTOA converts I from host byte order to network byte order using ***htonl http://opengroup.org/onlinepubs/007908775/xns/htonl.html***, and calls the Linux function ***inet_ntop http://www.opengroup.org/onlinepubs/000095399/functions/inet_ntop.html***.

```
INET_NTOA(INT8 I) -> VARCHAR A
```

If I is NULL, greater than 2^32 or negative, the result is NULL.

Examples

```
SELECT INET_NTOA(16909060);
 inet_ntoa
-----------
 1.2.3.4
(1 row)
SELECT INET_NTOA(03021962);
  inet_ntoa
-------------
 0.46.28.138
(1 row)
```

See Also

INET_ATON (page 222)

V6_ATON

Converts an IPv6 address represented as a character string to a binary string.

Behavior Type

Immutable

Syntax

```
V6_ATON ( expression )
```

Parameters

expression	(VARCHAR) is the string to convert.

Notes

The following syntax converts an IPv6 address represented as the character string A to a binary string B.

V6_ATON trims any spaces from the right of A and calls the Linux function ***inet_pton http://www.opengroup.org/onlinepubs/000095399/functions/inet_ntop.html***.

```
V6_ATON(VARCHAR A) -> VARBINARY(16) B
```

If A has no colons it is prepended with '::ffff:'. If A is NULL, too long, or if inet_pton returns an error, the result is NULL.

Examples

```
SELECT V6_ATON('2001:DB8::8:800:200C:417A');
                       v6_aton
-----------------------------------------------------
  \001\015\270\000\000\000\000\000\010\010\000 \014Az
(1 row)
SELECT TO_HEX(V6_ATON('2001:DB8::8:800:200C:417A'));
```

```
              to_hex
---------------------------------
 20010db8000000000080800200c417a
(1 row)
SELECT V6_ATON('1.2.3.4');
                               v6_aton
-----------------------------------------------------------------
 \000\000\000\000\000\000\000\000\000\000\377\377\001\002\003\004
(1 row)
SELECT V6_ATON('::1.2.3.4');
                               v6_aton
-----------------------------------------------------------------
 \000\000\000\000\000\000\000\000\000\000\000\000\001\002\003\004
(1 row)
```

See Also

V6_NTOA (page 225)

V6_NTOA

Converts an IPv6 address represented as varbinary to a character string.

Behavior Type

Immutable

Syntax

```
V6_NTOA ( expression )
```

Parameters

expression	(VARBINARY) is the binary string to convert.

Notes

The following syntax converts an IPv6 address represented as VARBINARY B to a string A.

V6_NTOA right-pads B to 16 bytes with zeros, if necessary, and calls the Linux function ***inet_ntop http://www.opengroup.org/onlinepubs/000095399/functions/inet_ntop.html***.

```
V6_NTOA(VARBINARY B) -> VARCHAR A
```

If B is NULL or longer than 16 bytes, the result is NULL.

Vertica automatically converts the form '::ffff:1.2.3.4' to '1.2.3.4'.

Examples

```
SELECT V6_NTOA(' \001\015\270\000\000\000\000\000\010\010\000 \014Az');
          v6_ntoa
---------------------------
 2001:db8::8:800:200c:417a
(1 row)
SELECT V6_NTOA(V6_ATON('1.2.3.4'));
 v6_ntoa
---------
 1.2.3.4
(1 row)
SELECT V6_NTOA(V6_ATON('::1.2.3.4'));
  v6_ntoa
-----------
 ::1.2.3.4
(1 row)
```

See Also

N6_ATON (page 224)

V6_SUBNETA

Calculates a subnet address in CIDR (Classless Inter-Domain Routing) format from a binary or alphanumeric IPv6 address.

Behavior Type

Immutable

Syntax

```
V6_SUBNETA ( expression1, expression2 )
```

Parameters

expression1	(VARBINARY or VARCHAR) is the string to calculate.
expression2	(INTEGER) is the size of the subnet.

Notes

The following syntax calculates a subnet address in CIDR format from a binary or varchar IPv6 address.

V6_SUBNETA masks a binary IPv6 address B so that the N leftmost bits form a subnet address, while the remaining rightmost bits are cleared. It then converts to an alphanumeric IPv6 address, appending a slash and N.

```
V6_SUBNETA(BINARY B, INT8 N) -> VARCHAR C
```

The following syntax calculates a subnet address in CIDR format from an alphanumeric IPv6 address.

```
V6_SUBNETA(VARCHAR A, INT8 N) -> V6_SUBNETA(V6_ATON(A), N) -> VARCHAR C
```

Examples

```
SELECT V6_SUBNETA(V6_ATON('2001:db8::8:800:200c:417a'), 28);
  v6_subneta
---------------
 2001:db0::/28
(1 row)
```

See Also

V6_SUBNETN (page 227)

V6_SUBNETN

Calculates a subnet address in CIDR (Classless Inter-Domain Routing) format from a varbinary or alphanumeric IPv6 address.

Behavior Type

Immutable

Syntax

```
V6_SUBNETN ( expression1, expression2 )
```

Parameters

expression1	(VARBINARY or VARCHAR or INTEGER) is the string to calculate.
expression2	(INTEGER) is the size of the subnet.

Notes

The following syntax masks a BINARY IPv6 address **B** so that the N left-most bits of **S** form a subnet address, while the remaining right-most bits are cleared.

V6_SUBNETN right-pads B to 16 bytes with zeros, if necessary and masks B, preserving its N-bit subnet prefix.

```
V6_SUBNETN(VARBINARY B, INT8 N) -> VARBINARY(16) S
```

If B is NULL or longer than 16 bytes, or if N is not between 0 and 128 inclusive, the result is NULL.

S = [B]/N in ***Classless Inter-Domain Routing http://en.wikipedia.org/wiki/Classless_Inter-Domain_Routing*** notation (CIDR notation).

The following syntax masks an alphanumeric IPv6 address **A** so that the N leftmost bits form a subnet address, while the remaining rightmost bits are cleared.

```
V6_SUBNETN(VARCHAR A, INT8 N) -> V6_SUBNETN(V6_ATON(A), N) -> VARBINARY(16) S
```

Example

```
SELECT V6_SUBNETN(V6_ATON('2001:db8::8:800:200c:417a'), 28);
```

```
                          v6_subnetn
-------------------------------------------------------------
  \001\015\260\000\000\000\000\000\000\000\000\000\000\000\000
```

See Also

V6_SUBNETA (page 226)

V6_TYPE

Characterizes a binary or alphanumeric IPv6 address B as an integer type.

Behavior Type

Immutable

Syntax

V6_TYPE (*expression*)

Parameters

expression	(VARBINARY or VARCHAR) is the type to convert.

Notes

V6_TYPE(VARBINARY B) returns INT8 T.

```
V6_TYPE(VARCHAR A) -> V6_TYPE(V6_ATON(A)) -> INT8 T
```

The IPv6 types are defined in the Network Working Group's ***IP Version 6 Addressing Architecture memo http://www.ietf.org/rfc/rfc4291.txt***.

```
  GLOBAL = 0       Global unicast addresses
  LINKLOCAL = 1    Link-Local unicast (and Private-Use) addresses
  LOOPBACK = 2     Loopback
  UNSPECIFIED = 3  Unspecified
  MULTICAST = 4    Multicast
```

IPv4-mapped and IPv4-compatible IPv6 addresses are also interpreted, as specified in ***IPv4 Global Unicast Address Assignments http://www.iana.org/assignments/ipv4-address-space***.

- For IPv4, Private-Use is grouped with Link-Local.
- If B is VARBINARY, it is right-padded to 16 bytes with zeros, if necessary.
- If B is NULL or longer than 16 bytes, the result is NULL.

Details

IPv4 (either kind):

```
  0.0.0.0/8         UNSPECIFIED
  10.0.0.0/8        LINKLOCAL
  127.0.0.0/8       LOOPBACK
  169.254.0.0/16    LINKLOCAL
  172.16.0.0/12     LINKLOCAL
```

```
    192.168.0.0/16   LINKLOCAL
    224.0.0.0/4      MULTICAST
    others           GLOBAL
```

IPv6:

```
    ::0/128          UNSPECIFIED
    ::1/128          LOOPBACK
    fe80::/10        LINKLOCAL
    ff00::/8         MULTICAST
    others           GLOBAL
```

Examples

```
SELECT V6_TYPE(V6_ATON('192.168.2.10'));
 v6_type
---------
       1
(1 row)
SELECT V6_TYPE(V6_ATON('2001:db8::8:800:200c:417a'));
 v6_type
---------
       0
(1 row)
```

See Also

INET_ATON (page 222)

IP Version 6 Addressing Architecture http://www.ietf.org/rfc/rfc4291.txt

IPv4 Global Unicast Address Assignments http://www.iana.org/assignments/ipv4-address-space

Mathematical Functions

Some of these functions are provided in multiple forms with different argument types. Except where noted, any given form of a function returns the same data type as its argument. The functions working with `DOUBLE PRECISION` (page 94) data could vary in accuracy and behavior in boundary cases depending on the host system.

See Also

Template Patterns for Numeric Formatting (page 220)

ABS

Returns the absolute value of the argument. The return value has the same data type as the argument..

Behavior Type

Immutable

Syntax

```
ABS ( expression )
```

Parameters

expression	Is a value of type INTEGER or DOUBLE PRECISION

Examples

```
SELECT ABS(-28.7);
 abs
------
 28.7
(1 row)
```

ACOS

Returns a DOUBLE PRECISION value representing the trigonometric inverse cosine of the argument.

Behavior Type

Immutable

Syntax

```
ACOS ( expression )
```

Parameters

expression	Is a value of type DOUBLE PRECISION

Example

```
SELECT ACOS (1);
 acos
------
    0
(1 row)
```

ASIN

Returns a DOUBLE PRECISION value representing the trigonometric inverse sine of the argument.

Behavior Type

Immutable

Syntax

```
ASIN ( expression )
```

Parameters

expression	Is a value of type DOUBLE PRECISION

Example

```
SELECT ASIN(1);
      asin
-----------------
 1.5707963267949
(1 row)
```

ATAN

Returns a DOUBLE PRECISION value representing the trigonometric inverse tangent of the argument.

Behavior Type

Immutable

Syntax

```
ATAN ( expression )
```

Parameters

expression	Is a value of type DOUBLE PRECISION

Example

```
SELECT ATAN(1);
       atan
-------------------
 0.785398163397448
(1 row)
```

ATAN2

Returns a DOUBLE PRECISION value representing the trigonometric inverse tangent of the arithmetic dividend of the arguments.

Behavior Type

Immutable

Syntax

```
ATAN2 ( quotient, divisor )
```

Parameters

quotient	Is an expression of type DOUBLE PRECISION representing the quotient
divisor	Is an expression of type DOUBLE PRECISION representing the divisor

Example

```
SELECT ATAN2(2,1);
      atan2
------------------
 1.10714871779409
(1 row)
```

CBRT

Returns the cube root of the argument. The return value has the type DOUBLE PRECISION.

Behavior Type

Immutable

Syntax

```
CBRT ( expression )
```

Parameters

expression	Is a value of type DOUBLE PRECISION

Examples

```
SELECT CBRT(27.0);
 cbrt
------
    3
(1 row)
```

CEILING (CEIL)

Rounds the returned value up to the next whole number. Any expression that contains even a slight decimal is rounded up.

Behavior Type

Immutable

Syntax

```
CEILING ( expression )
CEIL ( expression )
```

Parameters

expression	Is a value of type INTEGER or DOUBLE PRECISION

Notes

CEILING is the opposite of ***FLOOR*** (page 235), which rounds the returned value down:

```
=> SELECT CEIL(48.01) AS ceiling, FLOOR(48.01) AS floor; ceiling | floor
```

```
---------+-------
      49 |    48
(1 row)
```

Examples

```
=> SELECT CEIL(-42.8);
 CEIL
------
  -42
(1 row)
SELECT CEIL(48.01);
 CEIL
------
   49
(1 row)
```

COS

Returns a DOUBLE PRECISION value representing the trigonometric cosine of the argument.

Behavior Type

Immutable

Syntax

```
COS ( expression )
```

Parameters

expression	Is a value of type DOUBLE PRECISION

Example

```
SELECT COS(-1);
       cos
------------------
 0.54030230586814
(1 row)
```

COT

Returns a DOUBLE PRECISION value representing the trigonometric cotangent of the argument.

Behavior Type

Immutable

Syntax

```
COT ( expression )
```

Parameters

expression	Is a value of type DOUBLE PRECISION

Example

```
SELECT COT(1);
        cot
-------------------
 0.642092615934331
(1 row)
```

DEGREES

Converts an expression from radians to degrees. The return value has the type DOUBLE PRECISION.

Behavior Type

Immutable

Syntax

```
DEGREES ( expression )
```

Parameters

expression	Is a value of type DOUBLE PRECISION

Examples

```
SELECT DEGREES(0.5);
     degrees
------------------
 28.6478897565412
(1 row)
```

EXP

Returns the exponential function, e to the power of a number. The return value has the same data type as the argument.

Behavior Type

Immutable

Syntax

```
EXP ( exponent )
```

Parameters

exponent	Is an expression of type INTEGER or DOUBLE PRECISION

Example

```
SELECT EXP(1.0);
       exp
------------------
 2.71828182845905
(1 row)
```

FLOOR

Rounds the returned value down to the next whole number. Any expression that contains even a slight decimal is rounded down.

Behavior Type

Immutable

Syntax

```
FLOOR ( expression )
```

Parameters

expression	Is an expression of type INTEGER or DOUBLE PRECISION.

Notes

FLOOR is the opposite of ***CEILING*** (page 232), which rounds the returned value up:

```
=> SELECT FLOOR(48.01) AS floor, CEIL(48.01) AS ceiling; floor | ceiling
-------+---------
    48 |      49
(1 row)
```

Examples

```
=> SELECT FLOOR((TIMESTAMP '2005-01-17 10:00' - TIMESTAMP '2005-01-01') / INTERVAL '7');
 floor
-------
     2
(1 row)
=> SELECT FLOOR(-42.8);
 floor
-------
   -43
(1 row)
=> SELECT FLOOR(42.8);
 floor
-------
    42
(1 row)
```

Although the following example looks like an INTEGER, the number on the left is 2^49 as an INTEGER, but the number on the right is a FLOAT:

```
=> SELECT 1<<49, FLOOR(1 << 49);
    ?column?     |      floor
-----------------+-----------------
 562949953421312 | 562949953421312
(1 row)
```

Compare the above example to:

```
=> SELECT 1<<50, FLOOR(1 << 50);
     ?column?     |        floor
------------------+---------------------
 1125899906842624 | 1.12589990684262e+15
(1 row)
```

HASH

Calculates a hash value over its arguments, producing a value in the range 0 <= x < 2^{63} (two to the sixty-third power or 2^63).

Behavior Type

Immutable

Syntax

```
HASH ( expression [ ,... ] )
```

Parameters

expression	Is an expression of any data type. For the purpose of hash segmentation, each expression is a ***column reference*** (see "***Column References***" on page 45).

Notes

- The HASH() function is used to provide projection segmentation over a set of nodes in a cluster and takes up to 32 arguments, usually column names, and selects a specific node for each row based on the values of the columns for that row. HASH (Col1, Col2).
- If your data is fairly regular and you want more even distribution than you get with HASH, consider using ***MODULARHASH*** (page 239)() for project segmentation.

Examples

```
SELECT HASH(product_price, product_cost)
FROM product_dimension
WHERE product_price = '11';
        hash
---------------------
 4157497907121511878
 1799398249227328285
 3250220637492749639
(3 rows)
```

See Also

MODULARHASH (page 239)

LN

Returns the natural logarithm of the argument. The return data type is the same as the argument.

Behavior Type

Immutable

Syntax

```
LN ( expression )
```

Parameters

expression	Is an expression of type INTEGER or DOUBLE PRECISION

Examples

```
SELECT LN(2);
        ln
-------------------
 0.693147180559945
(1 row)
```

LOG

Returns the logarithm to the specified base of the argument. The return data type is the same as the argument.

Behavior Type

Immutable

Syntax

```
LOG ( [ base, ] expression )
```

Parameters

base	Specifies the base (default is base 10)
expression	Is an expression of type INTEGER or DOUBLE PRECISION

Examples

```
SELECT LOG(2.0, 64);
 log
-----
   6
(1 row)
SELECT LOG(100);
 log
-----
   2
(1 row)
```

MOD

Returns the remainder of a division operation. MOD is also called `modulo`.

Behavior Type

Immutable

Syntax

`MOD( expression1, expression2 )`

Parameters

expression1	Specifies the dividend (INTEGER, NUMERIC, or FLOAT)
expression2	Specifies the divisor (type same as dividend)

Notes

When computing mod(N,M), the following rules apply:

- If either N or M is the null value, then the result is the null value.
- If M is zero, then an exception condition is raised: data exception — division by zero.
- Otherwise, the result is the unique exact numeric value R with scale 0 (zero) such that all of the following are true:
  - R has the same sign as N.
  - The absolute value of R is less than the absolute value of M.
  - N = M * K + R for some exact numeric value K with scale 0 (zero).

Examples

```
SELECT MOD(9,4);
 mod
-----
   1
(1 row)
SELECT MOD(10,3);
 mod
-----
   1
(1 row)
SELECT MOD(-10,3);
 mod
-----
  -1
(1 row)
SELECT MOD(-10,-3);
 mod
-----
  -1
(1 row)
SELECT MOD(10,-3);
```

```
 mod
-----
   1
(1 row)
```

`MOD(<float>, 0)` gives an error:

```
=> SELECT MOD(6.2,0);
ERROR:  numeric division by zero
```

MODULARHASH

Calculates a hash value over its arguments for the purpose of projection segmentation. In all other uses, returns 0.

If you can hash segment your data using a column with a regular pattern, such as a sequential unique identifier, MODULARHASH distributes the data more evenly than HASH, which distributes data using a normal statistical distribution.

Behavior Type

Immutable

Syntax

```
MODULARHASH ( expression [ ,... ] )
```

Parameters

expression	Is a ***column reference*** (see "***Column References***" on page 45) of any data type.

Notes

The MODULARHASH() function takes up to 32 arguments, usually column names, and selects a specific node for each row based on the values of the columns for that row.

Examples

```
CREATE PROJECTION fact_ts_2 (f_price, f_cid, f_tid, f_cost, f_date)
AS (SELECT price, cid, tid, cost, dwdate
    FROM fact)
    SEGMENTED BY MODULARHASH(dwdate)
    ALL NODES OFFSET 2;
```

See Also

HASH (page 236)

PI

Returns the constant pi (Π), the ratio of any circle's circumference to its diameter in Euclidean geometry The return type is DOUBLE PRECISION.

Behavior Type

Immutable

Syntax

```
PI()
```

Examples

```
SELECT PI();
        pi
------------------
 3.14159265358979
(1 row)
```

POWER

Returns a DOUBLE PRECISION value representing one number raised to the power of another number.

Behavior Type

Immutable

Syntax

```
POWER ( expression1, expression2 )
```

Parameters

expression1	Is an expression of type DOUBLE PRECISION that represents the base
expression2	Is an expression of type DOUBLE PRECISION that represents the exponent

Examples

```
SELECT POWER(9.0, 3.0);
 power
-------
   729
(1 row)
```

RADIANS

Returns a DOUBLE PRECISION value representing an angle expressed in degrees converted to radians.

Behavior Type

Immutable

Syntax

```
RADIANS ( expression )
```

Parameters

expression	Is an expression of type DOUBLE PRECISION representing degrees

Examples

```
SELECT RADIANS(45);
      radians
-------------------
 0.785398163397448
(1 row)
```

RANDOM

Returns a uniformly-distributed random number x, where 0 <= x < 1.

Behavior Type

Volatile

Syntax

```
RANDOM()
```

Parameters

RANDOM has no arguments. Its result is a FLOAT8 data type (also called ***DOUBLE PRECISION*** (page 94)).

Notes

Typical pseudo-random generators accept a seed, which is set to generate a reproducible pseudo-random sequence. Vertica, however, distributes SQL processing over a cluster of nodes, where each node generates its own independent random sequence.

Results depending on RANDOM are not reproducible because the work might be divided differently across nodes. Therefore, Vertica automatically generates truly random seeds for each node each time a request is executed and does not provide a mechanism for forcing a specific seed.

Examples

In the following example, the result is a float, which is >= 0 and < 1.0:

```
SELECT RANDOM();
      random
-------------------
 0.211625560652465
(1 row)
```

RANDOMINT

Returns a uniformly-distributed integer I, where 0 <= I < N, where N <= MAX_INT8. That is, RANDOMINT(N) returns one of the N integers from 0 through N-1.

Behavior Type

Volatile

Syntax

```
RANDOMINT ( N )
```

Example

In the following example, the result is an INT8, which is >= 0 and < N. In this case, INT8 is randomly chosen from the set {0,1,2,3,4}.

```
SELECT RANDOMINT(5);
randomint
----------
         3
(1 row)
```

ROUND

Rounds a value to a specified number of decimal places, retaining the original scale and precision. Fractions greater than or equal to .5 are rounded up. Fractions less than .5 are rounded down (truncated).

Behavior Type

Immutable

Syntax

```
ROUND ( expression [ , decimal-places ] )
```

Parameters

expression	Is an expression of type NUMERIC.
decimal-places	If positive, specifies the number of decimal places to display to the right of the decimal point; if negative, specifies the number of decimal places to display to the left of the decimal point.

Notes

NUMERIC ROUND() returns NUMERIC, retaining the original scale and precision:

```
=> SELECT ROUND(3.5);
 ROUND
-------
   4.0
(1 row)
```

The internal floating point representation used to compute the ROUND function causes the fraction to be evaluated as 3.5, which is rounded up.

Examples

```
SELECT ROUND(2.0, 1.0 ) FROM dual;
 round
-------
     2
(1 row)
SELECT ROUND(12.345, 2.0 );
 round
-------
 12.35
(1 row)

SELECT ROUND(3.444444444444444);
       ROUND
--------------------
 3.000000000000000
(1 row)
SELECT ROUND(3.14159, 3);
  ROUND
---------
 3.14200
(1 row)
SELECT ROUND(1234567, -3);
  round
---------
 1235000
(1 row)
SELECT ROUND(3.4999, -1);
 ROUND
-------
 .0000
(1 row)
SELECT employee_last_name, ROUND(annual_salary,4) FROM
employee_dimension;
 employee_last_name | ROUND
--------------------+--------
 Li                 |   1880
 Rodriguez          |   1704
 Goldberg           |   2282
 Meyer              |   1628
 Pavlov             |   3168
 McNulty            |   1516
 Dobisz             |   3006
 Pavlov             |   2142
 Goldberg           |   2268
 Pavlov             |   1918
 Robinson           |   2366
 ...
```

SIGN

Returns a DOUBLE PRECISION value of -1, 0, or 1 representing the arithmetic sign of the argument.

Behavior Type

Immutable

Syntax

```
SIGN ( expression )
```

Parameters

expression	Is an expression of type DOUBLE PRECISION

Examples

```
SELECT SIGN(-8.4);
 sign
------
   -1
(1 row)
```

SIN

Returns a DOUBLE PRECISION value representing the trigonometric sine of the argument.

Behavior Type

Immutable

Syntax

```
SIN ( expression )
```

Parameters

expression	Is an expression of type DOUBLE PRECISION

Example

```
SELECT SIN(30 * 2 * 3.14159 / 360);
        sin
-------------------
 0.499999616987256
(1 row)
```

SQRT

Returns a DOUBLE PRECISION value representing the arithmetic square root of the argument.

Behavior Type

Immutable

Syntax

```
SQRT ( expression )
```

Parameters

expression	Is an expression of type DOUBLE PRECISION

Examples

```
SELECT SQRT(2);
      sqrt
-----------------
 1.4142135623731
(1 row)
```

TAN

Returns a DOUBLE PRECISION value representing the trigonometric tangent of the argument.

Behavior Type

Immutable

Syntax

```
TAN ( expression )
```

Parameters

expression	Is an expression of type DOUBLE PRECISION

Example

```
SELECT TAN(30);
        tan
-------------------
 -6.40533119664628
(1 row)
```

TRUNC

Returns a value representing the argument fully truncated (toward zero) or truncated to a specific number of decimal places, retaining the original scale and precision.

Behavior Type

Immutable

Syntax

```
TRUNC ( expression [ , places ]
```

Parameters

expression	Is an expression of type INTEGER or DOUBLE PRECISION that represents the number to truncate
places	Is an expression of type INTEGER that specifies the number of decimal places to return

Notes

NUMERIC TRUNC() returns NUMERIC, retaining the original scale and precision:

```
=> SELECT TRUNC(3.5);
 TRUNC
-------
   3.0
(1 row)
```

Examples

```
=>SELECT TRUNC(42.8);
 TRUNC
-------
  42.0
(1 row)
=>SELECT TRUNC(42.4382, 2);
  TRUNC
---------
 42.4300
(1 row)
```

WIDTH_BUCKET

Constructs equiwidth histograms, in which the histogram range is divided into intervals (buckets) of identical sizes. In addition, values below the low bucket return 0, and values above the high bucket return bucket_count +1. Returns an integer value.

Behavior Type

Immutable

Syntax

```
WIDTH_BUCKET ( expression, hist_min, hist_max, bucket_count )
```

Parameters

expression	Is the expression for which the histogram is created. This expression must evaluate to a numeric or datetime value or to a value that can be implicitly converted to a numeric or datetime value. If *expression* evaluates to null, then the *expression* returns null.

hist_min	Is an expression that resolves to the low boundary of bucket 1. Must also evaluate to numeric or datetime values and cannot evaluate to null.
hist_max	Is an expression that resolves to the high boundary of bucket bucket_count. Must also evaluate to a numeric or datetime value and cannot evaluate to null.
bucket_count	Is an expression that resolves to a constant, indicating the number of buckets. This expression always evaluates to a positive INTEGER.

Notes

- WIDTH_BUCKET divides a data set into buckets of equal width. For example, Age = 0-20, 20-40, 40-60, 60-80. This is known as an equiwidth histogram.
- When using WIDTH_BUCKET pay attention to the minimum and maximum boundary values. Each bucket contains values equal to or greater than the base value of that bucket, so that age ranges of 0-20, 20-40, and so on, are actually 0-19.99 and 20-39.999.
- WIDTH_BUCKET accepts the following data types: (FLOAT and/or INT), (TIMESTAMP and/or DATE and/or TIMESTAMPTZ), or (INTERVAL and/or TIME).

Examples

The following example returns five possible values and has three buckets: 0 [Up to 100), 1 [100-300), 2 [300-500), 3 [500-700), and 4 [700 and up):

```
SELECT product_description, product_cost,
WIDTH_BUCKET(product_cost, 100, 700, 3);
```

The following example creates a nine-bucket histogram on the annual_income column for customers in Connecticut who are female doctors. The results return the bucket number to an "Income" column, divided into eleven buckets, including an underflow and an overflow. Note that if customers had an annual incomes greater than the maximum value, they would be assigned to an overflow bucket, 10:

```
SELECT customer_name, annual_income,
WIDTH_BUCKET (annual_income, 100000, 1000000, 9) AS "Income"
FROM public.customer_dimension WHERE customer_state='CT'
AND title='Dr.' AND customer_gender='Female' AND household_id < '1000'
ORDER BY "Income";
```

In the following result set, the reason there is a bucket 0 is because buckets are numbered from 1 to bucket_count. Anything less than the given value of `hist_min` goes in bucket 0, and anything greater than the given value of `hist_max` goes in the bucket `bucket_count+1`. In this example, bucket 9 is empty, and there is no overflow. The value 12,283 is less than 100,000, so it goes into the underflow bucket.

```
   customer_name    | annual_income | Income
--------------------+---------------+--------
 Joanna A. Nguyen   |         12283 |      0
 Amy I. Nguyen      |        109806 |      1
 Juanita L. Taylor  |        219002 |      2
 Carla E. Brown     |        240872 |      2
```

```
 Kim U. Overstreet  |        284011 |      2
 Tiffany N. Reyes   |        323213 |      3
 Rebecca V. Martin  |        324493 |      3
 Betty . Roy        |        476055 |      4
 Midori B. Young    |        462587 |      4
 Martha T. Brown    |        687810 |      6
 Julie D. Miller    |        616509 |      6
 Julie Y. Nielson   |        894910 |      8
 Sarah B. Weaver    |        896260 |      8
 Jessica C. Nielson |        861066 |      8
(14 rows)
```

See Also

NTILE (page 150)

NULL-handling Functions

NULL-handling functions take arguments of any type, and their return type is based on their argument types.

COALESCE

Returns the value of the first non-null expression in the list. If all expressions evaluate to null, then the COALESCE function returns null.

Behavior Type

Immutable

Syntax

```
COALESCE ( expression1, expression2 );
COALESCE ( expression1, expression2, ... expression-n );
```

Parameters

- `COALESCE (expression1, expression2)` is equivalent to the following CASE expression:
  `CASE WHEN expression1 IS NOT NULL THEN expression1 ELSE expression2 END;`
- `COALESCE (expression1, expression2, ... expression-n)`, for n >= 3, is equivalent to the following CASE expression:
  ```
  CASE WHEN expression1 IS NOT NULL THEN expression1
  ELSE COALESCE (expression2, . . . , expression-n) END;
  ```

Notes

COALESCE is an ANSI standard function (SQL-92).

Example

```
SELECT product_description, COALESCE(lowest_competitor_price,
  highest_competitor_price, average_competitor_price) AS price
FROM product_dimension;
```

```
        product_description         | price
------------------------------------+-------
 Brand #54109 kidney beans          |   264
 Brand #53364 veal                  |   139
 Brand #50720 ice cream sandwiches  |   127
 Brand #48820 coffee cake           |   174
 Brand #48151 halibut               |   353
 Brand #47165 canned olives         |   250
 Brand #39509 lamb                  |   306
 Brand #36228 tuna                  |   245
 Brand #34156 blueberry muffins     |   183
 Brand #31207 clams                 |   163
(10 rows)
```

See Also

Case Expressions (page 44)

ISNULL (page 249)

ISNULL

Returns the value of the first non-null expression in the list.

ISNULL is an alias of ***NVL*** (page 251).

Behavior Type

Immutable

Syntax

```
ISNULL ( expression1 , expression2 );
```

Parameters

- If *expression1* is null, then ISNULL returns *expression2.*
- If *expression1* is not null, then ISNULL returns *expression1.*

Notes

- ***COALESCE*** (page 248) is the more standard, more general function.
- ISNULL is equivalent to COALESCE except that ISNULL is called with only two arguments.
- `ISNULL(a,b)` is different from `x IS NULL`.
- The arguments can have any data type supported by Vertica.
- Implementation is equivalent to the CASE expression. For example:
  ```
  CASE WHEN expression1 IS NULL THEN expression2 ELSE expression1 END;
  ```
- The following statement returns the value 140:
  ```
  SELECT ISNULL(NULL, 140) FROM employee_dimension;
  ```
- The following statement returns the value 60:
  ```
  SELECT ISNULL(60, 90) FROM employee_dimension;
  ```

Examples

```
SELECT product_description, product_price, ISNULL(product_cost, 0.0) AS cost FROM
product_dimension;
      product_description       | product_price | cost
--------------------------------+---------------+------
 Brand #59957 wheat bread       |           405 |  207
 Brand #59052 blueberry muffins |           211 |  140
 Brand #59004 english muffins   |           399 |  240
 Brand #53222 wheat bread       |           323 |   94
 Brand #52951 croissants        |           367 |  121
 Brand #50658 croissants        |           100 |   94
 Brand #49398 white bread       |           318 |   25
 Brand #46099 wheat bread       |           242 |    3
 Brand #45283 wheat bread       |           111 |  105
 Brand #43503 jelly donuts      |           259 |   19
(10 rows)
```

See Also

Case Expressions (page 44)

COALESCE (page 248)

NVL (page 251)

NULLIF

Compares two expressions. If the expressions are not equal, the function returns the first expression (expression1). If the expressions are equal, the function returns null.

Behavior Type

Immutable

Syntax

```
NULLIF( expression1, expression2 )
```

Parameters

expression1	Is a value of any data type.
expression2	Must have the same data type as *expr1* or a type that can be implicitly cast to match *expression1*. The result has the same type as *expression1*.

Examples

The following series of statements illustrates one simple use of the NULLIF function.

Creates a single-column table `t and insert some values`:

```
CREATE TABLE t (x TIMESTAMPTZ);
INSERT INTO t VALUES('2009-09-04 09:14:00-04');
INSERT INTO t VALUES('2010-09-04 09:14:00-04');
```

Issue a select statement:

```
SELECT x, NULLIF(x, '2009-09-04 09:14:00 EDT') FROM t;
           x            |         nullif
------------------------+------------------------
 2009-09-04 09:14:00-04 |
 2010-09-04 09:14:00-04 | 2010-09-04 09:14:00-04

SELECT NULLIF(1, 2);
 NULLIF
--------
      1
(1 row)
SELECT NULLIF(1, 1);
 NULLIF
--------

(1 row)
SELECT NULLIF(20.45, 50.80);
 NULLIF
--------
  20.45
(1 row)
```

NVL

Returns the value of the first non-null expression in the list.

Behavior Type

Immutable

Syntax

```
NVL ( expression1 , expression2 );
```

Parameters

- If *expression1* is null, then NVL returns *expression2.*
- If *expression1* is not null, then NVL returns *expression1.*

Notes

- ***COALESCE*** (page 248) is the more standard, more general function.
- NVL is equivalent to COALESCE except that NVL is called with only two arguments.
- The arguments can have any data type supported by Vertica.
- Implementation is equivalent to the CASE expression:
  `CASE WHEN expression1 IS NULL THEN expression2 ELSE expression1 END;`

Examples

expression1 is not null, so NVL returns expression1:

```
SELECT NVL('fast', 'database');
```

```
 nvl
------
 fast
(1 row)
```

expression1 is null, so NVL returns expression2:

```
SELECT NVL(null, 'database');
   nvl
----------
 database
(1 row)
```

expression2 is null, so NVL returns expression1:

```
SELECT NVL('fast', null);
 nvl
------
 fast
(1 row)
```

In the following example, expression1 (title) contains nulls, so NVL returns expression2 and substitutes 'Withheld' for the unknown values:

```
SELECT customer_name,
       NVL(title, 'Withheld') as title
FROM customer_dimension
ORDER BY title;
     customer_name      | title
------------------------+-------
 Alexander I. Lang      | Dr.
 Steve S. Harris        | Dr.
 Daniel R. King         | Dr.
 Luigi I. Sanchez       | Dr.
 Duncan U. Carcetti     | Dr.
 Meghan K. Li           | Dr.
 Laura B. Perkins       | Dr.
 Samantha V. Robinson   | Dr.
 Joseph P. Wilson       | Mr.
 Kevin R. Miller        | Mr.
 Lauren D. Nguyen       | Mrs.
 Emily E. Goldberg      | Mrs.
 Darlene K. Harris      | Ms.
 Meghan J. Farmer       | Ms.
 Bettercare             | Withheld
 Ameristar              | Withheld
 Initech                | Withheld
(17 rows)
```

See Also

Case Expressions (page 44)

COALESCE (page 248)

ISNULL (page 249)

NVL2 (page 253)

NVL2

Takes three arguments. If the first argument is not NULL, it returns the second argument, otherwise it returns the third argument. The data types of the second and third arguments are implicitly cast to a common type if they don't agree, similar to ***COALESCE*** (page 248).

Behavior Type

Immutable

Syntax

```
NVL2 ( expression1 , expression2 , expression3 );
```

Parameters

- If *expression1* is not null, then NVL2 returns *expression2.*
- If *expression1* is null, then NVL2 returns *expression3.*

Notes

Arguments two and three can have any data type supported by Vertica.

Implementation is equivalent to the CASE expression:

```
  CASE WHEN expression1 IS NOT NULL THEN expression2 ELSE expression3 END;
```

Examples

In this example, expression1 is not null, so NVL2 returns expression2:

```
SELECT NVL2('very', 'fast', 'database');
 nvl2
------
 fast
(1 row)
```

In this example, expression1 is null, so NVL2 returns expression3:

```
SELECT NVL2(null, 'fast', 'database');
   nvl2
----------
 database
(1 row)
```

In the following example, expression1 (title) contains nulls, so NVL2 returns expression3 ('Withheld') and also substitutes the non-null values with the expression 'Known':

```
SELECT customer_name,
       NVL2(title, 'Known', 'Withheld') as title
FROM customer_dimension
ORDER BY title;
     customer_name      | title
------------------------+-------
 Alexander I. Lang      | Known
 Steve S. Harris        | Known
 Daniel R. King         | Known
```

```
 Luigi I. Sanchez       | Known
 Duncan U. Carcetti     | Known
 Meghan K. Li           | Known
 Laura B. Perkins       | Known
 Samantha V. Robinson   | Known
 Joseph P. Wilson       | Known
 Kevin R. Miller        | Known
 Lauren D. Nguyen       | Known
 Emily E. Goldberg      | Known
 Darlene K. Harris      | Known
 Meghan J. Farmer       | Known
 Bettercare             | Withheld
 Ameristar              | Withheld
 Initech                | Withheld
(17 rows)
```

See Also

Case Expressions (page 44)

COALESCE (page 248)

NVL (page 248)

Sequence Functions

The sequence functions provide simple, multiuser-safe methods for obtaining successive sequence values from sequence objects.

NEXTVAL

Advances the return of a new sequence value. A positive value is incremented for ascending sequences and a negative value is decremented for descending sequences.

Behavior Type

Volatile

Syntax

```
<sequence_name>.NEXTVAL
NEXTVAL('sequence_name')
```

Parameters

sequence_name	Identifies the sequence for which to determine the next value.

Notes

- NEXTVAL is used in INSERT, COPY, and SELECT statements to create unique values.
- The first time NEXTVAL is called, it generates the starting number for the sequence. Thereafter, it increments this number.

- While executing a SQL statement, if NEXTVAL is called on two different nodes, each node creates and maintains its own cache of values per session. Thus, you need a Global Catalog Lock (X) to obtain a cache of values from a sequence.
- NEXTVAL is evaluated on a per-row basis. Thus, in the following example, both calls to NEXTVAL yield same result:
  ```
  SELECT NEXTVAL('seq1'), NEXTVAL('seq1') FROM vendor_key;
  ```

Examples

The following example creates an ascending sequence called my_seq, starting at 101:

```
CREATE SEQUENCE sequential START 101;
```

The following command generates the first number in the sequence:

```
SELECT NEXTVAL('my_seq');
 nextval
---------
     101
(1 row)
```

The following command generates the next number in the sequence:

```
SELECT NEXTVAL('my_seq');
 nextval
---------
     102
(1 row)
```

The following example shows how to use NEXTVAL in a table SELECT statement. Notice that the `nextval` column incremented by (1) again:

```
SELECT NEXTVAL('my_seq'), lname FROM customer;
 nextval | lname
---------+-------
     103 | Carr
(1 row)
```

See Also

ALTER SEQUENCE (page 485)

CREATE SEQUENCE (page 540)

CURRVAL (page 255)

DROP SEQUENCE (page 587)

Using Sequences and Sequence Privileges in the Administrator's Guide

CURRVAL

For a sequence generator, returns the LAST value across all nodes returned by a previous invocation of ***NEXTVAL*** (page 254) in the same session. If there were no calls to NEXTVAL, an error is returned.

Behavior Type

Volatile

Syntax

<*sequence_name*>.CURRVAL

Parameters

sequence_name	Identifies the sequence for which to return the current value.

Notes

NEXTVAL is executed before anything else. Therefore, the following statement succeeds even though CURRVAL appears before NEXTVAL in the statement:

```
SELECT CURRVAL('seq1'), NEXTVAL('seq1') FROM vendor_key;
```

Examples

The following example creates an ascending sequence called sequential, starting at 101:

```
CREATE SEQUENCE seq2 START 101;
```

You cannot call CURRVAL until after you have initiated the sequence with NEXTVAL or the system returns an error:

```
SELECT CURRVAL('seq2');
ERROR:  Sequence seq2 has not been accessed in the session
```

Use the NEXTVAL function to generate the first number for this sequence:

```
SELECT NEXTVAL('seq2');
 nextval
---------
     101
(1 row)
```

Now you can use CURRVAL to return the current number from this sequence:

```
SELECT CURRVAL('seq2');
 currval
---------
     101
(1 row)
```

The following command shows how to use CURRVAL in a SELECT statement:

```
CREATE TABLE customer3 (
  lname VARCHAR(25),
  fname VARCHAR(25),
  membership_card INTEGER,
  ID INTEGER
);
INSERT INTO customer3 VALUES ('Brown' ,'Sabra', 072753, CURRVAL('my_seq'));
SELECT CURRVAL('seq2'), lname FROM customer3;
 CURRVAL | lname
---------+-------
```

```
     101 | Brown
(1 row)
```

See Also

ALTER SEQUENCE (page 485)

CREATE SEQUENCE (page 540)

DROP SEQUENCE (page 587)

NEXTVAL (page 254)

Using Sequences and Sequence Privileges in the Administrator's Guide

LAST_INSERT_ID

Returns the last value of a column whose value is automatically incremented through the AUTO_INCREMENT or IDENTITY ***column-constraint*** (page 556).

Behavior Type

Volatile

Syntax

```
LAST_INSERT_ID()
```

Notes

- This function works only with auto-increment and identity columns. See ***column-constraints*** (page 556) for the ***CREATE TABLE*** (page 546) statement.
- LAST_INSERT_ID does not work with sequence generators created through the ***CREATE SEQUENCE*** (page 540) statement.

Examples

Create a sample table called `customer4`. Notice that the IDENTITY column has a seed of 2, which specifies the value for the first row loaded into the table, and an increment of 2, which specifies the value that is added to identity value of the previous row.

```
CREATE TABLE customer4(
  ID IDENTITY(2,2),
  lname VARCHAR(25),
  fname VARCHAR(25),
  membership_card INTEGER
);
INSERT INTO customer4(lname, fname, membership_card)
VALUES ('Gupta', 'Saleem', 475987);
```

Query the table you just created:

```
SELECT * FROM customer4;
 ID | lname | fname  | membership_card
----+-------+--------+-----------------
  2 | Gupta | Saleem |          475987
(1 row)
```

Insert some additional values:

```
INSERT INTO customer4(lname, fname, membership_card)
VALUES ('Lee', 'Chen', 598742);
```

Call the LAST_INSERT_ID function:

```
SELECT LAST_INSERT_ID();
last_insert_id
---------------
              4
(1 row)
```

Query the table again:

```
SELECT * FROM customer4;
 ID | lname | fname  | membership_card
----+-------+--------+-----------------
  2 | Gupta | Saleem |          475987
  4 | Lee   | Chen   |          598742
(2 rows)
```

Add another row:

```
INSERT INTO customer4(lname, fname, membership_card)
VALUES ('Davis', 'Bill', 469543);
```

Call the LAST_INSERT_ID function:

```
SELECT LAST_INSERT_ID();
 LAST_INSERT_ID
----------------
             6
(1 row)
```

Query the table again:

```
SELECT * FROM customer4;
 ID | lname | fname  | membership_card
----+-------+--------+-----------------
  2 | Gupta | Saleem |          475987
  4 | Lee   | Chen   |          598742
  6 | Davis | Bill   |          469543
(3 rows)
```

See Also

ALTER SEQUENCE (page 485)

CREATE SEQUENCE (page 540)

DROP SEQUENCE (page 587)

Using Sequences and Sequence Privileges in the Administrator's Guide

String Functions

String functions perform conversion, extraction, or manipulation operations on strings, or return information about strings.

This section describes functions and operators for examining and manipulating string values. Strings in this context include values of the types CHAR, VARCHAR, BINARY, and VARBINARY.

Unless otherwise noted, all of the functions listed in this section work on all four data types. As opposed to some other SQL implementations, Vertica keeps CHAR strings unpadded internally, padding them only on final output. So converting a CHAR(3) 'ab' to VARCHAR(5) results in a VARCHAR of length 2, not one with length 3 including a trailing space.

Some of the functions described here also work on data of non-string types by converting that data to a string representation first. Some functions work only on character strings, while others work only on binary strings. Many work for both. BINARY and VARBINARY functions ignore multibyte UTF-8 character boundaries.

Non-binary character string functions handle normalized multibyte UTF-8 characters, as specified by the Unicode Consortium. Unless otherwise specified, those character string functions for which it matters can optionally specify whether VARCHAR arguments should be interpreted as octet (byte) sequences, or as (locale-aware) sequences of UTF-8 characters. This is accomplished by adding "USING OCTETS" or "USING CHARACTERS" (default) as a parameter to the function.

Some character string functions are stable because in general UTF-8 case-conversion, searching and sorting can be locale dependent. Thus, LOWER is stable, while LOWERB is immutable. The USING OCTETS clause converts these functions into their "B" forms, so they become immutable. If the locale is set to collation=binary, which is the default, all string functions — except CHAR_LENGTH/CHARACTER_LENGTH, LENGTH, SUBSTR, and OVERLAY — are converted to their "B" forms and so are immutable.

BINARY implicitly converts to VARBINARY, so functions that take VARBINARY arguments work with BINARY.

ASCII

Converts the first octet of a VARCHAR to an INTEGER.

Behavior Type

Immutable

Syntax

```
ASCII ( expression )
```

Parameters

expression	(VARCHAR) is the string to convert.

Notes

- ASCII is the opposite of the ***CHR*** (page 264) function.
- ASCII operates on UTF-8 characters, not only on single-byte ASCII characters. It continues to get the same results for the ASCII subset of UTF-8.

Examples

Expression	Result
`SELECT ASCII('A');`	`65`
`SELECT ASCII('ab');`	`97`
`SELECT ASCII(null);`	
`SELECT ASCII('');`	

BIT_LENGTH

Returns the length of the string expression in bits (bytes * 8) as an INTEGER.

Behavior Type

Immutable

Syntax

`BIT_LENGTH ( expression )`

Parameters

expression	(CHAR or VARCHAR or BINARY or VARBINARY) is the string to convert.

Notes

BIT_LENGTH applies to the contents of VARCHAR and VARBINARY fields.

Examples

Expression	Result
`SELECT BIT_LENGTH('abc'::varbinary);`	`24`
`SELECT BIT_LENGTH('abc'::binary);`	`8`
`SELECT BIT_LENGTH(''::varbinary);`	`0`
`SELECT BIT_LENGTH(''::binary);`	`8`
`SELECT BIT_LENGTH(null::varbinary);`	
`SELECT BIT_LENGTH(null::binary);`	
`SELECT BIT_LENGTH(VARCHAR 'abc');`	`24`
`SELECT BIT_LENGTH(CHAR 'abc');`	`24`
`SELECT BIT_LENGTH(CHAR(6) 'abc');`	`48`

```
SELECT BIT_LENGTH(VARCHAR(6) 'abc');         24
SELECT BIT_LENGTH(BINARY(6) 'abc');          48
SELECT BIT_LENGTH(BINARY 'abc');             24
SELECT BIT_LENGTH(VARBINARY 'abc');          24
SELECT BIT_LENGTH(VARBINARY(6) 'abc');       24
```

See Also

CHARACTER_LENGTH (page 263), ***LENGTH*** (page 279), ***OCTET_LENGTH*** (page 283)

BITCOUNT

Returns the number of one-bits (sometimes referred to as set-bits) in the given VARBINARY value. This is also referred to as the population count.

Behavior Type

Immutable

Syntax

```
BITCOUNT ( expression )
```

Parameters

expression	(BINARY or VARBINARY) is the string to return.

Examples

```
SELECT BITCOUNT(HEX_TO_BINARY('0x10'));
 bitcount
----------
        1
(1 row)
SELECT BITCOUNT(HEX_TO_BINARY('0xF0'));
 bitcount
----------
        4
(1 row)
SELECT BITCOUNT(HEX_TO_BINARY('0xAB'))
 bitcount
----------
        5
(1 row)
```

BITSTRING_TO_BINARY

Translates the given VARCHAR bitstring representation into a VARBINARY value.

Behavior Type

Immutable

Syntax

```
BITSTRING_TO_BINARY ( expression )
```

Parameters

expression	(VARCHAR) is the string to return.

Notes

VARBINARY BITSTRING_TO_BINARY(VARCHAR) converts data from character type (in bitstring format) to binary type. This function is the inverse of TO_BITSTRING.

```
BITSTRING_TO_BINARY(TO_BITSTRING(x)) = x
TO_BITSTRING(BITSTRING_TO_BINARY(x)) = x
```

Examples

If there are an odd number of characters in the hex value, then the first character is treated as the low nibble of the first (furthest to the left) byte.

```
SELECT BITSTRING_TO_BINARY('0110000101100010');
 bitstring_to_binary
---------------------
 ab
(1 row)
```

If an invalid bitstring is supplied, the system returns an error:

```
SELECT BITSTRING_TO_BINARY('010102010');
ERROR:  invalid bitstring "010102010"
```

BTRIM

Removes the longest string consisting only of specified characters from the start and end of a string.

Behavior Type

Immutable

Syntax

```
BTRIM ( expression [ , characters-to-remove ] )
```

Parameters

expression	(CHAR or VARCHAR) is the string to modify
characters-to-remove	(CHAR or VARCHAR) specifies the characters to remove. The default is the space character.

Examples

```
SELECT BTRIM('xyxtrimyyx', 'xy');
 btrim
-------
```

```
 trim
(1 row)
```

See Also

LTRIM (page 281), ***RTRIM*** (page 292), ***TRIM*** (page 301)

CHARACTER_LENGTH

Returns an INTEGER value representing the number of characters or octets in a string. It strips the padding from CHAR expressions but not from VARCHAR expressions.

Behavior Type

Immutable if USING OCTETS, stable otherwise.

Syntax

```
[ CHAR_LENGTH | CHARACTER_LENGTH ] ( expression ,
... [ USING { CHARACTERS | OCTETS } ] )
```

Parameters

expression	(CHAR or VARCHAR) is the string to measure
USING CHARACTERS | OCTETS	Determines whether the character length is expressed in characters (the default) or octets.

Notes

CHARACTER_LENGTH is identical to ***LENGTH*** (page 279). See ***BIT_LENGTH*** (page 260) and ***OCTET_LENGTH*** (page 283) for similar functions.

Examples

```
SELECT CHAR_LENGTH('1234  '::CHAR(10), USING OCTETS);
 char_length
-------------
           4
(1 row)
SELECT CHAR_LENGTH('1234  '::VARCHAR(10));
 char_length
-------------
           6
(1 row)
SELECT CHAR_LENGTH(NULL::CHAR(10)) IS NULL;
 ?column?
----------
 t
(1 row)
```

CHR

Converts the first octet of an INTEGER to a VARCHAR.

Behavior Type

Immutable

Syntax

```
CHR ( expression )
```

Parameters

expression	(INTEGER) is the string to convert and is masked to a single octet.

Notes

- CHR is the opposite of the ***ASCII*** (page 259) function.
- CHR operates on UTF-8 characters, not only on single-byte ASCII characters. It continues to get the same results for the ASCII subset of UTF-8.

Examples

Expression	Result
`SELECT CHR(65);`	`A`
`SELECT CHR(65+32);`	`a`
`SELECT CHR(null);`	

DECODE

Compares *expression* to each search value one by one. If *expression* is equal to a search, the function returns the corresponding result. If no match is found, the function returns default. If default is omitted, the function returns null.

Behavior Type

Immutable

Syntax

```
DECODE ( expression, search, result [ , search, result ]
...[, default ] );
```

Parameters

expression	Is the value to compare.
search	Is the value compared against *expression.*
result	Is the value returned, if *expression* is equal to search.

default	Is optional. If no matches are found, DECODE returns default. If default is omitted, then DECODE returns NULL (if no matches are found).

Notes

DECODE is similar to the IF-THEN-ELSE and ***CASE*** (page 44) expression:

```
CASE expression
WHEN search THEN result
[WHEN search THEN result]
[ELSE default];
```

The arguments can have any data type supported by Vertica. The result types of individual results are promoted to the least common type that can be used to represent all of them. This leads to a character string type, an exact numeric type, an approximate numeric type, or a DATETIME type, where all the various result arguments must be of the same type grouping.

Examples

The following example converts numeric values in the weight column from the product_dimension table to descriptive values in the output.

```
SELECT product_description, DECODE(weight,
    2, 'Light',
   50, 'Medium',
   71, 'Heavy',
   99, 'Call for help',
       'N/A')
FROM product_dimension
WHERE category_description = 'Food'
AND department_description = 'Canned Goods'
AND sku_number BETWEEN 'SKU-#49750' AND 'SKU-#49999'
LIMIT 15;

        product_description        |     case
-----------------------------------+---------------
 Brand #499 canned corn            | N/A
 Brand #49900 fruit cocktail       | Medium
 Brand #49837 canned tomatoes      | Heavy
 Brand #49782 canned peaches       | N/A
 Brand #49805 chicken noodle soup  | N/A
 Brand #49944 canned chicken broth | N/A
 Brand #49819 canned chili         | N/A
 Brand #49848 baked beans          | N/A
 Brand #49989 minestrone soup      | N/A
 Brand #49778 canned peaches       | N/A
 Brand #49770 canned peaches       | N/A
 Brand #4977 fruit cocktail        | N/A
 Brand #49933 canned olives        | N/A
 Brand #49750 canned olives        | Call for help
 Brand #49777 canned tomatoes      | N/A
(15 rows)
```

GREATEST

Returns the largest value in a list of expressions.

Behavior Type

Stable

Syntax

```
GREATEST ( expression1, expression2, ... expression-n );
```

Parameters

expression1, *expression2*, and *expression-n* are the expressions to be evaluated.

Notes

- Works for all data types, and implicitly casts similar types. See Examples.
- A NULL value in any one of the expressions returns NULL.
- Depends on the collation setting of the locale.

Examples

This example returns 9 as the greatest in the list of expressions:

```
SELECT GREATEST(7, 5, 9);
 greatest
----------
        9
(1 row)
```

Note that putting quotes around the integer expressions returns the same result as the first example:

```
SELECT GREATEST('7', '5', '9');
 greatest
----------
        9
(1 row)
```

The next example returns FLOAT 1.5 as the greatest because the integer is implicitly cast to float:

```
SELECT GREATEST(1, 1.5);
 greatest
----------
      1.5
(1 row)
```

The following example returns 'vertica' as the greatest:

```
SELECT GREATEST('vertica', 'analytic', 'database');
 greatest
----------
 vertica
(1 row)
```

Notice this next command returns NULL:

```
SELECT GREATEST('vertica', 'analytic', 'database', null);
 greatest
----------

(1 row)
```

And one more:

```
SELECT GREATEST('sit', 'site', 'sight');
 greatest
----------
 site
(1 row)
```

See Also

LEAST (page 275)

GREATESTB

Returns its greatest argument, using binary ordering, not UTF-8 character ordering.

Behavior Type

Immutable

Syntax

```
GREATESTB ( expression1, expression2, ... expression-n );
```

Parameters

expression1, *expression2*, and *expression-n* are the expressions to be evaluated.

Notes

- Works for all data types, and implicitly casts similar types. See Examples.
- A NULL value in any one of the expressions returns NULL.
- Depends on the collation setting of the locale.

Examples

The following command selects straße as the greatest in the series of inputs:

```
SELECT GREATESTB('straße', 'strasse');
 GREATESTB
-----------
 straße
(1 row)
```

This example returns 9 as the greatest in the list of expressions:

```
SELECT GREATESTB(7, 5, 9);
 GREATESTB
-----------
         9
(1 row)
```

Note that putting quotes around the integer expressions returns the same result as the first example:

```
 GREATESTB
-----------
 9
(1 row)
```

The next example returns FLOAT 1.5 as the greatest because the integer is implicitly cast to float:

```
SELECT GREATESTB(1, 1.5);
 GREATESTB
-----------
       1.5
(1 row)
```

The following example returns 'vertica' as the greatest:

```
SELECT GREATESTB('vertica', 'analytic', 'database');
 GREATESTB
-----------
 vertica
(1 row)
```

Notice this next command returns NULL:

```
SELECT GREATESTB('vertica', 'analytic', 'database', null);
 GREATESTB
-----------

(1 row)
```

And one more:

```
SELECT GREATESTB('sit', 'site', 'sight');
 GREATESTB
-----------
 site
(1 row)
```

See Also

LEASTB (page 277)

HEX_TO_BINARY

Translates the given VARCHAR hexadecimal representation into a VARBINARY value.

Behavior Type

Immutable

Syntax

```
HEX_TO_BINARY ( [ 0x ] expression )
```

Parameters

expression	(BINARY or VARBINARY) is the string to translate.
0x	Is optional prefix

Notes

VARBINARY HEX_TO_BINARY(VARCHAR) converts data from character type in hexadecimal format to binary type. This function is the inverse of ***TO_HEX*** (page 216).

```
HEX_TO_BINARY(TO_HEX(x)) = x)
TO_HEX(HEX_TO_BINARY(x)) = x)
```

If there are an odd number of characters in the hexadecimal value, the first character is treated as the low nibble of the first (furthest to the left) byte.

Examples

If the given string begins with "0x" the prefix is ignored. For example:

```
SELECT HEX_TO_BINARY('0x6162') AS hex1, HEX_TO_BINARY('6162') AS hex2;
 hex1 | hex2
------+------
 ab   | ab
(1 row)
```

If an invalid hex value is given, Vertica returns an “invalid binary representation" error; for example:

```
SELECT HEX_TO_BINARY('0xffgf');
ERROR:  invalid hex string "0xffgf"
```

See Also

TO_HEX (page 216)

INET_ATON

Returns an integer that represents the value of the address in host byte order, given the dotted-quad representation of a network address as a string.

Behavior Type

Immutable

Syntax

```
INET_ATON ( expression )
```

Parameters

expression	(VARCHAR) is the string to convert.

Notes

The following syntax converts an IPv4 address represented as the string A to an integer I.

INET_ATON trims any spaces from the right of A, calls the Linux function ***inet_pton http://www.opengroup.org/onlinepubs/000095399/functions/inet_ntop.html***, and converts the result from network byte order to host byte order using ***ntohl http://opengroup.org/onlinepubs/007908775/xns/ntohl.html***.

```
INET_ATON(VARCHAR A) -> INT8 I
```

If A is NULL, too long, or inet_pton returns an error, the result is NULL.

Examples

The generated number is always in host byte order. In the following example, the number is calculated as 209×256^3 + 207×256^2 + 224×256 + 40.

```
SELECT INET_ATON('209.207.224.40');
 inet_aton
------------
 3520061480
(1 row)
SELECT INET_ATON('1.2.3.4');
 inet_aton
-----------
  16909060
(1 row)
SELECT TO_HEX(INET_ATON('1.2.3.4'));
 to_hex
---------
 1020304
(1 row)
```

See Also

INET_NTOA (page 223)

INET_NTOA

Returns the dotted-quad representation of the address as a VARCHAR, given a network address as an integer in network byte order.

Behavior Type

Immutable

Syntax

```
INET_NTOA ( expression )
```

Parameters

expression	(INTEGER) is the network address to convert.

Notes

The following syntax converts an IPv4 address represented as integer I to a string A.

INET_NTOA converts I from host byte order to network byte order using ***htonl http://opengroup.org/onlinepubs/007908775/xns/htonl.html***, and calls the Linux function ***inet_ntop http://www.opengroup.org/onlinepubs/000095399/functions/inet_ntop.html***.

```
INET_NTOA(INT8 I) -> VARCHAR A
```

If I is NULL, greater than 2^32 or negative, the result is NULL.

Examples

```
SELECT INET_NTOA(16909060);
 inet_ntoa
-----------
 1.2.3.4
(1 row)
SELECT INET_NTOA(03021962);
  inet_ntoa
-------------
 0.46.28.138
(1 row)
```

See Also

INET_ATON (page 222)

INITCAP

Capitalizes first letter of each alphanumeric word and puts the rest in lowercase.

Behavior Type

Stable

Syntax

```
INITCAP ( expression )
```

Parameters

expression	(VARCHAR) is the string to format.

Notes

- Depends on collation setting of the locale.
- INITCAP is restricted to 32750 octet inputs, since it is possible for the UTF-8 representation of result to double in size.

Examples

Expression **Result**

```
SELECT INITCAP('high speed database');          High Speed Database

SELECT INITCAP('LINUX TUTORIAL');               Linux Tutorial
SELECT INITCAP('abc DEF 123aVC 124Btd,lAsT');   Abc Def 123Avc
                                                124Btd,Last
SELECT INITCAP('');
SELECT INITCAP(null);
```

INITCAPB

Capitalizes first letter of each alphanumeric word and puts the rest in lowercase.

Behavior Type

Immutable

Syntax

```
INITCAPB ( expression )
```

Parameters

expression	(VARCHAR) is the string to format.

Notes

Depends on collation setting of the locale.

Examples

Expression	Result

```
SELECT INITCAPB('étudiant');                    éTudiant

SELECT INITCAPB('high speed database');         High Speed Database
SELECT INITCAPB('LINUX TUTORIAL');              Linux Tutorial
SELECT INITCAPB('abc DEF 123aVC 124Btd,lAsT');  Abc Def 123Avc
                                                124Btd,Last
SELECT INITCAPB('');
SELECT INITCAPB(null);
```

INSTR

Searches *string* for *substring* and returns an integer indicating the position of the character in *string* that is the first character of this *occurrence*. The return value is based on the character position of the identified character.

Behavior Type

Stable

Syntax

```
INSTR ( string , substring [, position [, occurrence ] ] )
```

Parameters

string	(CHAR or VARCHAR, or BINARY or VARBINARY) Is the text expression to search.
substring	(CHAR or VARCHAR, or BINARY or VARBINARY) Is the string to search for.
position	Is a nonzero integer indicating the character of string where Vertica begins the search. If position is negative, then Vertica counts backward from the end of string and then searches backward from the resulting position. The first character of string occupies the default position 1, and position cannot be 0.
occurrence	Is an integer indicating which occurrence of string Vertica searches. The value of occurrence must be positive (greater than 0), and the default is 1.

Notes

Both *position* and *occurrence* must be of types that can resolve to an integer. The default values of both parameters are 1, meaning Vertica begins searching at the first character of string for the first occurrence of substring. The return value is relative to the beginning of string, regardless of the value of position, and is expressed in characters.

If the search is unsuccessful (that is, if substring does not appear *occurrence* times after the *position* character of *string,* then the return value is 0.

Examples

The first example searches forward in string ‘abc’ for substring ‘b’. The search returns the position in ‘abc’ where ‘b’ occurs, or position 2. Because no position parameters are given, the default search starts at ‘a’, position 1.

```
SELECT INSTR('abc', 'b');
INSTR
-------
     2
(1 row)
```

The following three examples use character position to search backward to find the position of a substring.

Note: Although it seems intuitive that the function returns a negative integer, the position of *n* occurrence is read left to right in the sting, even though the search happens in reverse (from the end — or right side — of the string).

In the first example, the function counts backward one character from the end of the string, starting with character ‘c’. The function then searches backward for the first occurrence of ‘a’, which it finds it in the first position in the search string.

```
SELECT INSTR('abc', 'a', -1);
 INSTR
-------
     1
```

```
(1 row)
```

In the second example, the function counts backward one byte from the end of the string, starting with character ‘c’. The function then searches backward for the first occurrence of ‘a’, which it finds it in the first position in the search string.

```
SELECT INSTR(VARBINARY 'abc', VARBINARY 'a', -1);
 INSTR
-------
     1
(1 row)
```

In the third example, the function counts backward one character from the end of the string, starting with character ‘b’, and searches backward for substring ‘bc’, which it finds in the second position of the search string.

```
SELECT INSTR('abcb', 'bc', -1);
 INSTR
-------
     2
(1 row)
```

In the fourth example, the function counts backward one character from the end of the string, starting with character ‘b’, and searches backward for substring ‘bcef’, which it does not find. The result is 0.

```
SELECT INSTR('abcb', 'bcef', -1);
INSTR
-------
     0
(1 row)
```

In the fifth example, the function counts backward one byte from the end of the string, starting with character ‘b’, and searches backward for substring ‘bcef’, which it does not find. The result is 0.

```
SELECT INSTR(VARBINARY 'abcb', VARBINARY 'bcef', -1);
 INSTR
-------
     0
(1 row)
```

INSTRB

Searches *string* for *substring* and returns an integer indicating the octet position within string that is the first *occurrence*. The return value is based on the octet position of the identified byte.

Behavior Type

Immutable

Syntax

```
INSTRB ( string , substring [, position [, occurrence ] ] )
```

Parameters

string	Is the text expression to search.

substring	Is the string to search for.
position	Is a nonzero integer indicating the character of string where Vertica begins the search. If position is negative, then Vertica counts backward from the end of string and then searches backward from the resulting position. The first byte of string occupies the default position 1, and position cannot be 0.
occurrence	Is an integer indicating which occurrence of string Vertica searches. The value of occurrence must be positive (greater than 0), and the default is 1.

Notes

Both *position* and *occurrence* must be of types that can resolve to an integer. The default values of both parameters are 1, meaning Vertica begins searching at the first byte of string for the first occurrence of substring. The return value is relative to the beginning of string, regardless of the value of position, and is expressed in octets.

If the search is unsuccessful (that is, if substring does not appear *occurrence* times after the *position* character of *string,* then the return value is 0.

Examples

```
SELECT INSTRB('straße', 'ß');
 INSTRB
--------
      5
(1 row)
```

See Also

INSTR (page 272)

LEAST

Returns the smallest value in a list of expressions.

Behavior Type

Stable

Syntax

```
LEAST ( expression1, expression2, ... expression-n );
```

Parameters

expression1, *expression2*, and *expression-n* are the expressions to be evaluated.

Notes

- Works for all data types, and implicitly casts similar types. See Examples below.
- A NULL value in any one of the expressions returns NULL.

Examples

This example returns 5 as the least:

```
SELECT LEAST(7, 5, 9);
 least
-------
     5
(1 row)
```

Note that putting quotes around the integer expressions returns the same result as the first example:

```
SELECT LEAST('7', '5', '9');
 least
-------
 5
(1 row)
```

In the above example, the values are being compared as strings, so '10' would be less than '2'.

The next example returns 1.5, as INTEGER 2 is implicitly cast to FLOAT:

```
SELECT LEAST(2, 1.5);
 least
-------
   1.5
(1 row)
```

The following example returns 'analytic' as the least:

```
SELECT LEAST('vertica', 'analytic', 'database');
  least
----------
 analytic
(1 row)
```

Notice this next command returns NULL:

```
SELECT LEAST('vertica', 'analytic', 'database', null);
 least
-------

(1 row)
```

And one more:

```
SELECT LEAST('sit', 'site', 'sight');
 least
-------
 sight
(1 row)
```

See Also

GREATEST (page 266)

LEASTB

Returns the function's least argument, using binary ordering, not UTF-8 character ordering.

Behavior Type

Immutable

Syntax

```
LEASTB ( expression1, expression2, ... expression-n );
```

Parameters

expression1, *expression2*, and *expression-n* are the expressions to be evaluated.

Notes

- Works for all data types, and implicitly casts similar types. See Examples below.
- A NULL value in any one of the expressions returns NULL.

Examples

The following command selects strasse as the least in the series of inputs:

```
SELECT LEASTB('straße', 'strasse');
 LEASTB
---------
 strasse
(1 row)
```

This example returns 5 as the least:

```
SELECT LEASTB(7, 5, 9);
 LEASTB
--------
      5
(1 row)
```

Note that putting quotes around the integer expressions returns the same result as the first example:

```
SELECT LEASTB('7', '5', '9');
 LEASTB
--------
 5
(1 row)
```

In the above example, the values are being compared as strings, so '10' would be less than '2'.

The next example returns 1.5, as INTEGER 2 is implicitly cast to FLOAT:

```
SELECT LEASTB(2, 1.5);
 LEASTB
--------
    1.5
(1 row)
```

The following example returns 'analytic' as the least in the series of inputs:

```
SELECT LEASTB('vertica', 'analytic', 'database');
  LEASTB
----------
 analytic
(1 row)
```

Notice this next command returns NULL:

```
SELECT LEASTB('vertica', 'analytic', 'database', null);
 LEASTB
--------

(1 row)
```

See Also

GREATESTB (page 267)

LEFT

Returns the specified characters from the left side of a string.

Behavior Type

Immutable

Syntax

```
LEFT ( string , length )
```

Parameters

string	(CHAR or VARCHAR) is the string to return.
length	Is an INTEGER value that specifies the count of characters to return.

Examples

```
SELECT LEFT('vertica', 3);
 left
------
 ver
(1 row)
SELECT LEFT('straße', 5);
 LEFT
-------
 straß
(1 row)
```

See Also

SUBSTR (page 296)

LENGTH

Takes one argument as an input and returns returns an INTEGER value representing the number of characters in a string.

Behavior Type

Immutable

Syntax

```
LENGTH ( expression )
```

Parameters

expression	(CHAR or VARCHAR or BINARY or VARBINARY) is the string to measure

Notes

- LENGTH strips the padding from CHAR expressions but not from VARCHAR expressions.
- LENGTH is identical to ***CHARACTER_LENGTH*** (page 263) for CHAR and VARCHAR. For binary types, it is identical to octet length. See ***BIT_LENGTH*** (page 260) and ***OCTET_LENGTH*** (page 283) for similar functions.

Examples

Expression	Result
`SELECT LENGTH('1234  '::CHAR(10));`	`4`
`SELECT LENGTH('1234  '::VARCHAR(10));`	`6`
`SELECT LENGTH('1234  '::BINARY(10));`	`10`
`SELECT LENGTH('1234  '::VARBINARY(10));`	`6`
`SELECT LENGTH(NULL::CHAR(10)) IS NULL;`	`t`

LOWER

Returns a VARCHAR value containing the argument converted to lowercase letters.

Behavior Type

Stable

Syntax

```
LOWER ( expression )
```

Parameters

expression	(CHAR or VARCHAR) is the string to convert

Notes

LOWER is restricted to 32750 octet inputs, since it is possible for the UTF-8 representation of result to double in size.

Examples

```
SELECT LOWER('AbCdEfG');
  lower
----------
 abcdefg
(1 row)
SELECT LOWER('The Cat In The Hat');
       lower
--------------------
 the cat in the hat
(1 row)
SELECT LOWER('ÉTUDIANT');
  LOWER
----------
 Étudiant
(1 row)
```

LOWERB

Returns a character string with each ASCII character converted to lowercase; multibyte UTF-8 characters are not converted.

Behavior Type

Immutable

Syntax

```
LOWERB ( expression )
```

Parameters

expression	(CHAR or VARCHAR) is the string to convert

Examples

In the following example, the multibyte UTF-8 character É is not converted to lowercase:

```
SELECT LOWERB('ÉTUDIANT');
  LOWERB
----------
 Étudiant
(1 row)
SELECT LOWERB('AbCdEfG');
 LOWERB
---------
```

```
 abcdefg
(1 row)
SELECT LOWERB('The Vertica Database');
        LOWERB
----------------------
 the vertica database
(1 row)
```

LPAD

Returns a VARCHAR value representing a string of a specific length filled on the left with specific characters.

Behavior Type

Immutable

Syntax

```
LPAD ( expression , length [ , fill ] )
```

Parameters

expression	(CHAR OR VARCHAR) specifies the string to fill
length	(INTEGER) specifies the number of characters to return
fill	(CHAR OR VARCHAR) specifies the repeating string of characters with which to fill the output string. The default is the space character.

Examples

```
SELECT LPAD('database', 15, 'xzy');
      lpad
-----------------
 xzyxzyxdatabase
(1 row)
```

If the string is already longer than the specified length it is truncated on the right:

```
SELECT LPAD('establishment', 10, 'abc');
    lpad
------------
 establishm
(1 row)
```

LTRIM

Returns a VARCHAR value representing a string with leading blanks removed from the left side (beginning).

Behavior Type

Immutable

Syntax

```
LTRIM ( expression [ , characters ] )
```

Parameters

expression	(CHAR or VARCHAR) is the string to trim
characters	(CHAR or VARCHAR) specifies the characters to remove from the left side of *expression*. The default is the space character.

Examples

```
SELECT LTRIM('zzzyyyyyyyxxxxxxxxtrim', 'xyz');
 ltrim
-------
 trim
(1 row)
```

See Also

BTRIM (page 262), ***RTRIM*** (page 292), ***TRIM*** (page 301)

MD5

Calculates the MD5 hash of string, returning the result as a VARCHAR string in hexadecimal.

Behavior Type

Immutable

Syntax

```
MD5 ( string )
```

Parameters

string	Is the argument string.

Examples

```
SELECT MD5('123');
               md5
----------------------------------
 202cb962ac59075b964b07152d234b70
(1 row)

SELECT MD5('Vertica'::bytea);
               md5
----------------------------------
 fc45b815747d8236f9f6fdb9c2c3f676
(1 row)
```

OCTET_LENGTH

Returns the length of the input string expression in octets.

Behavior Type

Immutable

Syntax

```
OCTET_LENGTH ( expression )
```

Parameters

expression	(CHAR or VARCHAR or BINARY or VARBINARY) is the string to measure.

Notes

- If the data type of *expression* is a CHAR, VARCHAR or VARBINARY, the result is the same as the actual length of *expression* in octets. For CHAR, the length does not include any trailing spaces.
- If the data type of *expression* is BINARY, the result is the same as the fixed-length of *expression*.
- If the value of *expression* is NULL, the result is NULL.

Examples

Expression	Result
`SELECT OCTET_LENGTH(CHAR(10) '1234  ');`	4
`SELECT OCTET_LENGTH(CHAR(10) '1234');`	4
`SELECT OCTET_LENGTH(CHAR(10) '  1234');`	6
`SELECT OCTET_LENGTH(VARCHAR(10) '1234  ');`	6
`SELECT OCTET_LENGTH(VARCHAR(10) '1234 ');`	5
`SELECT OCTET_LENGTH(VARCHAR(10) '1234');`	4
`SELECT OCTET_LENGTH(VARCHAR(10) '  1234');`	7
`SELECT OCTET_LENGTH('abc'::VARBINARY);`	3
`SELECT OCTET_LENGTH(VARBINARY 'abc');`	3
`SELECT OCTET_LENGTH(VARBINARY 'abc  ');`	5
`SELECT OCTET_LENGTH(BINARY(6) 'abc');`	6
`SELECT OCTET_LENGTH(VARBINARY '');`	0
`SELECT OCTET_LENGTH(''::BINARY);`	1
`SELECT OCTET_LENGTH(null::VARBINARY);`	
`SELECT OCTET_LENGTH(null::BINARY);`	

See Also

BIT_LENGTH (page 260), ***CHARACTER_LENGTH*** (page 263), ***LENGTH*** (page 279)

OVERLAY

Returns a VARCHAR value representing a string having had a substring replaced by another string.

Behavior Type

Immutable if using OCTETS, Stable otherwise

Syntax

```
OVERLAY ( expression1 PLACING expression2 FROM position
... [ FOR extent ]
... [ USING { CHARACTERS | OCTETS } ] )
```

Parameters

expression1	(CHAR or VARCHAR) is the string to process
expression2	(CHAR or VARCHAR) is the substring to overlay
position	(INTEGER) is the character or octet position (counting from one) at which to begin the overlay
extent	(INTEGER) specifies the number of characters or octets to replace with the overlay
USING CHARACTERS | OCTETS	Determines whether OVERLAY uses characters (the default) or octets

Examples

```
SELECT OVERLAY('123456789' PLACING 'xxx' FROM 2);
  overlay
-----------
 1xxx56789
(1 row)
SELECT OVERLAY('123456789' PLACING 'XXX' FROM 2 USING OCTETS);
 overlay
-----------
 1XXX56789
(1 row)
SELECT OVERLAY('123456789' PLACING 'xxx' FROM 2 FOR 4);
 overlay
----------
 1xxx6789
(1 row)
SELECT OVERLAY('123456789' PLACING 'xxx' FROM 2 FOR 5);
 overlay
---------
 1xxx789
(1 row)
SELECT OVERLAY('123456789' PLACING 'xxx' FROM 2 FOR 6);
 overlay
---------
 1xxx89
(1 row)
```

OVERLAYB

Returns an octet value representing a string having had a substring replaced by another string.

Behavior Type

Immutable

Syntax

```
OVERLAYB ( expression1, expression2, position [ , extent ] )
```

Parameters

expression1	(CHAR or VARCHAR) is the string to process
expression2	(CHAR or VARCHAR) is the substring to overlay
position	(INTEGER) is the octet position (counting from one) at which to begin the overlay
extent	(INTEGER) specifies the number of octets to replace with the overlay

Notes

This function treats the multibyte character string as a string of octets (bytes) and use octet numbers as incoming and outgoing position specifiers and lengths. The strings themselves are type VARCHAR, but they treated as if each byte was a separate character.

Examples

```
SELECT OVERLAYB('123456789', 'ééé', 2);
 OVERLAYB
----------
 1ééé89
(1 row)
SELECT OVERLAYB('123456789', 'ßßß', 2);
 OVERLAYB
----------
 1ßßß89
(1 row)
SELECT OVERLAYB('123456789', 'xxx', 2);
  OVERLAYB
-----------
 1xxx56789
(1 row)
SELECT OVERLAYB('123456789', 'xxx', 2, 4);
 OVERLAYB
----------
 1xxx6789
(1 row)
SELECT OVERLAYB('123456789', 'xxx', 2, 5);
 OVERLAYB
---------
 1xxx789
```

```
(1 row)
SELECT OVERLAYB('123456789', 'xxx', 2, 6);
 OVERLAYB
---------
 1xxx89
(1 row)
```

POSITION

Returns an INTEGER value representing the character location of a specified substring with a string (counting from one).

Behavior Type

Immutable if USING OCTETS, stable otherwise

Syntax 1

```
POSITION ( substring IN string [ USING { CHARACTERS | OCTETS } ] )
```

Parameters

substring	(CHAR or VARCHAR) is the substring to locate
string	(CHAR or VARCHAR) is the string in which to locate the substring
USING CHARACTERS | OCTETS	Determines whether the position is reported by using characters (the default) or octets.

Syntax 2

```
POSITION ( substring IN string )
```

Parameters

substring	(VARBINARY) is the substring to locate
string	(VARBINARY) is the string in which to locate the substring

Notes

- When the string and substring are CHAR or VARCHAR, the return value is based on either the character or octet position of the substring.
- When the string and substring are VARBINARY, the return value is always based on the octet position of the substring.
- The string and substring must be consistent. Do not mix VARBINARY with CHAR or VARCHAR.

Examples

```
SELECT POSITION('é' IN 'étudiant' USING CHARACTERS);
 position
----------
```

```
        1
(1 row)
SELECT POSITION('ß' IN 'straße' USING OCTETS);
 position
----------
        5
(1 row)
SELECT POSITION('c' IN 'abcd' USING CHARACTERS);
 position
----------
        3
(1 row)
SELECT POSITION(VARBINARY '456' IN VARBINARY '123456789');
 position
----------
        4
(1 row)
```

POSITIONB

Returns an INTEGER value representing the octet location of a specified substring with a string (counting from one).

Behavior Type

Immutable

Syntax

```
POSITIONB ( string, substring )
```

Parameters

string	(CHAR or VARCHAR) is the string in which to locate the substring
substring	(CHAR or VARCHAR) is the substring to locate

Examples

```
SELECT POSITIONB('straße', 'ße');
 POSITIONB
-----------
         5
(1 row)
SELECT POSITIONB('étudiant', 'é');
 position
----------
        1
(1 row)
```

QUOTE_IDENT

Returns the given string, suitably quoted, to be used as an ***identifier*** (page 15) in a SQL statement string. Quotes are added only if necessary; that is, if the string contains non-identifier characters, is a SQL ***keyword*** (page 12), such as `'1time'`, `'Next week'` and `'Select'`. Embedded double quotes are doubled.

Behavior Type

Immutable

Syntax

```
QUOTE_IDENT( string )
```

Parameters

string	Is the argument string.

Notes

- SQL identifiers, such as table and column names, are stored as created, and references to them are resolved using case-insensitive compares. Thus, you do not need to double-quote mixed-case identifiers.
- Vertica quotes all currently-reserved keywords, even those not currently being used.

Examples

Quoted identifiers are case-insensitive, and Vertica does not supply the quotes:

```
SELECT QUOTE_IDENT('VErtIcA');
 QUOTE_IDENT
-------------
 VErtIcA
(1 row)

SELECT QUOTE_IDENT('Vertica database');
    QUOTE_IDENT
--------------------
 "Vertica database"
(1 row)
```

Embedded double quotes are doubled:

```
SELECT QUOTE_IDENT('Vertica "!" database');
       QUOTE_IDENT
-------------------------
 "Vertica ""!"" database"
(1 row)
```

The following example uses the SQL keyword, SELECT; results are double quoted:

```
 SELECT QUOTE_IDENT('select');
 QUOTE_IDENT
-------------
```

```
 "select"
(1 row)
```

QUOTE_LITERAL

Returns the given string, suitably quoted, to be used as a string literal in a SQL statement string. Embedded single quotes and backslashes are doubled.

Behavior Type

Immutable

Syntax

```
QUOTE_LITERAL ( string )
```

Parameters

string	Is the argument string.

Notes

Vertica recognizes two consecutive single quotes within a string literal as one single quote character. For example, `'You''re here!'`. This is the SQL standard representation and is preferred over the form, `'You\'re here!'`, as backslashes are not parsed as before.

Examples

```
SELECT QUOTE_LITERAL('You''re here!');
  QUOTE_LITERAL
-----------------
 'You''re here!'
(1 row)

SELECT QUOTE_LITERAL('You\'re here!');
WARNING:  nonstandard use of \' in a string literal at character 22
HINT:  Use '' to write quotes in strings, or use the escape string syntax (E'\'').
```

See Also

String Literals (Character) (page 23)

REPEAT

Returns a VARCHAR or VARBINARY value that repeats the given value COUNT times, given a value and a count this function.

If the return value is truncated the given value might not be repeated count times, and the last occurrence of the given value might be truncated.

Behavior Type

Immutable

Syntax

```
REPEAT ( string , repetitions )
```

Parameters

string	(CHAR or VARCHAR or BINARY or VARBINARY) is the string to repeat
repetitions	(INTEGER) is the number of times to repeat the string

Notes

If the repetitions field depends on the contents of a column (is not a constant), then the repeat operator maximum length is 65000 bytes. You can add a cast of the repeat to cast the result down to a size big enough for your purposes (reflects the actual maximum size) so you can do other things with the result.

Examples

The following example repeats 'vmart' three times:

```
SELECT REPEAT ('vmart', 3);
     repeat
-----------------
 vmartvmartvmart
(1 row)
```

If you run the following example, you get an error message:

```
SELECT '123456' || REPEAT('a', colx);
ERROR: Operator || may give a 65006-byte Varchar result; the limit is 65000 bytes.
```

If you know that `colx` can never be greater than 3, the solution is to add a cast (::VARCHAR(3)):

```
SELECT '123456' || REPEAT('a', colx)::VARCHAR(3);
```

If `colx` is greater than 3, the repeat is truncated to exactly three (3) a's.

REPLACE

Replaces all occurrences of characters in a string with another set of characters.

Behavior Type

Immutable

Syntax

```
REPLACE ( string , target , replacement )
```

Parameters

string	(CHAR OR VARCHAR) is the string to which to perform the replacement
target	(CHAR OR VARCHAR) is the string to replace
replacement	(CHAR OR VARCHAR) is the string with which to replace the target

Examples

```
SELECT REPLACE('Documentation%20Library', '%20', ' ');
        replace
-----------------------
 Documentation Library
(1 row)
SELECT REPLACE('This & That', '&', 'and');
    replace
---------------
 This and That
(1 row)
SELECT REPLACE('straße', 'ß', 'ss');
 REPLACE
---------
 strasse
(1 row)
```

RIGHT

Returns the specified characters from the right side of a string.

Behavior Type

Immutable

Syntax

```
RIGHT ( string , length )
```

Parameters

string	(CHAR or VARCHAR) is the string to return.
length	Is an INTEGER value that specifies the count of characters to return.

Examples

The following command returns the last three characters of the string 'vertica':

```
SELECT RIGHT('vertica', 3);
 right
-------
 ica
(1 row)
```

The following command returns the last two characters of the string 'straße':

```
SELECT RIGHT('straße', 2);
 RIGHT
-------
 ße
(1 row)
```

See Also

SUBSTR (page 296)

RPAD

Returns a VARCHAR value representing a string of a specific length filled on the right with specific characters.

Behavior Type

Immutable

Syntax

```
RPAD ( expression , length [ , fill ] )
```

Parameters

expression	(CHAR OR VARCHAR) specifies the string to fill
length	(INTEGER) specifies the number of characters to return
fill	(CHAR OR VARCHAR) specifies the repeating string of characters with which to fill the output string. The default is the space character.

Examples

```
SELECT RPAD('database', 15, 'xzy');
      rpad
-----------------
 databasexzyxzyx
(1 row)
```

If the string is already longer than the specified length it is truncated on the right:

```
SELECT RPAD('database', 6, 'xzy');
  rpad
--------
 databa
(1 row)
```

RTRIM

Returns a VARCHAR value representing a string with trailing blanks removed from the right side (end).

Behavior Type

Immutable

Syntax

```
RTRIM ( expression [ , characters ] )
```

Parameters

expression	(CHAR or VARCHAR) is the string to trim
characters	(CHAR or VARCHAR) specifies the characters to remove from the right side of *expression*. The default is the space character.

Examples

```
SELECT RTRIM('trimzzzyyyyyyxxxxxxx', 'xyz');
 ltrim
-------
 trim
(1 row)
```

See Also

BTRIM (page 262), ***LTRIM*** (page 281), ***TRIM*** (page 301)

SPLIT_PART

Splits string on the delimiter and returns the location of the beginning of the given field (counting from one).

Behavior Type

Stable

Syntax

```
SPLIT_PART ( string , delimiter , field )
```

Parameters

string	Is the argument string.
delimiter	Is the given delimiter.
field	(INTEGER) is the number of the part to return.

Note

Use this with the character form of the subfield.

Examples

The specified integer of 2 returns the second string, or `def`.

```
SELECT SPLIT_PART('abc~@~def~@~ghi', '~@~', 2);
 split_part
------------
 def
(1 row)
```

Here, we specify 3, which returns the third string, or `789`.

```
SELECT SPLIT_PART('123~|~456~|~789', '~|~', 3);
 split_part
------------
 789
(1 row)
```

Note that the tildes are for readability only. Omitting them returns the same results:

```
SELECT SPLIT_PART('123|456|789', '|', 3);
 split_part
------------
 789
(1 row)
```

See what happens if you specify an integer that exceeds the number of strings: No results.

```
SELECT SPLIT_PART('123|456|789', '|', 4);
 split_part
------------

(1 row)
```

The above result is not null, it is the empty string.

```
SELECT SPLIT_PART('123|456|789', '|', 4) IS NULL;
 ?column?
----------
 f
(1 row)
```

If SPLIT_PART had returned NULL, LENGTH would have returned null.

```
SELECT LENGTH (SPLIT_PART('123|456|789', '|', 4));
 length
--------
      0
(1 row)
```

SPLIT_PARTB

Splits string on the delimiter and returns the location of the beginning of the given field (counting from one).

Behavior Type

Immutable

Syntax

```
SPLIT_PARTB ( string , delimiter , field )
```

Parameters

string	Is the argument string.
delimiter	Is the given delimiter.
field	(INTEGER) is the number of the part to return.

Note

Use this function with the character form of the subfield.

Examples

The specified integer of 3 returns the third string, or `soupçon`.

```
SELECT SPLIT_PARTB('straße~@~café~@~soupçon', '~@~', 3);
 SPLIT_PARTB
-------------
 soupçon
(1 row)
```

Note that the tildes are for readability only. Omitting them returns the same results:

```
SELECT SPLIT_PARTB('straße @ café @ soupçon', '@', 3);
 SPLIT_PARTB
-------------
  soupçon
(1 row)
```

See what happens if you specify an integer that exceeds the number of strings: No results.

```
 SELECT SPLIT_PARTB('straße @ café @ soupçon', '@', 4);
 SPLIT_PARTB
-------------

(1 row)
```

The above result is not null, it is the empty string.

```
SELECT SPLIT_PARTB('straße @ café @ soupçon', '@', 4) IS NULL;
 ?column?
----------
 f
(1 row)
```

STRPOS

Returns an INTEGER value representing the character location of a specified substring within a string (counting from one).

Behavior Type

Stable

Syntax

```
STRPOS ( string , substring )
```

Parameters

string	(CHAR or VARCHAR) is the string in which to locate the substring
substring	(CHAR or VARCHAR) is the substring to locate

Notes

STRPOS is identical to ***POSITION*** (page 286) except for the order of the arguments.

Examples

```
SELECT STRPOS('abcd','c');
 strpos
--------
      3
(1 row)
```

STRPOSB

Returns an INTEGER value representing the character location of a specified substring within a string (counting from one).

Behavior Type

Immutable

Syntax

```
STRPOSB ( string , substring )
```

Parameters

string	(CHAR or VARCHAR) is the string in which to locate the substring
substring	(CHAR or VARCHAR) is the substring to locate

Notes

STRPOSB is identical to ***POSITIONB*** (page 287) except for the order of the arguments.

Examples

```
SELECT STRPOSB('straße', 'ße');
 STRPOSB
---------
       5
(1 row)
SELECT STRPOSB('étudiant', 'é');
 position
----------
        1
(1 row)
```

SUBSTR

Returns a VARCHAR value representing a substring of a specified string.

Behavior Type

Immutable

Syntax

```
SUBSTR ( string , position [ , extent ] )
```

Parameters

string	(CHAR or VARCHAR or BINARY or VARBINARY) is the string from which to extract a substring.
position	(INTEGER) is the starting position of the substring (counting from one by characters).
extent	(INTEGER) is the length of the substring to extract (in characters). The default is the end of the string.

Notes

SUBSTR performs the same function as ***SUBSTRING*** (page 298). The only difference is the syntax allowed.

Examples

```
SELECT SUBSTR('123456789', 3, 2);
 substr
--------
 34
(1 row)
SELECT SUBSTR('123456789', 3);
 substr
---------
 3456789
(1 row)
SELECT SUBSTR(TO_BITSTRING(HEX_TO_BINARY('0x10')), 2, 2);
 substr
--------
 00
(1 row)
SELECT SUBSTR(TO_HEX(10010), 2, 2);
 substr
--------
 71
(1 row)
```

SUBSTRB

Returns an octet value representing the substring of a specified string.

Behavior Type

Immutable

Syntax

```
SUBSTRB ( string , position [ , extent ] )
```

Parameters

string	(CHAR or VARCHAR or BINARY or VARBINARY) is the string from which to extract a substring.
position	(INTEGER) is the starting position of the substring (counting from one in octets).
extent	(INTEGER) is the length of the substring to extract (in octets). The default is the end of the string.

Notes

This function treats the multibyte character string as a string of octets (bytes) and use octet numbers as incoming and outgoing position specifiers and lengths. The strings themselves are type VARCHAR, but they treated as if each octet was a separate character.

Examples

```
 SELECT SUBSTRB('soupçon', 5);
 SUBSTRB
---------
 çon
(1 row)
 SELECT SUBSTRB('soupçon', 5, 2);
 SUBSTRB
---------
 ç
(1 row)
```

SUBSTRING

Returns a value representing a substring of the specified string at the given position, given a value, a position, and an optional length.

Behavior Type

Immutable if USING OCTETS, stable otherwise.

Syntax

```
SUBSTRING ( string , position [ , length ]
... [USING {CHARACTERS | OCTETS } ] )
SUBSTRING ( string FROM position [ FOR length ]
... [USING { CHARACTERS | OCTETS } ] )
```

Parameters

string	(CHAR or VARCHAR or BINARY or VARBINARY) is the string from which to extract a substring

position	(INTEGER) is the starting position of the substring (counting from one by either characters or octets). (The default is characters.) If position is greater than the length of the given value, an empty value is returned.
length	(INTEGER) is the length of the substring to extract in either characters or octets. (The default is characters.) The default is the end of the string.If a length is given the result is at most that many bytes. The maximum length is the length of the given value less the given position. If no length is given or if the given length is greater than the maximum length then the length is set to the maximum length.
USING CHARACTERS |OCTETS	Determines whether the value is expressed in characters (the default) or octets.

Notes

Neither length nor position can be negative, and the position cannot be zero because it is one based. If these forms are violated, the system returns an error:

```
SELECT SUBSTRING('ab'::binary(2), -1, 2);
ERROR:  negative or zero substring start position not allowed
```

Examples

```
 SELECT SUBSTRING('soupçon', 5, 2 USING CHARACTERS);
 substring
-----------
 ço
(1 row)
 SELECT SUBSTRING('soupçon', 5, 2 USING OCTETS);
 substrb
---------
 ç
(1 row)
```

TO_BITSTRING

Returns a VARCHAR that represents the given VARBINARY value in bitstring format

Behavior Type

Immutable

Syntax

```
TO_BITSTRING ( expression )
```

Parameters

expression	(VARCHAR) is the string to return.

Notes

VARCHAR TO_BITSTRING(VARBINARY) converts data from binary type to character type (where the character representation is the bitstring format). This function is the inverse of BITSTRING_TO_BINARY:

```
TO_BITSTRING(BITSTRING_TO_BINARY(x)) = x)
BITSTRING_TO_BINARY(TO_BITSTRING(x)) = x)
```

Examples

```
SELECT TO_BITSTRING('ab'::BINARY(2));
   to_bitstring
------------------
 0110000101100010
(1 row)
SELECT TO_BITSTRING(HEX_TO_BINARY('0x10'));
to_bitstring
--------------
00010000
(1 row)
SELECT TO_BITSTRING(HEX_TO_BINARY('0xF0'));
to_bitstring
--------------
11110000
(1 row)
```

See Also

BITCOUNT (page 261) and ***BITSTRING_TO_BINARY*** (page 261)

TO_HEX

Returns a VARCHAR or VARBINARY representing the hexadecimal equivalent of a number.

Behavior Type

Immutable

Syntax

```
TO_HEX ( number )
```

Parameters

number	(INTEGER) is the number to convert to hexadecimal

Notes

VARCHAR TO_HEX(INTEGER) and VARCHAR TO_HEX(VARBINARY) are similar. The function converts data from binary type to character type (where the character representation is in hexadecimal format). This function is the inverse of HEX_TO_BINARY.

```
TO_HEX(HEX_TO_BINARY(x)) = x).
HEX_TO_BINARY(TO_HEX(x)) = x).
```

Examples

```
SELECT TO_HEX(123456789);
 to_hex
---------
 75bcd15
(1 row)
```

For VARBINARY inputs, the returned value is not preceded by "0x". For example:

```
SELECT TO_HEX('ab'::binary(2));
 to_hex
--------
 6162
(1 row)
```

TRANSLATE

Replaces individual characters in *string_to_replace* with other characters.

Behavior Type

Immutable

Syntax

```
TRANSLATE ( string_to_replace , from_string , to_string );
```

Parameters

string_to_replace	Is the string to be translated.
from_string	Contains characters that should be replaced in string_to_replace.
to_string	Any character in string_to_replace that matches a character in from_string is replaced by the corresponding character in to_string.

Example

```
SELECT TRANSLATE('straße', 'ß', 'ss');
 TRANSLATE
-----------
 strase
(1 row)
```

TRIM

Combines the BTRIM, LTRIM, and RTRIM functions into a single function.

Behavior Type

Immutable

Syntax

```
TRIM ( [ [ LEADING | TRAILING | BOTH ] characters FROM ] expression )
```

Parameters

LEADING	Removes the specified characters from the left side of the string
TRAILING	Removes the specified characters from the right side of the string
BOTH	Removes the specified characters from both sides of the string (default)
characters	(CHAR or VARCHAR) specifies the characters to remove from *expression*. The default is the space character.
expression	(CHAR or VARCHAR) is the string to trim

Examples

```
SELECT '-' || TRIM(LEADING 'x' FROM 'xxdatabasexx') || '-';
   ?column?
--------------
 -databasexx-
(1 row)
SELECT '-' || TRIM(TRAILING 'x' FROM 'xxdatabasexx') || '-';
   ?column?
--------------
 -xxdatabase-
(1 row)
SELECT '-' || TRIM(BOTH 'x' FROM 'xxdatabasexx') || '-';
  ?column?
------------
 -database-
(1 row)
SELECT '-' || TRIM('x' FROM 'xxdatabasexx') || '-';
  ?column?
------------
 -database-
(1 row)
SELECT '-' || TRIM(LEADING FROM '  database  ') || '-';
   ?column?
--------------
 -database  -
(1 row)
SELECT '-' || TRIM('  database  ') || '-';
  ?column?
------------
 -database-
(1 row)
```

See Also

BTRIM (page 262)

LTRIM (page 281)

RTRIM (page 292)

UPPER

Returns a VARCHAR value containing the argument converted to uppercase letters.

Behavior Type

Stable

Syntax

```
UPPER ( expression )
```

Parameters

expression	(CHAR or VARCHAR) is the string to convert

Notes

UPPER is restricted to 32750 octet inputs, since it is possible for the UTF-8 representation of result to double in size.

Examples

```
SELECT UPPER('AbCdEfG');
  upper
----------
 ABCDEFG
(1 row)
SELECT UPPER('étudiant');
  UPPER
----------
 éTUDIANT
(1 row)
```

UPPERB

Returns a character string with each ASCII character converted to uppercase; multibyte UTF-8 characters are not converted.

Behavior Type

Immutable

Syntax

```
UPPERB ( expression )
```

Parameters

expression	(CHAR or VARCHAR) is the string to convert

Examples

In the following example, the multibyte UTF-8 character é is not converted to uppercase:

```
SELECT UPPERB('étudiant');
  UPPERB
----------
 éTUDIANT
(1 row)

SELECT UPPERB('AbCdEfG');
 UPPERB
---------
 ABCDEFG
(1 row)
SELECT UPPERB('The Vertica Database');
        UPPERB
----------------------
 THE VERTICA DATABASE
(1 row)
```

V6_ATON

Converts an IPv6 address represented as a character string to a binary string.

Behavior Type

Immutable

Syntax

```
V6_ATON ( expression )
```

Parameters

expression	(VARCHAR) is the string to convert.

Notes

The following syntax converts an IPv6 address represented as the character string A to a binary string B.

V6_ATON trims any spaces from the right of A and calls the Linux function ***inet_pton http://www.opengroup.org/onlinepubs/000095399/functions/inet_ntop.html***.

```
V6_ATON(VARCHAR A) -> VARBINARY(16) B
```

If A has no colons it is prepended with '::ffff:'. If A is NULL, too long, or if inet_pton returns an error, the result is NULL.

Examples

```
SELECT V6_ATON('2001:DB8::8:800:200C:417A');
                      v6_aton
```

```
-----------------------------------------------------
  \001\015\270\000\000\000\000\000\010\010\000 \014Az
(1 row)
SELECT TO_HEX(V6_ATON('2001:DB8::8:800:200C:417A'));
              to_hex
----------------------------------
 20010db80000000000080800200c417a
(1 row)
SELECT V6_ATON('1.2.3.4');
                             v6_aton
-----------------------------------------------------------------
 \000\000\000\000\000\000\000\000\000\000\377\377\001\002\003\004
(1 row)
SELECT V6_ATON('::1.2.3.4');
                             v6_aton
-----------------------------------------------------------------
 \000\000\000\000\000\000\000\000\000\000\000\000\001\002\003\004
(1 row)
```

See Also

V6_NTOA (page 225)

V6_NTOA

Converts an IPv6 address represented as varbinary to a character string.

Behavior Type

Immutable

Syntax

```
V6_NTOA ( expression )
```

Parameters

expression	(VARBINARY) is the binary string to convert.

Notes

The following syntax converts an IPv6 address represented as VARBINARY B to a string A.

V6_NTOA right-pads B to 16 bytes with zeros, if necessary, and calls the Linux function ***inet_ntop http://www.opengroup.org/onlinepubs/000095399/functions/inet_ntop.html***.

```
V6_NTOA(VARBINARY B) -> VARCHAR A
```

If B is NULL or longer than 16 bytes, the result is NULL.

Vertica automatically converts the form '::ffff:1.2.3.4' to '1.2.3.4'.

Examples

```
SELECT V6_NTOA(' \001\015\270\000\000\000\000\000\010\010\000 \014Az');
          v6_ntoa
---------------------------
 2001:db8::8:800:200c:417a
(1 row)
SELECT V6_NTOA(V6_ATON('1.2.3.4'));
 v6_ntoa
---------
 1.2.3.4
(1 row)
SELECT V6_NTOA(V6_ATON('::1.2.3.4'));
  v6_ntoa
-----------
 ::1.2.3.4
(1 row)
```

See Also

N6_ATON (page 224)

V6_SUBNETA

Calculates a subnet address in CIDR (Classless Inter-Domain Routing) format from a binary or alphanumeric IPv6 address.

Behavior Type

Immutable

Syntax

```
V6_SUBNETA ( expression1, expression2 )
```

Parameters

expression1	(VARBINARY or VARCHAR) is the string to calculate.
expression2	(INTEGER) is the size of the subnet.

Notes

The following syntax calculates a subnet address in CIDR format from a binary or varchar IPv6 address.

V6_SUBNETA masks a binary IPv6 address B so that the N leftmost bits form a subnet address, while the remaining rightmost bits are cleared. It then converts to an alphanumeric IPv6 address, appending a slash and N.

```
V6_SUBNETA(BINARY B, INT8 N) -> VARCHAR C
```

The following syntax calculates a subnet address in CIDR format from an alphanumeric IPv6 address.

```
V6_SUBNETA(VARCHAR A, INT8 N) -> V6_SUBNETA(V6_ATON(A), N) -> VARCHAR C
```

Examples

```
SELECT V6_SUBNETA(V6_ATON('2001:db8::8:800:200c:417a'), 28);
  v6_subneta
---------------
 2001:db0::/28
(1 row)
```

See Also

V6_SUBNETN (page 227)

V6_SUBNETN

Calculates a subnet address in CIDR (Classless Inter-Domain Routing) format from a varbinary or alphanumeric IPv6 address.

Behavior Type

Immutable

Syntax

```
V6_SUBNETN ( expression1, expression2 )
```

Parameters

expression1	(VARBINARY or VARCHAR or INTEGER) is the string to calculate.
expression2	(INTEGER) is the size of the subnet.

Notes

The following syntax masks a BINARY IPv6 address **B** so that the N left-most bits of **S** form a subnet address, while the remaining right-most bits are cleared.

V6_SUBNETN right-pads B to 16 bytes with zeros, if necessary and masks B, preserving its N-bit subnet prefix.

```
V6_SUBNETN(VARBINARY B, INT8 N) -> VARBINARY(16) S
```

If B is NULL or longer than 16 bytes, or if N is not between 0 and 128 inclusive, the result is NULL.

S = [B]/N in ***Classless Inter-Domain Routing http://en.wikipedia.org/wiki/Classless_Inter-Domain_Routing*** notation (CIDR notation).

The following syntax masks an alphanumeric IPv6 address **A** so that the N leftmost bits form a subnet address, while the remaining rightmost bits are cleared.

```
V6_SUBNETN(VARCHAR A, INT8 N) -> V6_SUBNETN(V6_ATON(A), N) -> VARBINARY(16) S
```

Example

```
SELECT V6_SUBNETN(V6_ATON('2001:db8::8:800:200c:417a'), 28);
                          v6_subnetn
------------------------------------------------------------
  \001\015\260\000\000\000\000\000\000\000\000\000\000\000\000
```

See Also

V6_SUBNETA (page 226)

V6_TYPE

Characterizes a binary or alphanumeric IPv6 address B as an integer type.

Behavior Type

Immutable

Syntax

```
V6_TYPE ( expression )
```

Parameters

expression	(VARBINARY or VARCHAR) is the type to convert.

Notes

V6_TYPE(VARBINARY B) returns INT8 T.

```
V6_TYPE(VARCHAR A) -> V6_TYPE(V6_ATON(A)) -> INT8 T
```

The IPv6 types are defined in the Network Working Group's ***IP Version 6 Addressing Architecture memo http://www.ietf.org/rfc/rfc4291.txt***.

```
  GLOBAL = 0       Global unicast addresses
  LINKLOCAL = 1    Link-Local unicast (and Private-Use) addresses
  LOOPBACK = 2     Loopback
  UNSPECIFIED = 3  Unspecified
  MULTICAST = 4    Multicast
```

IPv4-mapped and IPv4-compatible IPv6 addresses are also interpreted, as specified in ***IPv4 Global Unicast Address Assignments http://www.iana.org/assignments/ipv4-address-space***.

- For IPv4, Private-Use is grouped with Link-Local.
- If B is VARBINARY, it is right-padded to 16 bytes with zeros, if necessary.
- If B is NULL or longer than 16 bytes, the result is NULL.

Details

IPv4 (either kind):

```
  0.0.0.0/8        UNSPECIFIED
  10.0.0.0/8       LINKLOCAL
```

```
    127.0.0.0/8       LOOPBACK
    169.254.0.0/16    LINKLOCAL
    172.16.0.0/12     LINKLOCAL
    192.168.0.0/16    LINKLOCAL
    224.0.0.0/4       MULTICAST
    others            GLOBAL
```

IPv6:

```
    ::0/128           UNSPECIFIED
    ::1/128           LOOPBACK
    fe80::/10         LINKLOCAL
    ff00::/8          MULTICAST
    others            GLOBAL
```

Examples

```
SELECT V6_TYPE(V6_ATON('192.168.2.10'));
 v6_type
---------
       1
(1 row)
SELECT V6_TYPE(V6_ATON('2001:db8::8:800:200c:417a'));
 v6_type
---------
       0
(1 row)
```

See Also

INET_ATON (page 222)

IP Version 6 Addressing Architecture http://www.ietf.org/rfc/rfc4291.txt

IPv4 Global Unicast Address Assignments http://www.iana.org/assignments/ipv4-address-space

System Information Functions

These functions provide system information regarding user sessions. The superuser has unrestricted access to all system information, but users can view only information about their own, current sessions.

CURRENT_DATABASE

Returns a VARCHAR value containing the name of the database to which you are connected.

Behavior Type

Immutable

Syntax

```
CURRENT_DATABASE()
```

Notes

The CURRENT_DATABASE function does not require parentheses.

Examples

```
SELECT CURRENT_DATABASE();
 current_database
------------------
 vmartschema
(1 row)
```

The following command returns the same results without the parentheses:

```
SELECT CURRENT_DATABASE;
 current_database
------------------
 vmartschema
(1 row)
```

CURRENT_SCHEMA

Shows the resolved name of $User.

Behavior Type

Stable

Syntax

```
CURRENT_SCHEMA()
```

Notes

If the search path for USER1 is: $USER, COMMON, PUBLIC:

`SELECT CURRENT_SCHEMA()` returns the following output if schema USER1 exists:

```
USER1
```

If schema USER1 does not exist, it returns the following output:

```
COMMON
```

Example

```
SELECT CURRENT_SCHEMA();
 current_schema
----------------
 public
(1 row)
```

CURRENT_USER

Returns a VARCHAR containing the name of the user who initiated the current database connection.

Behavior Type

Stable

Syntax

```
CURRENT_USER()
```

Notes

- The CURRENT_USER function does not require parentheses.
- This function is useful for permission checking and is equivalent to ***SESSION_USER*** (page 312) and ***USER*** (page 313).

Examples

```
SELECT CURRENT_USER();
 current_user
--------------
 dbadmin
(1 row)
```

The following command returns the same results without the parentheses:

```
SELECT CURRENT_USER;
 current_user
--------------
 dbadmin
(1 row)
```

HAS_TABLE_PRIVILEGE

Returns a true/false value indicating whether a user can access a table in a particular way.

Behavior Type

Stable

Syntax

```
HAS_TABLE_PRIVILEGE ( [ user, ] table , privilege )
```

Parameters

user	Specifies the name or OID of a database user. The default is the ***CURRENT_USER*** (page 311).
table	Specifies the name or OID of a table in the logical schema.
privilege	▪ `SELECT` Allows the user to SELECT from any column of the specified table. ▪ `INSERT` Allows the user to INSERT records into the specified table and to use the ***COPY*** (page 497) command to load the table. ▪ `UPDATE` Allows the user to UPDATE records in the specified table. ▪ `DELETE` Allows the user to delete a row from the specified table. ▪ `REFERENCES` Allows the user to create a foreign key constraint (privileges required on both the referencing and referenced tables).

Examples

```
SELECT HAS_TABLE_PRIVILEGE('store.store_dimension', 'SELECT');
 has_table_privilege
---------------------
 t
(1 row)
SELECT HAS_TABLE_PRIVILEGE('release', 'store.store_dimension',
'INSERT');
 has_table_privilege
---------------------
 t
(1 row)
SELECT HAS_TABLE_PRIVILEGE('store.store_dimension', 'UPDATE');
 has_table_privilege
---------------------
 t
(1 row)
SELECT HAS_TABLE_PRIVILEGE('store.store_dimension', 'REFERENCES');
 has_table_privilege
---------------------
 t
(1 row)
SELECT HAS_TABLE_PRIVILEGE(45035996273711159, 45035996273711160,
'select');
 has_table_privilege
---------------------
t
(1 row)
```

SESSION_USER

Returns a VARCHAR containing the name of the user who initiated the current database session.

Behavior Type

Stable

Syntax

```
SESSION_USER()
```

Notes

- The SESSION_USER function does not require parentheses.
- Is equivalent to ***CURRENT_USER*** (page 311) and ***USER*** (page 313).

Examples

```
SELECT SESSION_USER();
 session_user
--------------
 dbadmin
(1 row)
```

The following command returns the same results without the parentheses:

```
SELECT SESSION_USER;
 session_user
--------------
 dbadmin
(1 row)
```

USER

Returns a VARCHAR containing the name of the user who initiated the current database connection.

Behavior Type

Stable

Syntax

```
USER()
```

Notes

- The USER function does not require parentheses.
- Is equivalent to ***CURRENT_USER*** (page 311).

Examples

```
SELECT USER();
 current_user
--------------
 dbadmin
(1 row)
```

The following command returns the same results without the parentheses:

```
SELECT USER;
```

```
 current_user
--------------
 dbadmin
(1 row)
```

VERSION

Returns a VARCHAR containing a Vertica node's version information.

Behavior Type

Stable

Syntax

```
VERSION()
```

Examples

```
SELECT VERSION();
                      VERSION
-------------------------------------------------
 Vertica Analytic Database v4.0.12-20100513010203
(1 row)
```

The parentheses are required. If you omit them, the system returns an error:

```
SELECT VERSION;
ERROR:  column "version" does not exist
```

Timeseries Aggregate (TSA) Functions

Time series functions evaluate the values of a given set of variables over time and group those values into a window for analysis and aggregation.

One output row is produced per time slice—or per partition per time slice—if partition expressions are present.

See Also

TIMESERIES Clause (page 623)

CONDITIONAL_CHANGE_EVENT (page 129) and ***CONDITIONAL_TRUE_EVENT*** (page 130)

Using Time Series Analytics in the Programmer's Guide

TS_FIRST_VALUE

Processes the data that belongs to each time slice. A time series aggregate (TSA) function, TS_FIRST_VALUE returns the value at the start of the time slice, where an interpolation scheme is applied if the timeslice is missing, in which case the value is determined by the values corresponding to the previous (and next) timeslices based on the interpolation scheme of const (linear). There is one value per time slice per partition.

Behavior Type

Immutable

Syntax

```
TS_FIRST_VALUE ( expression [ IGNORE NULLS ]
... [, { 'CONST' | 'LINEAR' } ] )
```

Parameters

expression	Is the argument expression on which to aggregate and interpolate. *expression* is data type INTEGER or FLOAT.
IGNORE NULLS	The IGNORE NULLS behavior changes depending on a CONST or LINEAR interpolation scheme. See When Time Series Data Contains Nulls in the Programmer's Guide for details.
'CONST' | 'LINEAR'	Optionally specifies the interpolation value as either constant or linear. The default is constant. If omitted, Vertica defaults to CONST, but you can also specify CONST.

Notes

- The function returns one output row per time slice or one output row per partition per time slice if partition expressions are specified.
- Multiple time series aggregate functions can exists in the same query. They share the same gap-filling policy as defined by the ***TIMESERIES clause*** (page 623); however, each time series aggregate function can specify its own interpolation policy. For example:

```
SELECT slice_time, symbol,
       TS_FIRST_VALUE(bid, 'const') fv_c,
       TS_FIRST_VALUE(bid, 'linear') fv_l,
       TS_LAST_VALUE(bid, 'const') lv_c
FROM TickStore
TIMESERIES slice_time AS '3 seconds' OVER(PARTITION BY symbol ORDER BY ts);
```

- You must use an ORDER BY clause with a timestamp column.

Example

For detailed examples, see Gap Filling and Interpolation and When Time Series Data Contains Nulls in the Programmer's Guide.

See Also

TIMESERIES Clause (page 623) and ***TS_LAST_VALUE*** (page 316)

Using Time Series Analytics in the Programmer's Guide

TS_LAST_VALUE

Processes the data that belongs to each time slice. A time series aggregate (TSA) function, TS_LAST_VALUE returns the value at the end of the time slice, where an interpolation scheme is applied if the timeslice is missing, in which case the value is determined by the values corresponding to the previous (and next) timeslices based on the interpolation scheme of const (linear). There is one value per time slice per partition.

Behavior Type

Immutable

Syntax

```
TS_LAST_VALUE ( expression [ IGNORE NULLS ]
... [, { 'CONST' | 'LINEAR' } ] )
```

Parameters

expression	Is the argument expression on which to aggregate and interpolate. *expression* is data type INTEGER or FLOAT.
IGNORE NULLS	The IGNORE NULLS behavior changes depending on a CONST or LINEAR interpolation scheme. See When Time Series Data Contains Nulls in the Programmer's Guide for details.
'CONST' | 'LINEAR'	Optionally specifies the interpolation value as either constant or linear. The default is constant. If omitted, Vertica defaults to CONST, but you can also specify CONST.

Notes

- The function returns one output row per time slice or one output row per partition per time slice if partition expressions are specified.
- Multiple time series aggregate functions can exists in the same query. They share the same gap-filling policy as defined by the ***TIMESERIES clause*** (page 623); however, each time series aggregate function can specify its own interpolation policy. For example:

```
SELECT slice_time, symbol,
       TS_FIRST_VALUE(bid, 'const') fv_c,
       TS_FIRST_VALUE(bid, 'linear') fv_l,
       TS_LAST_VALUE(bid, 'const') lv_c
FROM TickStore
TIMESERIES slice_time AS 3 seconds OVER(PARTITION BY symbol ORDER BY ts);
```

- If you use the window_order_clause, you can order by a TIMESTAMP column only, not, for example, an by an INTEGER column.

Example

For detailed examples, see Gap Filling and Interpolation and When Time Series Data Contains Nulls in the Programmer's Guide.

See Also

TIMESERIES Clause (page 623) and ***TS_FIRST_VALUE*** (page 314)

Using Time Series Analytics in the Programmer's Guide

Vertica Functions

The functions in this section are used to query or change the internal state of Vertica and are not part of the SQL standard. Since these meta-functions access internal data structures, they cannot be called in DML, DDL, or `SELECT` queries.

The behavior type of Vertica built-in functions is immutable.

Alphabetical List of Vertica Functions

This section contains all Vertica-specific functions, listed alphabetically, as in previous releases. Each function is also grouped into the appropriate category; for example:

- ***Catalog management functions*** (page 395)
- ***Constraint management functions*** (page 401)
- ***Database management functions*** (page 411)
- ***Epoch management functions*** (page 418)
- ***Partition management functions*** (page 424)
- ***Projection management functions*** (page 432)
- ***Purge functions*** (page 440)
- ***Regular expression functions*** (page 442)
- ***Session management functions*** (page 455)
- ***Statistic management functions*** (page 465)
- ***Storage management functions*** (page 469)
- ***Tuple Mover functions*** (page 475)

ADD_LOCATION

Adds a location to store data.

Syntax

```
ADD_LOCATION ( path , [ node , usage_string ] )
```

Parameters

path	Specifies where the storage location is mounted. Path must be an empty directory with write permissions for user, group, or all.
node	Is the Vertica node where the location is available. If this parameter is omitted, *node* defaults to the initiator.
usage_string	Is one of the following: ▪ DATA: Only data is stored in the location. ▪ TEMP: Only temporary files that are created during loads or queries are stored in the location. ▪ DATA,TEMP: Both types of files are stored in the location.

	If this parameter is omitted, the default is DATA,TEMP.

Notes

- By default, the location is used to store both data and temporary files.
- Locations can be added from any node to any node.
- Either node and usage_string must both be specified or neither of them specified.
- Information about storage locations is visible ***V_MONITOR.DISK_STORAGE*** (page 699).
- A storage location annotation called CATALOG indicates the location is used to store the catalog and is visible in V_MONITOR.DISK_STORAGE. However, no new locations can be added, as CATALOG locations and existing CATALOG annotations cannot be removed.

Example

This example adds a location that stores data and temporary files:

```
SELECT ADD_LOCATION('/secondVerticaStorageLocation/');
```

This example adds a location to store data only:

```
SELECT ADD_LOCATION('/secondVerticaStorageLocation/' , 'node2' , 'DATA');
```

See Also

ALTER_LOCATION_USE (page 320)

RETIRE_LOCATION (page 388)

ADVANCE_EPOCH

Manually closes the current epoch and begins a new epoch.

Syntax

```
ADVANCE_EPOCH ( [ integer ] )
```

Parameters

integer	Specifies the number of epochs to advance. If the EpochAdvancementMode parameter is set to DML (the default), the number of epochs to advance defaults to zero (0). If the EpochAdvancementMode is set to AdvanceEpochInterval, the number of epochs to advance defaults to one(1). Note that the AdvanceEpochInterval parameter is ignored by default. See Configuration Parameters in the Administrator's Guide for more information about the EpochAdvancementMode parameter.

Note

This function is primarily maintained for backward compatibility with earlier versions of Vertica that advance epochs based on the ADVANCEEPOCHINTERVAL.

Example

The following command increments the epoch number by 1:

```
=> SELECT ADVANCE_EPOCH(1);
```

See Also

ALTER PROJECTION (page 479)

ALTER_LOCATION_USE

Alters the type of files stored in the specified storage location.

Syntax

```
ALTER_LOCATION_USE ( path , [ node ] , usage_string )
```

Parameters

path	Specifies where the storage location is mounted.
node	[Optional] Is the Vertica node where the location is available. If this parameter is omitted, *node* defaults to the initiator.
usage_string	Is one of the following: ▪ DATA: Only data is stored in the location. ▪ TEMP: Only temporary files that are created during loads or queries are stored in the location. ▪ DATA,TEMP: Both types of files are stored in the location.

Notes

- Altering the type of files stored in a particular location is useful if you create additional storage locations and you want to isolate execution engine temporary files from data files.
- After modifying the location's use, at least one location must remain for storing data and temp files. These files can be stored in the same storage location or separate storage locations.
- When a storage location is altered, it stores only the type of information indicated from that point forward. For example:
  - If you modify a storage location that previously stored both temp and data files so that it only stores temp files, the data is eventually merged out through the ATM. You can also merge it out manually.
  - If you modify a storage location that previously stored both temp and data files so that it only stores data files, all currently running statements that use these temp files, such as queries and loads, continue to run. Subsequent statements will no longer use this location.

Example

The following example alters the storage location on node3 to store data only:

```
=> SELECT ALTER_LOCATION_USE ('/thirdVerticaStorageLocation/' , 'node3' ,
'DATA');
```

See Also

ADD_LOCATION (page 318)

RETIRE_LOCATION (page 388)

Modifying Storage Locations in the Administrator's Guide

ANALYZE_CONSTRAINTS

Analyzes and reports on constraint violations within the current schema search path.

You can check for constraint violations by passing an empty argument (which returns violations on all tables within the current schema), by passing a single table argument, or by passing two arguments containing a table name and a column or list of columns.

Syntax

```
ANALYZE_CONSTRAINTS [ ( '' )
... | ( schema.table )
... | [ ( schema.table , column ) ]
```

Parameters

`('')`	Analyzes and reports on all tables within the current schema search path.
table	Analyzes and reports on all constraints referring to the specified table.
column	Analyzes and reports on all constraints referring to specified table that contains the specified columns.

Notes

- ANALYZE_CONSTRAINTS(), takes locks in the same way that `SELECT * FROM t1` holds a lock on table `t1`. See ***LOCKS*** (page 712) for additional information.
- Use ***COPY*** (page 497) with NO COMMIT keywords to incorporate detection of constraint violations into the load process. Vertica checks for constraint violations when queries are run, not when data is loaded. To avoid constraint violations, load data without committing it and then perform a post-load check of your data using the ANALYZE_CONSTRAINTS function. If the function finds constraint violations, you can roll back the load because you have not committed it.
- ANALYZE_CONSTRAINTS() fails if the database cannot perform constraint checks, such as when the system is out of resources. Vertica returns an error that identifies the specific condition that caused the failure.
- When ANALYZE_CONSTRAINTS finds violations, such as when you insert a duplicate value into a primary key, you can correct errors using the following functions. Effects last until the end of the session only:
  - SELECT ***DISABLE_DUPLICATE_KEY_ERROR*** (page 336)
  - SELECT ***REENABLE_DUPLICATE_KEY_ERROR*** (page 373)
- If you specify the wrong table, the system returns an error message:

```
SELECT ANALYZE_CONSTRAINTS('abc');
ERROR: 'abc' is not a table in the current search path
```

- If you issue the function using incorrect syntax, the system returns an error message with a hint:

```
ANALYZE ALL CONSTRAINT;
```

  Or

```
ANALYZE CONSTRAINT abc;
ERROR: ANALYZE CONSTRAINT is not supported.
HINT: You may consider using analyze_constraints().
```

- ANALYZE_CONSTRAINTS returns an error if run from a non-default locale; for example:

```
=> \locale LEN
INFO:  Canonical locale: 'en'
INFO:    English
INFO:  Standard collation: 'LEN'
=> SELECT ANALYZE_CONSTRAINTS('t1');
ERROR:  ANALYZE_CONSTRAINTS is currently not supported in non-default
   locales
HINT:  Set the locale in this session to en_US@collation=binary using
   the
command "\locale en_US@collation=binary"
```

Return Values

ANALYZE_CONSTRAINTS() returns results in a structured set (see table below) that lists the schema name, table name, column name, constraint name, constraint type, and the column values that caused the violation.

If the result set is empty, then no constraint violations exist; for example:

```
SELECT ANALYZE_CONSTRAINTS ('public.product_dimension', 'product_key');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+---------------
(0 rows)
```

The following result set, on the other hand, shows a primary key violation, along with the value that caused the violation (`'10'`):

```
SELECT ANALYZE_CONSTRAINTS ('');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+---------------
 store         t1           c1             pk_t1             PRIMARY           ('10')
(1 row)
```

The result set columns are described in further detail in the following table:

Column Name	Data Type	Description
`Schema Name`	VARCHAR	The name of the schema.
`Table Name`	VARCHAR	The name of the table, if specified.

`Column Names`	VARCHAR	Names of columns containing constraints. Multiple columns are in a comma-separated list:
		`store_key,`
		`store_key, date_key,`

`Constraint Name`	VARCHAR	The given name of the primary key, foreign key, unique, or not null constraint, if specified.
`Constraint Type`	VARCHAR	Identified by one of the following strings: 'PRIMARY KEY', 'FOREIGN KEY', 'UNIQUE', or 'NOT NULL'.

`Column Values`	VARCHAR	Value of the constraint column, in the same order in which `Column Names` contains the value of that column in the violating row.
		When interpreted as SQL, the value of this column forms a list of values of the same type as the columns in `Column Names`; for example:
		`('1'),`
		`('1', 'z')`

Examples

Given the following inputs, Vertica returns one row, indicating one violation, because the same primary key value (10) was inserted into table t1 twice:

```
CREATE TABLE t1(c1 INT);
ALTER TABLE t1 ADD CONSTRAINT pk_t1 PRIMARY KEY (c1);
CREATE PROJECTION t1_p (c1) AS SELECT * FROM t1 UNSEGMENTED ALL NODES;
INSERT INTO t1 values (10);
INSERT INTO t1 values (10); --Duplicate primary key value
SELECT ANALYZE_CONSTRAINTS('t1');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+---------------
 public        t1           c1             pk_t1             PRIMARY           ('10')
(1 row)
```

If the second INSERT statement above had contained any different value, the result would have been 0 rows (no violations).

In this example, create a table that contains 3 integer columns, one a unique key and one a primary key:

```
CREATE TABLE fact_1(
  f INTEGER,
  f_UK INTEGER UNIQUE,
  f_PK  INTEGER PRIMARY KEY
);
```

Try issuing a command that refers to a nonexistent column:

```
SELECT ANALYZE_CONSTRAINTS('f_BB', 'f2');
ERROR: 'f_BB' is not a table name in the current search path
```

Insert some values into table `fact_1` and commit the changes:

```
INSERT INTO fact_1 values (1, 1, 1);
COMMIT;
```

Now issue the ANALYZE_CONSTRAINTS command on table `fact_1`. No constraint violations are expected and none are found:

```
SELECT ANALYZE_CONSTRAINTS('fact_1');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+---------------
(0 rows)
```

Now insert duplicate unique and primary key values and run ANALYZE_CONSTRAINTS on table `fact_1` again. The system shows two violations: one against the primary key and one against the unique key:

```
INSERT INTO fact_1 VALUES (1, 1, 1);
COMMIT;
SELECT ANALYZE_CONSTRAINTS('fact_1');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+---------------
 public      | fact_1     | f_pk         | -               | PRIMARY         | ('1')
 public      | fact_1     | f_uk         | -               | UNIQUE          | ('1')
(2 rows)
```

The following command looks for constraint validation on only the unique key in table `fact_1`:

```
SELECT ANALYZE_CONSTRAINTS('fact_1', 'f_UK');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+---------------
 public      | fact_1     | f_uk         | C_UNIQUE        | UNIQUE          | ('1')
(1 row)
```

The following example shows that you can specify the same column more than once; the function, however, returns the violation once only:

```
SELECT ANALYZE_CONSTRAINTS('fact_1', 'f_PK, F_PK');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+---------------
 public      | fact_1     | f_pk         | C_PRIMARY       | PRIMARY         | ('1')
(1 row)
```

The following example creates a new dimension table, `dim_1`, and inserts a foreign key and different (character) data types:

```
CREATE TABLE dim_1 (b VARCHAR(3), b_PK VARCHAR(4), b_FK INTEGER REFERENCES fact_1(f_PK));
```

Alter the table to create a multicolumn unique key and multicolumn foreign key and create superprojections:

```
ALTER TABLE dim_1 ADD CONSTRAINT dim_1_multiuk PRIMARY KEY (b, b_PK);
```

The following command inserts a missing foreign key (0) in table `dim_1` and commits the changes:

```
INSERT INTO dim_1 VALUES ('r1', 'Xpk1', 0);
COMMIT;
```

Checking for constraints on table `dim_1` detects a foreign key violation:

```
SELECT ANALYZE_CONSTRAINTS('dim_1');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+---------------
 public      | dim_1      | b_fk         | C_FOREIGN       | FOREIGN         | ('0')
(1 row)
```

Now add a duplicate value into the unique key and commit the changes:

```
INSERT INTO dim_1 values ('r2', 'Xpk1', 1);
INSERT INTO dim_1 values ('r1', 'Xpk1', 1);
COMMIT;
```

Checking for constraint violations on table `dim_1` detects the duplicate unique key error:

```
SELECT ANALYZE_CONSTRAINTS('dim_1');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+----------------
 public      | dim_1      | b, b_pk      | dim_1_multiuk   | PRIMARY         | ('r1', 'Xpk1')
 public      | dim_1      | b_fk         | C_FOREIGN       | FOREIGN         | ('0')
(2 rows)
```

Now create a table with multicolumn foreign key and create the superprojections:

```
CREATE TABLE dim_2(z_fk1 VARCHAR(3), z_fk2 VARCHAR(4));
ALTER TABLE dim_2 ADD CONSTRAINT dim_2_multifk FOREIGN KEY (z_fk1, z_fk2) REFERENCES dim_1(b, b_PK);
```

Now insert a foreign key that matches a foreign key in table dim_1 and commit the changes:

```
INSERT INTO dim_2 VALUES ('r1', 'Xpk1');
COMMIT;
```

Checking for constraints on table `dim_2` detects no violations:

```
SELECT ANALYZE_CONSTRAINTS('dim_2');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+---------------
(0 rows)
```

Add a value that does not match and commit the change:

```
INSERT INTO dim_2 values ('r1', 'NONE');
COMMIT;
```

Checking for constraints on table `dim_2` detects a foreign key violation:

```
SELECT ANALYZE_CONSTRAINTS('dim_2');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+----------------
 public      | dim_2      | z_fk1, z_fk2 | dim_2_multifk   | FOREIGN         | ('r1', 'NONE')
(1 row)
```

Now analyze all constraints on all tables:

```
SELECT ANALYZE_CONSTRAINTS('');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+----------------
 public      | dim_1      | b, b_pk      | dim_1_multiuk   | PRIMARY         | ('r1', 'Xpk1')
 public      | dim_1      | b_fk         | C_FOREIGN       | FOREIGN         | ('0')
 public      | dim_2      | z_fk1, z_fk2 | dim_2_multifk   | FOREIGN         | ('r1', 'NONE')
 public      | fact_1     | f_pk         | C_PRIMARY       | PRIMARY         | ('1')
 public      | fact_1     | f_uk         | C_UNIQUE        | UNIQUE          | ('1')
```

```
(5 rows)
```

To quickly clean up your database, issue the following command:

```
DROP TABLE fact_1 cascade;
DROP TABLE dim_1 cascade;
DROP TABLE dim_2 cascade;
```

To learn how to remove violating rows, see the ***DISABLE_DUPLICATE_KEY_ERROR*** (page 336) function.

See Also

Adding Constraints in the Administrator's Guide

COPY (page 497)

ALTER TABLE (page 488)

CREATE TABLE (page 546)

ANALYZE_STATISTICS

Collects and aggregates data samples and storage information as a background process from all nodes on which a projection is stored, then writes statistics into the catalog so that the statistics can be used by the query optimizer. Without these statistics, the query optimizer would assume uniform distribution of data values and equal storage usage for all projections.

Syntax

```
ANALYZE_STATISTICS { ( '' )
... | ( '[ schema.]table' )
... | ( 'projection' ) }
... | ( 'column-name' )
```

Return Value

- 0 - For success.
- 1 - For failure. Refer to `vertica.log` for details.

Parameters

`''`	Empty string. Collects statistics for all projections.
[schema.]table	Specifies the name of the table and optional schema. When using more than one schema, specify the schema that contains the projection. Collects statistics for all projections of the specified table.
projection	Specifies the name of the projection. Collects statistics for the specified projection as well as all the projections with the same anchor table.
column-name	Specifies the name of a single table column. Collects statistics for the specified column as well as all the projections with the same anchor table.

Notes

Issuing the command against very large tables/projections could return results more slowly. To return results more quickly, you could issue the command against a single column.

Example

The examples use the Vmart example database.

The following command computes statistics on all projections in the database and returns 0 (success):

```
=> SELECT ANALYZE_STATISTICS ('');
 analyze_statistics
--------------------
                  0
(1 row)
```

The following command computes statistics on the `shipping_dimension` table and returns 0 (success):

```
=> SELECT ANALYZE_STATISTICS ('shipping_dimension');
 analyze_statistics
--------------------
                  0
(1 row)
```

The following command computes statistics on one of the `shipping_dimension` table's projections and returns 0 (success):

```
=> SELECT ANALYZE_STATISTICS('shipping_dimension_site02'); analyze_statistics
--------------------
                  0
(1 row)
```

The following command computes statistics on the `shipping_dimension` table's `shipping_key` column for all projections and returns 0 (success):

```
=> SELECT ANALYZE_STATISTICS('shipping_dimension.shipping_key');
analyze_statistics
--------------------
                  0
(1 row)
```

For use cases, see Collecting Statistics in the Administrator's Guide

See Also

DROP_STATISTICS (page 343)

EXPORT_STATISTICS (page 353)

IMPORT_STATISTICS (page 362)

CLEAR_QUERY_REPOSITORY

Triggers Vertica to clear query data from the query repository immediately.

Syntax

```
CLEAR_QUERY_REPOSITORY()
```

Notes

Before using this function:

1. Note the value of the QueryRepoRetentionTime parameter.
2. Set the QueryRepoRetentionTime parameter to zero (0). (See Configuring Query Repository in the Troubleshooting Guide.)

   ```
   => SELECT SET_CONFIG_PARAMETER('QueryRepoRetentionTime','0');
   ```

Once you have cleared the query repository, set the QueryRepoRetentionTime parameter back to the original value (before you changed it to zero). The default value is 100.

Example

```
SELECT CLEAR_QUERY_REPOSITORY();
  CLEAR_QUERY_REPOSITORY
-------------------------
 Query Repository Cleaned
(1 row)
```

See Also

Collecting Query Information in the Troubleshooting Guide

Configuration Parameters in the Administrator's Guide

CLEAR_PROJECTION_REFRESHES

Triggers Vertica to clear information about refresh operations for projections immediately.

Syntax

```
CLEAR_PROJECTION_REFRESHES()
```

Notes

Information about a refresh operation—whether successful or unsuccessful—is maintained in the ***PROJECTION_REFRESHES*** (page 717) system table until either the ***CLEAR_PROJECTION_REFRESHES*** (page 329)() function is executed or the storage quota for the table is exceeded. The `PROJECTION_REFRESHES.IS_EXECUTING` column returns a boolean value that indicates whether the refresh is currently running (t) or occurred in the past (f).

Example

To immediately purge projection refresh history, use the CLEAR_PROJECTION_REFRESHES() function:

```
=> SELECT CLEAR_PROJECTION_REFRESHES();
 CLEAR_PROJECTION_REFRESHES
----------------------------
 CLEAR
(1 row)
```

Only the rows where the `PROJECTION_REFRESHES.IS_EXECUTING` column equals false are cleared.

See Also

PROJECTION_REFRESHES (page 717)

REFRESH (page 373)

START_REFRESH (page 394)

Clearing PROJECTION_REFRESHES History in the Administrator's Guide

CLEAR_RESOURCE_REJECTIONS

Clears the content of the ***RESOURCE_REJECTIONS*** (page 735) and ***DISK_RESOURCE_REJECTIONS*** (page 698) system tables. Normally, these tables are only cleared during a node restart. This function lets you clear the tables whenever you need. For example, you may want to clear the tables after having resolved a disk space issue that caused disk resource rejections.

CLOSE_SESSION

Interrupts the specified external session and rolls back the current transaction, if any, and closes the socket.

Syntax

```
CLOSE_SESSION ( sessionid )
```

Parameters

sessionid	A string that specifies the session to close. This identifier is unique within the cluster at any point in time but can be reused when the session closes.

Notes

- Closing of the session is processed asynchronously. It could take some time for the session to be closed. Check the ***SESSIONS*** (page 741) table for the status.
- Database shutdown is prevented if new sessions connect after the CLOSE_SESSION() command is invoked (and before the database is actually shut down. See **Controlling Sessions** below.

Messages

The following are the messages you could encounter:

- For a badly formatted sessionID
  ```
  close_session | Session close command sent. Check SESSIONS for progress.
  Error: invalid Session ID format
  ```
- For an incorrect sessionID parameter
  ```
  Error: Invalid session ID or statement key
  ```

Examples

User session opened. RECORD 2 shows the user session running COPY DIRECT statement.

```
vmartdb=> SELECT * FROM sessions;
-[ RECORD 1 ]--------------+-------------------------------------------------
node_name                  | v_vmartdb_node0001
user_name                  | dbadmin
client_hostname            | 127.0.0.1:52110
client_pid                 | 4554
login_timestamp            | 2011-01-03 14:05:40.252625-05
session_id                 | stress04-4325:0x14
client_label               |
transaction_start          | 2011-01-03 14:05:44.325781
```

```
transaction_id             | 45035996273728326
transaction_description    | user dbadmin (SELECT * FROM sessions;)
statement_start            | 2011-01-03 15:36:13.896288
statement_id               | 10
last_statement_duration_us | 14978
current_statement          | select * from sessions;
ssl_state                  | None
authentication_method      | Trust
-[ RECORD 2 ]--------------+-------------------------------------------------
node_name                  | v_vmartdb_node0002
user_name                  | dbadmin
client_hostname            | 127.0.0.1:57174
client_pid                 | 30117
login_timestamp            | 2011-01-03 15:33:00.842021-05
session_id                 | stress05-27944:0xc1a
client_label               |
transaction_start          | 2011-01-03 15:34:46.538102
transaction_id             | -1
transaction_description    | user dbadmin (COPY ClickStream_Fact FROM
                             '/data/clickstream/1g/ClickStream_Fact.tbl'
                             DELIMITER '|' NULL '\\n' DIRECT;)
statement_start            | 2011-01-03 15:34:46.538862
statement_id               |
last_statement_duration_us | 26250
current_statement          | COPY ClickStream_Fact FROM '/data/clickstream
                             /1g/ClickStream_Fact.tbl' DELIMITER '|' NULL
                             '\\n' DIRECT;
ssl_state                  | None
authentication_method      | Trust
```

Close user session stress05-27944:0xc1a

```
vmartdb=> \x
Expanded display is off.
vmartdb=> SELECT CLOSE_SESSION('stress05-27944:0xc1a');
                          CLOSE_SESSION
-----------------------------------------------------------------------
 Session close command sent. Check v_monitor.sessions for progress.
(1 row)
```

Query the sessions table again for current status, and you can see that the second session has been closed:

```
=> SELECT * FROM SESSIONS;
-[ RECORD 1 ]--------------+-------------------------------------------
node_name                  | v_vmartdb_node0001
user_name                  | dbadmin
client_hostname            | 127.0.0.1:52110
client_pid                 | 4554
login_timestamp            | 2011-01-03 14:05:40.252625-05
session_id                 | stress04-4325:0x14
client_label               |
transaction_start          | 2011-01-03 14:05:44.325781
transaction_id             | 45035996273728326
transaction_description    | user dbadmin (select * from SESSIONS;)
statement_start            | 2011-01-03 16:12:07.841298
```

```
statement_id                | 20
last_statement_duration_us | 2099
current_statement           | SELECT * FROM SESSIONS;
ssl_state                   | None
authentication_method       | Trust
```

Controlling Sessions

The database administrator must be able to disallow new incoming connections in order to shut down the database. On a busy system, database shutdown is prevented if new sessions connect after the CLOSE_SESSION or CLOSE_ALL_SESSIONS() command is invoked — and before the database actually shuts down.

One option is for the administrator to issue the `SHUTDOWN('true')` command, which forces the database to shut down and disallow new connections. See ***SHUTDOWN*** (page 393) in the SQL Reference Manual.

Another option is to modify the `MaxClientSessions` parameter from its original value to 0, in order to prevent new non-dbadmin users from connecting to the database.

1. Determine the original value for the `MaxClientSessions` parameter by querying the V_MONITOR.***CONFIGURATIONS_PARAMETERS*** (page 693) system table:

   ```
   => SELECT CURRENT_VALUE FROM CONFIGURATION_PARAMETERS WHERE
      parameter_name='MaxClientSessions';
    CURRENT_VALUE
   ---------------
    50
   (1 row)
   ```

2. Set the `MaxClientSessions` parameter to 0 to prevent new non-dbadmin connections:

   ```
   => SELECT SET_CONFIG_PARAMETER('MaxClientSessions', 0);
   ```

   Note: The previous command allows up to five administrators to log in.

3. Issue the `CLOSE_ALL_SESSIONS`() command to remove existing sessions:

   ```
   => SELECT CLOSE_ALL_SESSIONS();
   ```

4. Query the `SESSIONS` table:

   ```
   => SELECT * FROM SESSIONS;
   ```

   When the session no longer appears in the `SESSIONS` table, disconnect and run the Stop Database command.

5. Restart the database.
6. Restore the `MaxClientSessions` parameter to its original value:

   ```
   => SELECT SET_CONFIG_PARAMETER('MaxClientSessions', 50);
   ```

See Also

CLOSE_ALL_SESSIONS (page 333), ***CONFIGURATION_PARAMETERS*** (page 693), ***SESSIONS*** (page 741), ***SHUTDOWN*** (page 393)

Managing Sessions and Configuration Parameters in the Administrator's Guide

Shutdown Problems in the Troubleshooting Guide

CLOSE_ALL_SESSIONS

Closes all external sessions except the one issuing the CLOSE_ALL_SESSIONS functions.

Syntax

```
CLOSE_ALL_SESSIONS()
```

Notes

Closing of the sessions is processed asynchronously. It might take some time for the session to be closed. Check the ***SESSIONS*** (page 741) table for the status.

Database shutdown is prevented if new sessions connect after the CLOSE_SESSION or CLOSE_ALL_SESSIONS() command is invoked (and before the database is actually shut down). See **Controlling Sessions** below.

Message

```
close_all_sessions | Close all sessions command sent.
Check SESSIONS for progress.
```

Examples

Two user sessions opened, each on a different node:

```
vmartdb=> SELECT * FROM sessions;
-[ RECORD 1
]-------------+-----------------------------------------------------
node_name                   | v_vmartdb_node0001
user_name                   | dbadmin
client_hostname             | 127.0.0.1:52110
client_pid                  | 4554
login_timestamp             | 2011-01-03 14:05:40.252625-05
session_id                  | stress04-4325:0x14
client_label                |
transaction_start           | 2011-01-03 14:05:44.325781
transaction_id              | 45035996273728326
transaction_description     | user dbadmin (select * from sessions;)
statement_start             | 2011-01-03 15:36:13.896288
statement_id                | 10
last_statement_duration_us | 14978
current_statement           | select * from sessions;
ssl_state                   | None
authentication_method       | Trust
-[ RECORD 2
]-------------+-----------------------------------------------------
node_name                   | v_vmartdb_node0002
user_name                   | dbadmin
client_hostname             | 127.0.0.1:57174
client_pid                  | 30117
login_timestamp             | 2011-01-03 15:33:00.842021-05
session_id                  | stress05-27944:0xc1a
```

```
client_label                |
transaction_start           | 2011-01-03 15:34:46.538102
transaction_id              | -1
transaction_description     | user dbadmin (COPY Mart_Fact FROM
'/data/mart_Fact.tbl'
                              DELIMITER '|' NULL '\\n';)
statement_start             | 2011-01-03 15:34:46.538862
statement_id                |
last_statement_duration_us | 26250
current_statement           | COPY Mart_Fact FROM '/data/Mart_Fact.tbl' DELIMITER
'|'
                              NULL '\\n';
ssl_state                   | None
authentication_method       | Trust
-[ RECORD 3
]--------------+-----------------------------------------------------
node_name                   | v_vmartdb_node0003
user_name                   | dbadmin
client_hostname             | 127.0.0.1:56367
client_pid                  | 1191
login_timestamp             | 2011-01-03 15:31:44.939302-05
session_id                  | stress06-25663:0xbec
client_label                |
transaction_start           | 2011-01-03 15:34:51.05939
transaction_id              | 54043195528458775
transaction_description     | user dbadmin (COPY Mart_Fact FROM
'/data/Mart_Fact.tbl'
                              DELIMITER '|' NULL '\\n' DIRECT;)
statement_start             | 2011-01-03 15:35:46.436748
statement_id                |
last_statement_duration_us | 1591403
current_statement           | COPY Mart_Fact FROM '/data/Mart_Fact.tbl' DELIMITER
'|'
                              NULL '\\n' DIRECT;
ssl_state                   | None
authentication_method       | Trust
```

Close all sessions:

```
vmartdb=> \x
Expanded display is off.
vmartdb=> SELECT CLOSE_ALL_SESSIONS();
                          CLOSE_ALL_SESSIONS
-------------------------------------------------------------------------
 Close all sessions command sent. Check v_monitor.sessions for progress.
(1 row)
```

Sessions contents after issuing the CLOSE_ALL_SESSIONS() command:

```
=> SELECT * FROM SESSIONS;
-[ RECORD 1 ]--------------+---------------------------------------
node_name                  | v_vmartdb_node0001
user_name                  | dbadmin
client_hostname            | 127.0.0.1:52110
client_pid                 | 4554
```

```
login_timestamp            | 2011-01-03 14:05:40.252625-05
session_id                 | stress04-4325:0x14
client_label               |
transaction_start          | 2011-01-03 14:05:44.325781
transaction_id             | 45035996273728326
transaction_description    | user dbadmin (SELECT * FROM sessions;)
statement_start            | 2011-01-03 16:19:56.720071
statement_id               | 25
last_statement_duration_us | 15605
current_statement          | SELECT * FROM SESSIONS;
ssl_state                  | None
authentication_method      | Trust
```

Controlling Sessions

The database administrator must be able to disallow new incoming connections in order to shut down the database. On a busy system, database shutdown is prevented if new sessions connect after the CLOSE_SESSION or CLOSE_ALL_SESSIONS() command is invoked — and before the database actually shuts down.

One option is for the administrator to issue the `SHUTDOWN('true')` command, which forces the database to shut down and disallow new connections. See ***SHUTDOWN*** (page 393) in the SQL Reference Manual.

Another option is to modify the `MaxClientSessions` parameter from its original value to 0, in order to prevent new non-dbadmin users from connecting to the database.

1. Determine the original value for the `MaxClientSessions` parameter by querying the V_MONITOR.***CONFIGURATIONS_PARAMETERS*** (page 693) system table:

   ```
   => SELECT CURRENT_VALUE FROM CONFIGURATION_PARAMETERS WHERE
      parameter_name='MaxClientSessions';
    CURRENT_VALUE
   ---------------
    50
   (1 row)
   ```

2. Set the `MaxClientSessions` parameter to 0 to prevent new non-dbadmin connections:

   ```
   => SELECT SET_CONFIG_PARAMETER('MaxClientSessions', 0);
   ```

   Note: The previous command allows up to five administrators to log in.

3. Issue the `CLOSE_ALL_SESSIONS`() command to remove existing sessions:

   ```
   => SELECT CLOSE_ALL_SESSIONS();
   ```

4. Query the `SESSIONS` table:

   ```
   => SELECT * FROM SESSIONS;
   ```

   When the session no longer appears in the `SESSIONS` table, disconnect and run the Stop Database command.

5. Restart the database.

6. Restore the `MaxClientSessions` parameter to its original value:

   ```
   => SELECT SET_CONFIG_PARAMETER('MaxClientSessions', 50);
   ```

See Also

CLOSE_SESSION (page 330), ***CONFIGURATION_PARAMETERS*** (page 693), ***SESSIONS*** (page 741), ***SHUTDOWN*** (page 393)

Managing Sessions and Configuration Parameters in the Administrator's Guide

Shutdown Problems in the Troubleshooting Guide

CURRENT_SCHEMA

Shows the resolved name of $User.

Behavior Type

Stable

Syntax

```
CURRENT_SCHEMA()
```

Notes

If the search path for USER1 is: $USER, COMMON, PUBLIC:

`SELECT CURRENT_SCHEMA()` returns the following output if schema USER1 exists:

```
USER1
```

If schema USER1 does not exist, it returns the following output:

```
COMMON
```

Example

```
SELECT CURRENT_SCHEMA();
 current_schema
----------------
 public
(1 row)
```

DISABLE_DUPLICATE_KEY_ERROR

Disables error messaging when Vertica finds duplicate PRIMARY KEY/UNIQUE KEY values at run time. Queries execute as though no constraints are defined on the schema. Effects are session scoped.

CAUTION: When called, DISABLE_DUPLICATE_KEY_ERROR() suppresses data integrity checking and can lead to incorrect query results. Use this function only after you insert duplicate primary keys into a dimension table in the presence of a prejoin projection. Then correct the violations and turn integrity checking back on with ***REENABLE_DUPLICATE_KEY_ERROR*** (page 373)().

Syntax

```
DISABLE_DUPLICATE_KEY_ERROR();
```

Notes

The following series of commands create a table named `dim` and the corresponding projection:

```
CREATE TABLE dim (pk INTEGER PRIMARY KEY, x INTEGER);
CREATE PROJECTION dim_p (pk, x) AS SELECT * FROM dim ORDER BY x UNSEGMENTED ALL
NODES;
```

The next two statements create a table named `fact` and the pre-join projection that joins `fact` to `dim`.

```
CREATE TABLE fact(fk INTEGER REFERENCES dim(pk));
CREATE PROJECTION prejoin_p (fk, pk, x) AS SELECT * FROM fact, dim WHERE pk=fk ORDER
BY x;
```

The following statements load values into table `dim`. Notice the last statement inserts a duplicate primary key value of 1:

```
INSERT INTO dim  values (1,1);
INSERT INTO dim  values (2,2);
INSERT INTO dim  values (1,2); --Constraint violation
COMMIT;
```

Table `dim` now contains duplicate primary key values, but you cannot delete the violating row because of the presence of the pre-join projection. Any attempt to delete the record results in the following error message:

```
ROLLBACK:  Duplicate primary key detected in FK-PK join Hash-Join (x dim_p), value
1
```

In order to remove the constraint violation `(pk=1)`, use the following sequence of commands, which puts the database back into the state just before the duplicate primary key was added.

To remove the violation:

1. First save the original `dim` rows that match the duplicated primary key.

   ```
   CREATE TEMP TABLE dim_temp(pk integer, x integer);
   INSERT INTO dim_temp SELECT * FROM dim WHERE pk=1 AND x=1; -- original
      dim row
   ```

2. Temporarily disable error messaging on duplicate constraint values:

   ```
   SELECT DISABLE_DUPLICATE_KEY_ERROR();
   ```

   Caution: Remember that issuing this command suppresses the enforcement of data integrity checking.

3. Remove the the original row that contains duplicate values:

   ```
   DELETE FROM dim WHERE pk=1;
   ```

4. Allow the database to resume data integrity checking:

   ```
   SELECT REENABLE_DUPLICATE_KEY_ERROR();
   ```

5. Reinsert the original values back into the dimension table:

   ```
   INSERT INTO dim SELECT * from dim_temp;
   COMMIT;
   ```

6. Validate your dimension and fact tables.

If you receive the following error message, it means that the duplicate records you want to delete are not identical. That is, the records contain values that differ in at least one column that is not a primary key; for example, (1,1) and (1,2).

```
ROLLBACK: Delete: could not find a data row to delete (data integrity violation?)
```

The difference between this message and the rollback message in the previous example is that a fact row contains a foreign key that matches the duplicated primary key, which has been inserted. Thus, a row with values from the fact and dimension table is now in the prejoin projection. In order for the DELETE statement (Step 3 in the following example) to complete successfully, extra predicates are required to identify the original dimension table values (the values that are in the prejoin).

This example is nearly identical to the previous example, except that an additional INSERT statement joins the fact table to the dimension table by a primary key value of 1:

```
INSERT INTO dim  values (1,1);
INSERT INTO dim  values (2,2);
INSERT INTO fact values (1);   -- New insert statement joins fact with dim on
primary key value=1
INSERT INTO dim  values (1,2); -- Duplicate primary key value=1
COMMIT;
```

To remove the violation:

1 First save the original `dim` and `fact` rows that match the duplicated primary key:

```
CREATE TEMP TABLE dim_temp(pk integer, x integer);
CREATE TEMP TABLE fact_temp(fk integer);
INSERT INTO dim_temp SELECT * FROM dim WHERE pk=1 AND x=1; -- original
   dim row
INSERT INTO fact_temp SELECT * FROM fact WHERE fk=1;
```

2 Temporarily suppresses the enforcement of data integrity checking:

```
SELECT DISABLE_DUPLICATE_KEY_ERROR();
```

3 Remove the duplicate primary keys. These steps implicitly remove all fact rows with the matching foreign key, as well.

a) Remove the the original row that contains duplicate values:

```
DELETE FROM dim WHERE pk=1 AND x=1;
```

Note: The extra predicate (`x=1`) specifies removal of the original (`1,1`) row, rather than the newly inserted (`1,2`) values that caused the violation.

b) Remove all remaining rows:

```
DELETE FROM dim WHERE pk=1;
```

4 Turn on integrity checking:

```
SELECT REENABLE_DUPLICATE_KEY_ERROR();
```

5 Reinsert the original values back into the fact and dimension table:

```
INSERT INTO dim SELECT * from dim_temp;
INSERT INTO fact SELECT * from fact_temp;
COMMIT;
```

6 Validate your dimension and fact tables.

See Also

ANALYZE_CONSTRAINTS (page 321)

REENABLE_DUPLICATE_KEY_ERROR (page 373)

DISPLAY_LICENSE

Returns license information.

Syntax

```
DISPLAY_LICENSE()
```

Examples

```
SELECT DISPLAY_LICENSE();
                   display_license
-----------------------------------------------------
 Vertica Systems, Inc.
2007-08-03
Perpetual
0
500GB

(1 row)
```

DO_TM_TASK

Runs a Tuple Mover operation (moveout) on one or more projections defined on the specified table. You do not need to stop the Tuple Mover to run this function.

Syntax

```
DO_TM_TASK ( 'task' [ , '[ schema.]table' | 'projection' ] )
```

Parameters

task	Is one of the following tuple mover operations: ▪ `'moveout'` — Moves out all projections on the specified table (if a particular projection is not specified). ▪ `'analyze_row_count'` — Automatically collects the number of rows in a projection every 60 seconds and aggregates row counts calculated during loads.
[*schema.*]*table*	Runs a tuple mover operation for all projections within the specified table. When using more than one schema, specify the schema that contains the table with the projections you want to affect.

projection	If *projection* is not passed as an argument, all projections in the system are used. If *projection* is specified, DO_TM_TASK looks for a projection of that name and, if found, uses it; if a named projection is not found, the function looks for a table with that name and, if found, moves out all projections on that table.

Notes

DO_TM_TASK() is useful because you can move out all projections from a table or database without having to name each projection individually.

Examples

The following example performs a moveout of all projections for table t1:

```
=> SELECT DO_TM_TASK('moveout', 't1');
```

The following example performs a moveout for projections t1_p:

```
=> SELECT DO_TM_TASK('moveout', 't1_p')
```

See Also

COLUMN_STORAGE (page 691)

DROP_PARTITION (page 341)

DUMP_PARTITION_KEYS (page 346)

DUMP_PROJECTION_PARTITION_KEYS (page 347)

DUMP_TABLE_PARTITION_KEYS (page 348)

PARTITION_PROJECTION (page 368)

Partitioning Tables in the Administrator's Guide

Collecting Statistics in the Administrator's Guide

DROP_LOCATION

Removes the specified storage location.

Syntax

```
DROP_LOCATION ( 'path' , 'site' )
```

Parameters

path	Specifies where the storage location to drop is mounted.
site	Is the Vertica site where the location is available.

Notes

- Dropping a storage location is a permanent operation and cannot be undone. Therefore, Vertica recommends that you retire a storage location before dropping it. This allows you to verify that you actually want to drop a storage location before doing so. Additionally, you can easily restore a retired storage location.
- Dropping storage locations is limited to locations that contain only temp files.
- If a location used to store data and you modified it to store only temp files, the location might still contain data files. If the storage location contains data files, Vertica does not allow you to drop it. You can manually merge out all the data in this location, wait for the ATM to mergeout the data files automatically, or you can drop partitions. Deleting data files does not work.

Example

The following example drops a storage location on node3 that was used to store temp files:

```
=> SELECT DROP_LOCATION('/secondVerticaStorageLocation/' , 'node3');
```

See Also

- ***RETIRE_LOCATION*** (page 388) in this SQL Reference Manual
- Dropping Storage Locations and Retiring Storage Locations in the Administrator's Guide

DROP_PARTITION

Forces the partition of projections (if needed) and then drops the specified partition.

Syntax

```
DROP_PARTITION [ ( table_name ) , ( partition_value ) ]
```

Parameters

table-name	Specifies the name of the table. Note: The specified table_name argument cannot be used as a dimension table in a pre-joined projection and cannot contain projections that are not up to date (have not been refreshed)
partition_value	Must be specified as a string (within quotes) for all data types; for example: `DROP_PARTITION('trade', '2006');`

Notes and Restrictions

In general, if a ROS container has data that belongs to *n*+1 partitions and you want to drop a specific partition, the DROP_PARTITION operation:

1 Forces the partition of data into two containers where
   - one container holds the data that belongs to the partition that is to be dropped
   - another container holds the remaining *n* partitions

2 Drops the specified partition.

You can also use the ***MERGE_PARTITIONS*** (page 367) function to merges ROS containers that have data belonging to partitions in a specified partition key range; for example, `[partitionKeyFrom, partitionKeyTo]`.

DROP_PARTITION forces a moveout if there is data in the WOS (WOS is not partition aware).

DROP_PARTITION acquires an exclusive lock on the table to prevent DELETE | UPDATE | INSERT | COPY statements from affecting the table, as well as any SELECT statements issued at SERIALIZABLE isolation level.

Users must be the table owner to drop a partition. They must have MODIFY (INSERT | UPDATE | DELETE) permissions in order to:

- Partition a projection/table
- Merge partitions
- Run mergeout, moveout or purge operations on a projection

DROP_PARTITION operations cannot be performed on tables with projections that are not up to date (have not been refreshed).

Examples

Using the example schema in Defining Partitions, the following command explicitly drops the 2006 partition key from table `trade`:

```
 SELECT DROP_PARTITION('trade', 2006);
  DROP_PARTITION
-------------------
 Partition dropped
(1 row)
```

Here, the partition key is specified:

```
SELECT DROP_PARTITION('trade', EXTRACT('year' FROM '2006-01-01'::date));
  DROP_PARTITION
-------------------
 Partition dropped
(1 row)
```

The following example creates a table called dates and partitions the table by year:

```
CREATE TABLE dates (
    year INTEGER NOT NULL,
    month VARCHAR(8) NOT NULL)
PARTITION BY year * 12 + month;
```

The following statement drops the partition using a constant for Oct 2007 (2007*12 + 10 = 24094):

```
 SELECT DROP_PARTITION('dates', '24094');
  DROP_PARTITION
-------------------
 Partition dropped
(1 row)
```

Alternatively, the expression can be placed in line: `SELECT DROP_PARTITION('dates', 2007*12 + 10);`

See Also

ADVANCE EPOCH (page 320)

ALTER PROJECTION (page 479)

COLUMN_STORAGE (page 691)

CREATE TABLE (page 546)

DO_TM_TASK (page 339)

DUMP_PARTITION_KEYS (page 346)

DUMP_PROJECTION_PARTITION_KEYS (page 347)

DUMP_TABLE_PARTITION_KEYS (page 348)

MERGE_PARTITIONS (page 367)

PARTITION_PROJECTION (page 368)

PARTITION_TABLE (page 369)

PROJECTIONS (page 673)

Dropping Partitions in the Administrator's Guide

DROP_STATISTICS

Removes statistics for the specified projection(s).

Syntax

```
DROP_STATISTICS { ( '' ) | ( '[ schema.]table' ) | ( 'projection' ) }
```

Return Value

- 0 - For success.
- 1 - For failure. Refer to *vertica.log* for details.

Parameters

`''`	Empty string. Drops statistics for all projections.
[schema.]table	Drops statistics for all projections within the specified table. When using more than one schema, specify the schema that contains the table with the projections you want to delete.
projection	Drops statistics for the specified projection.

Notes

Once dropped, statistics can be time consuming to regenerate.

Example

The following example drops statistics for all projections in the database and returns 0 (success):

```
=> SELECT DROP_STATISTICS ('');
 drop_statistics
-------------------
                 0
(1 row)
```

The following command drops statistics for the shipping_dimension table and returns 0 (success):

```
=> SELECT DROP_STATISTICS ('shipping_dimension');
 drop_statistics
-------------------
                 0
(1 row)
```

The following command drops statistics for one of the shipping_dimension table's projections and returns 0 (success):

```
=> SELECT DROP_STATISTICS('shipping_dimension_site02'); drop_statistics
-------------------
                 0
(1 row)
```

For use cases, see Collecting Statistics in the Administrator's Guide

See Also

ANALYZE_STATISTICS (page 327)

EXPORT_STATISTICS (page 353)

IMPORT_STATISTICS (page 362)

DUMP_CATALOG

Returns an internal representation of the Vertica catalog. This function is used for diagnostic purposes.

Syntax

```
DUMP_CATALOG()
```

Notes

To obtain an internal representation of the Vertica catalog for diagnosis, run the query:

```
SELECT DUMP_CATALOG();
```

The output is written to the specified file:

```
\o /tmp/catalog.txt
SELECT DUMP_CATALOG();
\o
```

Send the output to ***Technical Support*** (on page 1).

DUMP_LOCKTABLE

Returns information about deadlocked clients and the resources they are waiting for.

Syntax

```
DUMP_LOCKTABLE()
```

Notes

Use DUMP_LOCKTABLE if Vertica becomes unresponsive:

1. Open an additional vsql connection.
2. Execute the query:
   ```
   SELECT DUMP_LOCKTABLE();
   ```
   The output is written to vsql. See Monitoring the Log Files.
3. Copy the output and send it to ***Technical Support*** (on page 1).

You can also see who is connected using the following command:

```
SELECT * FROM SESSIONS;
```

Close all sessions using the following command:

```
SELECT CLOSE_ALL_SESSIONS();
```

Close a single session using the following command:

How to close a single session:

```
SELECT CLOSE_SESSION('session_id');
```

You get the session_id value from the ***V_MONITOR.SESSIONS*** (page 741) system table.

See Also

CLOSE_ALL_SESSIONS (page 333)

CLOSE_SESSION (page 330)

LOCKS (page 712)

V_MONITOR.SESSIONS (page 741)

DUMP_PARTITION_KEYS

Dumps the partition keys of all projections in the system.

Syntax

```
DUMP_PARTITION_KEYS( )
```

Example

```
SELECT DUMP_PARTITION_KEYS( );
```

See Also

DO_TM_TASK (page 339)

DROP_PARTITION (page 341)

DUMP_PROJECTION_PARTITION_KEYS (page 347)

DUMP_TABLE_PARTITION_KEYS (page 348)

PARTITIONS (page 716) system table

PARTITION_PROJECTION (page 368)

PARTITION_TABLE (page 369)

Partitioning Tables in the Administrator's Guide

DUMP_PROJECTION_PARTITION_KEYS

Dumps the partition keys of the specified projection.

Syntax

```
DUMP_PROJECTION_PARTITION_KEYS(  'projection_name' )
```

Parameters

projection_name	Specifies the name of the projection.

Example

The following example creates a simple table called `states` and partitions the data by state:

```
CREATE TABLE states (
    year INTEGER NOT NULL,
    state VARCHAR NOT NULL)
PARTITION BY state;
CREATE PROJECTION states_p (state, year) AS SELECT * FROM states
ORDER BY state, year UNSEGMENTED ALL NODES;
```

Now drop the partition key of the specified projection:

```
SELECT DUMP_PROJECTION_PARTITION_KEYS( 'states_p_node0001' );
 Partition keys on node helios_node0001
  Projection 'states_p_node0001'
   No of partition keys: 1
 Partition keys on node helios_node0002
 ...
(1 row)
```

See Also

DO_TM_TASK (page 339)

DROP_PARTITION (page 341)

DUMP_PARTITION_KEYS (page 346)

DUMP_TABLE_PARTITION_KEYS (page 348)

PARTITION_PROJECTION (page 368)

PARTITION_TABLE (page 369)

PROJECTIONS (page 673) system table

Partitioning Tables in the Administrator's Guide

DUMP_TABLE_PARTITION_KEYS

Dumps the partition keys of all projections anchored on the specified table.

Syntax

```
DUMP_TABLE_PARTITION_KEYS ( 'table_name' )
```

Parameters

table_name	Specifies the name of the table.

Example

The following example creates a simple table called `states` and partitions the data by state:

```
CREATE TABLE states (
    year INTEGER NOT NULL,
    state VARCHAR NOT NULL)
PARTITION BY state;
CREATE PROJECTION states_p (state, year) AS SELECT * FROM states
ORDER BY state, year UNSEGMENTED ALL NODES;
```

Now drop the partition keys of all projections anchored on table `states`:

```
SELECT DUMP_TABLE_PARTITION_KEYS( 'states' );
 Partition keys on helios_node0001
  Projection 'states_p_node0004'
   No of partition keys: 1
  Projection 'states_p_node0003'
   No of partition keys: 1
  Projection 'states_p_node0002'
   No of partition keys: 1
  Projection 'states_p_node0001'
   No of partition keys: 1
 Partition keys on helios_node0002
...
(1 row)
```

See Also

DO_TM_TASK (page 339)

DROP_PARTITION (page 341)

DUMP_PARTITION_KEYS (page 347)

DUMP_PROJECTION_PARTITION_KEYS (page 348)

PARTITION_PROJECTION (page 368)

PARTITION_TABLE (page 369)

Partitioning Tables in the Administrator's Guide

EVALUATE_DELETE_PERFORMANCE

Evaluates projections for potential ***DELETE*** (page 580) performance issues. If there are issues found, a warning message is displayed. For steps you can take to resolve delete and update performance issues, see Optimizing Deletes and Updates for Performance in the Administrator's Guide. This function uses data sampling to determine whether there are any issues with a projection. Therefore, it does not generate false-positives warnings, but it can miss some cases where there are performance issues.

Note: Optimizing for delete performance is the same as optimizing for update performance. So, you can use this function to help optimize a projection for updates as well as deletes.

Syntax

```
EVALUATE_DELETE_PERFORMANCE ( 'target' )
```

Parameters

target	The name of a projection or table. If you supply the name of a projection, only that projection is evaluated for DELETE performance issues. If you supply the name of a table, then all of the projections anchored to the table will be evaluated for issues. If you do not provide a projection or table name, EVALUATE_DELETE_PERFORMANCE examines all of the projections that you can access for DELETE performance issues. Depending on the size you your database, this may take a long time.

Note: When evaluating multiple projections, EVALUATE_DELETE_PERFORMANCE reports up to ten projections that have issues, and refers you to a table that contains the full list of issues it has found.

Example

The following example demonstrates how you can use EVALUATE_DELETE_PERFORMANCE to evaluate your projections for slow DELETE performance.

```
=> create table example (A int, B int,C int);
CREATE TABLE
=> create projection one_sort (A,B,C) as (select A,B,B from example) order by A;
CREATE PROJECTION
=> create projection two_sort (A,B,C) as (select A,B,C from example) order by A,B;
CREATE PROJECTION
=> select evaluate_delete_performance('one_sort');
            evaluate_delete_performance
-----------------------------------------------------
 No projection delete performance concerns found.
(1 row)
=> select evaluate_delete_performance('two_sort');
            evaluate_delete_performance
-----------------------------------------------------
 No projection delete performance concerns found.
(1 row)
```

The previous example showed that there was no structural issues with the projection that would cause poor DELETE performance. However, the data contained within the projection can create potential delete issues if the sorted columns do not uniquely identify a row or small number of rows. In the following example, Perl is used to populate the table with data using a nested series of loops. The inner loop populates column C, the middle loop populates column B, and the outer loop populates column A. The result is column A is contains only three distinct values (0, 1, and 2), while column B slowly varies between 20 and 0 and column C changes in each row. EVALUATE_DELETE_PERFORMANCE is run against the projections again to see if the data within the projections causes any potential DELETE performance issues.

```
=> \! perl -e 'for ($i=0; $i<3; $i++) { for ($j=0; $j<21; $j++) { for ($k=0; $k<19; $k++) { printf
"%d,%d,%d\n", $i,$j,$k;}}}' | /opt/vertica/bin/vsql -c "copy example from stdin delimiter ',' direct;"
Password:
=> select * from example;

 A | B  | C
-------------
 0 | 20 | 18
 0 | 20 | 17
 0 | 20 | 16
 0 | 20 | 15
 0 | 20 | 14
 0 | 20 | 13
 0 | 20 | 12
 0 | 20 | 11
 0 | 20 | 10
 0 | 20 |  9
 0 | 20 |  8
 0 | 20 |  7
 0 | 20 |  6
 0 | 20 |  5
 0 | 20 |  4
 0 | 20 |  3
 0 | 20 |  2
 0 | 20 |  1
 0 | 20 |  0
 0 | 19 | 18
 1157 rows omitted
 2 |  1 |  0
 2 |  0 | 18
 2 |  0 | 17
 2 |  0 | 16
 2 |  0 | 15
 2 |  0 | 14
 2 |  0 | 13
 2 |  0 | 12
 2 |  0 | 11
 2 |  0 | 10
 2 |  0 |  9
 2 |  0 |  8
 2 |  0 |  7
 2 |  0 |  6
 2 |  0 |  5
 2 |  0 |  4
 2 |  0 |  3
 2 |  0 |  2
 2 |  0 |  1
 2 |  0 |  0


=> SELECT COUNT (*) FROM example;
 COUNT
-------
  1197
```

```
(1 row)
=> SELECT COUNT (DISTINCT A) FROM example;
 COUNT
-------
     3
(1 row)

=> select evaluate_delete_performance('one_sort');
            evaluate_delete_performance
-----------------------------------------------------
 Projection exhibits delete performance concerns.
(1 row)
release=> select evaluate_delete_performance('two_sort');
            evaluate_delete_performance
-----------------------------------------------------
 No projection delete performance concerns found.
(1 row)
```

The one_sort projection has potential delete issues since it only sorts on column A which has few distinct values. This means that each value in the sort column corresponds to many rows in the projection, which negatively impacts DELETE performance. Since the two_sort projection is sorted on columns A and B, each distinct combination of values in the two sort columns identify just a few rows, allowing deletes to be performed faster.

Not supplying a projection name results in all of the projections you can access being evaluated for DELETE performance issues.

```
=> select evaluate_delete_performance();
                                                    evaluate_delete_performance
-------------------------------------------------------------------------------------------------------------------
-------------------------------
 The following projection exhibits delete performance concerns:
        "public"."one_sort"
See v_internal.comments for more details.
(1 row)
```

EXPORT_CATALOG

Generates a SQL script that can be used to recreate a physical schema design in its current state on a different cluster.

Syntax

```
EXPORT_CATALOG ( [ destination ] , [ type ] )
```

Parameters

destination	Specifies the path and name of the SQL output file. An empty string (' '), which is the default, dumps the script to standard output. A user who is not a DBA can only specify an empty string.
type	Determines what is exported: ▪ design — Exports schemas, tables, constraints, views, and projections to which the user has access. This is the default value. ▪ design_all — Exports all the design objects plus system objects created in Database Designer (for

	example, design contexts and their tables). The objects that are exported are only the ones to which the user has access. ▪ tables— Exports all tables, constraints, and projections for those tables for which the user has permissions. See also ***EXPORT_TABLES*** (page 354).

Notes

- Exporting a design is useful for quickly moving a design to another cluster.
- The script generated by this function:
  - Creates only the non-virtual objects for which the user has access.
  - Automatically runs MARK_DESIGN_KSAFE() with the correct K-Safety value to ensure the design copy has the same same K-Safety value as the original design.
  - Exports catalog objects in their Oid order.
- Use the design_all parameter when adding a node to a cluster. See Modifying Database Designs for Updated Nodes.
- If a projection is created with no sort order, Vertica implicitly assigns a sort order based on the SELECT columns in the projection definition. The sort order is explicitly defined in the exported script.

Restrictions

The export script Vertica generates is portable as long as all the projections were generated using UNSEGMENTED ALL NODES or SEGMENTED ALL NODES. Projections might not exist on ALL NODES for the following reasons:

- A projection was dropped from a node.
- A projection was created only on a subset of nodes.
- An additional node was added since the projection set was created and the design wasn't extended through Database Designer deployment.

Example

The following example exports the design to standard output:

```
SELECT EXPORT_CATALOG(' ','DESIGN');
```

EXPORT_OBJECTS

Generates a SQL script that can be used to recreate catalog objects on a different cluster.

Syntax

```
EXPORT_OBJECTS( [ destination ] , [ scope ] , [ bool_value ] )
```

Parameters

destination	Specifies the path and name of the SQL output file. An empty string (' '), which is the default, dumps the script to standard output. A user who is not a DBA can only specify an empty string.

scope	Determines the set of catalog objects to be exported where scope is one of the following: ▪ an empty string (' ')—exports all non-virtual objects to which the user has access, including constraints. (Note that constraints are not objects which can be passed as individual arguments.) This is the default if no scope is specified. ▪ a comma-delimited list of items in which each item can be one of the following: ▪ —'<schema>.<obj>'—matches the named object. The named object can be a table, projection, or view. ▪ —'<obj>'—matches the named object within the current search path. The named object can be a schema, table, projection, or view. If the named object is a schema, Vertica exports all non-virtual objects to which the user has access within that schema. If a schema and table both have the same name, the schema takes precedence. EXPORT_OBJECTS returns an error if: ▪ an explicitly-specified object does not exist. ▪ the user has no access to the specified object.
bool-value	Use one of the following: ▪ true—incorporates a MAKE_DESIGN_KSAFE statement with the correct K-Safety value for the database at the end of the output script. ▪ false—omits the MAKE_DESIGN_KSAFE statement from the script. Adding the MAKE_DESIGN_KSAFE statement is useful if you are planning to import the script into a new database and you want the new database to inherit the K-Safety value from the original database. By default, this parameter is true.

Notes

- The script generated by this function:
  - Creates only the non-virtual objects for which the user has access.
  - Exports catalog objects in their Oid order.
- None of the parameters for EXPORT_OBJECTS accepts a NULL value as input.

Example

The following example exports the all the non-virtual objects to which the user has access to standard output. It does not incorporates the MAKE_DESIGN_KSAFE statement at the end of the file.

```
SELECT EXPORT_OBJECTS(' ',' ',false);
```

EXPORT_STATISTICS

Generates an XML file that contains statistics for the database.

Syntax

```
EXPORT_STATISTICS ( filename )
```

Parameters

filename	Specifies the path and name of the XML output file. An empty string dumps the script to console.

Notes

- Before you export statistics for the database, be sure to run ***ANALYZE_STATISTICS*** (page 327) to collect and aggregate data samples and storage information. If you do not use ANALYZE_STATISTICS, Database Designer produce a suboptimal projection similar to those created for temporary designs.
- For use cases, see Collecting Statistics in the Administrator's Guide

See Also

ANALYZE_STATISTICS (page 327)

DROP_STATISTICS (page 343)

IMPORT_STATISTICS (page 362)

EXPORT_TABLES

Generates a SQL script that can be used to recreate a logical schema (schemas, tables, constraints, and views) on a different cluster.

Syntax

```
EXPORT_TABLES ( [ destination ] , [ scope ] )
```

Parameters

destination	Specifies the path and name of the SQL output file. An empty string (' '), which is the default, dumps the script to standard output. A user who is not a DBA can only specify an empty string.

scope	Determines the tables to be exported where scope is one of the following: ▪ an empty string (' ')—exports all non-virtual objects to which the user has access, including constraints. (Note that constraints are not objects which can be passed as individual arguments.) This is the default if no scope is specified. ▪ a comma-delimited list of items in which each item can be one of the following: ▪ —'<schema>.<obj>'—matches the named object. The named object can be a table or view. ▪ —'<obj>'--matches the named object within the current search path. The named object can be a schema, table, or view. If the named object is a schema, Vertica exports all non-virtual objects to which the user has access within that schema. If a schema and table both have the same name, the schema takes precedence. EXPORT_TABLES returns an error if: ▪ an explicitly-specified object does not exist. ▪ The user has no access to the specified object.

Notes

- The script generated by this function:
  - Creates only the non-virtual objects for which the user has access.
  - Exports catalog objects in their Oid order.
- If projections are specified in the scope parameter, they are ignored.
- None of the parameters for EXPORT_TABLES accepts a NULL value as input.

Example

The following example exports the store.store_orders_fact table to standard output:

```
=> SELECT EXPORT_TABLES(' ','store.store_orders_fact');
```

GET_AHM_EPOCH

Returns the number of the epoch in which the Ancient History Mark is located. Data deleted up to and including the AHM epoch can be purged from physical storage.

Syntax

```
GET_AHM_EPOCH()
```

Note: The AHM epoch is 0 (zero) by default (purge is disabled).

Examples

```
SELECT GET_AHM_EPOCH();
    get_ahm_epoch
----------------------
```

```
 Current AHM epoch: 0
(1 row)
```

GET_AHM_TIME

Returns a TIMESTAMP value representing the Ancient History Mark. Data deleted up to and including the AHM epoch can be purged from physical storage.

Syntax

```
GET_AHM_TIME()
```

Examples

```
SELECT GET_AHM_TIME();
                  GET_AHM_TIME
-------------------------------------------------
 Current AHM Time: 2010-05-13 12:48:10.532332-04
(1 row)
```

See Also

SET DATESTYLE (page 634) for information about valid ***TIMESTAMP*** (page 87) values.

GET_CURRENT_EPOCH

Returns the number of the current epoch. The epoch into which data (COPY, INSERT, UPDATE, and DELETE operations) is currently being written. The current epoch advances automatically every three minutes.

Syntax

```
GET_CURRENT_EPOCH()
```

Examples

```
SELECT GET_CURRENT_EPOCH();
 GET_CURRENT_EPOCH
-------------------
               683
(1 row)
```

GET_LAST_GOOD_EPOCH

Returns the number of the last good epoch. A term used in manual recovery, LGE (Last Good Epoch) refers to the most recent epoch that can be recovered.

Syntax

```
GET_LAST_GOOD_EPOCH()
```

Examples

```
SELECT GET_LAST_GOOD_EPOCH();
 GET_LAST_GOOD_EPOCH
---------------------
                 682
(1 row)
```

GET_NUM_ACCEPTED_ROWS

Returns the number of rows loaded into the database for the last completed load for the current session.

Syntax

```
GET_NUM_ACCEPTED_ROWS();
```

Notes

- Only loads from STDIN or a single file on the initiator are supported. This function cannot be called for multi-node loads.
- Information is not available for a load that is currently running. Check the system table ***LOAD_STREAMS*** (page 710) for its status.
- Data regarding loads does not persist, and is dropped when a new load is initiated.
- GET_NUM_ACCEPTED_ROWS is a meta-function, Do not use it as a value in an INSERT query.

GET_NUM_REJECTED_ROWS

Returns the number of rows that were rejected during the last completed load for the current session.

Syntax

```
GET_NUM_REJECTED_ROWS();
```

Notes

- Only loads from STDIN or a single file on the initiator are supported. This function cannot be called for multi-node loads.
- Information is not available for a load that is currently running. Check the system table ***LOAD_STREAMS*** (page 710) for its status.
- Data regarding loads does not persist, and is dropped when a new load is initiated.
- GET_NUM_REJECTED_ROWS is a meta-function, Do not use it as a value in an INSERT query.

GET_PROJECTION_STATUS

Returns information relevant to the status of a projection.

Syntax

```
GET_PROJECTION_STATUS ( [ schema-name.]projection );
```

Parameters

[*schema-name.*]*projection*	Is the name of the projection for which to display status. When using more than one schema, specify the schema that contains the projection.

Description

GET_PROJECTION_STATUS returns information relevant to the status of a projection:

- The current K-Safety status of the database
- The number of nodes in the database
- Whether the projection is segmented
- The number and names of buddy projections
- Whether the projection is safe
- Whether the projection is up-to-date
- Whether statistics have been computed for the projection

Notes

- You can use GET_PROJECTION_STATUS to monitor the progress of a projection data refresh. See ***ALTER PROJECTION*** (page 479).
- When using GET_PROJECTION_STATUS or GET_PROJECTIONS you must provide the name and node (for example, `ABC_NODE01)` instead of just `ABC`.
- To view a list of the nodes in a database, use the View Database Command in the Administration Tools.

Examples

```
=> SELECT GET_PROJECTION_STATUS('public.customer_dimension_site01');

                                    GET_PROJECTION_STATUS
-------------------------------------------------------------------------------------------------
 Current system K is 1.
# of Nodes: 4.
public.customer_dimension_site01 [Segmented: No] [Seg Cols: ] [K: 3]
[public.customer_dimension_site04, public.customer_dimension_site03,
public.customer_dimension_site02] [Safe: Yes] [UptoDate: Yes][Stats: Yes]
```

See Also

ALTER PROJECTION (page 479)

GET_PROJECTIONS (page 358)

GET_PROJECTIONS, GET_TABLE_PROJECTIONS

Note: This function was formerly named GET_TABLE_PROJECTIONS(). Vertica still supports the former function name.

Returns information relevant to the status of a table:

- The current K-Safety status of the database
- The number of sites (nodes) in the database
- The number of projections for which the specified table is the anchor table
- For each projection:
  - The projection's buddy projections
  - Whether the projection is segmented

- Whether the projection is safe
- Whether the projection is up-to-date

Syntax

```
GET_PROJECTIONS ( [ schema-name.]table )
```

Parameters

[*schema-name.*]*table*	Is the name of the table for which to list projections. When using more than one schema, specify the schema that contains the table.

Notes

- You can use GET_PROJECTIONS to monitor the progress of a projection data refresh. See ***ALTER PROJECTION*** (page 479).
- When using GET_PROJECTIONS or GET_PROJECTION_STATUS for replicated projections created using the ALL NODES syntax, you must provide the name and node (for example, ABC_NODE01 instead of just ABC).
- To view a list of the nodes in a database, use the View Database Command in the Administration Tools.

Examples

The following example gets information about the store_dimension table in the VMart schema:

```
=> SELECT GET_PROJECTIONS('store.store_dimension');
-------------------------------------------------------------------------------------------
Current system K is 1.
# of Nodes: 4.
Table store.store_dimension has 4 projections.

Projection Name: [Segmented] [Seg Cols] [# of Buddies] [Buddy Projections] [Safe] [UptoDate]
-----------------------------------------------------------
store.store_dimension_node0004 [Segmented: No] [Seg Cols: ] [K: 3] [store.store_dimension_node0003,
store.store_dimension_node0002, store.store_dimension_node0001] [Safe: Yes] [UptoDate: Yes][Stats:
Yes]
store.store_dimension_node0003 [Segmented: No] [Seg Cols: ] [K: 3] [store.store_dimension_node0004,
store.store_dimension_node0002, store.store_dimension_node0001] [Safe: Yes] [UptoDate: Yes][Stats:
Yes]
store.store_dimension_node0002 [Segmented: No] [Seg Cols: ] [K: 3] [store.store_dimension_node0004,
store.store_dimension_node0003, store.store_dimension_node0001] [Safe: Yes] [UptoDate: Yes][Stats:
Yes]
store.store_dimension_node0001 [Segmented: No] [Seg Cols: ] [K: 3] [store.store_dimension_node0004,
store.store_dimension_node0003, store.store_dimension_node0002] [Safe: Yes] [UptoDate: Yes][Stats:
Yes]
(1 row)
```

See Also

ALTER PROJECTION (page 479)

GET_PROJECTION_STATUS (page 357)

INTERRUPT_STATEMENT

Interrupts the specified statement (within an external session), rolls back the current transaction, and writes a success or failure message to the log file.

Syntax

```
INTERRUPT_STATEMENT( session_id , statement_id )
```

Parameters

session_id	Specifies the session to interrupt. This identifier is unique within the cluster at any point in time.
statement_id	Specifies the statement to interrupt

Notes

- Only statements run by external sessions can be interrupted.
- Sessions can be interrupted during statement execution.
- If the *statement_id* is valid, the statement is interruptible. The command is successfully sent and returns a success message. Otherwise the system returns an error.

Messages

The following list describes messages you might encounter and their meaning:

- `Statement interrupt sent. Check SESSIONS for progress.`
  This message indicates success.
- `Session <id> could not be successfully interrupted: session not found.`
  The session ID argument to the interrupt command does not match a running session.
- `Session <id> could not be successfully interrupted: statement not found.`
  The statement ID does not (or no longer) matches the ID of a running statement (if any).
- `No interruptible statement running`
  The statement is DDL or otherwise non-interruptible.
- `Internal (system) sessions cannot be interrupted.`
  The session is internal, and only statements run by external sessions can be interrupted.

Examples

Two user sessions are open. RECORD 1 shows user session running `SELECT FROM SESSION`, and RECORD 2 shows user session running `COPY DIRECT`:

```
=> SELECT * FROM SESSIONS;
-[ RECORD 1
]--------------+-----------------------------------------------------
node_name                   | v_vmartdb_node0001
user_name                   | dbadmin
client_hostname             | 127.0.0.1:52110
client_pid                  | 4554
login_timestamp             | 2011-01-03 14:05:40.252625-05
session_id                  | stress04-4325:0x14
client_label                |
transaction_start           | 2011-01-03 14:05:44.325781
transaction_id              | 45035996273728326
transaction_description     | user dbadmin (select * from sessions;)
```

```
statement_start            | 2011-01-03 15:36:13.896288
statement_id               | 10
last_statement_duration_us | 14978
current_statement          | select * from sessions;
ssl_state                  | None
authentication_method      | Trust
-[ RECORD 2
]--------------+--------------------------------------------------
node_name                  | v_vmartdb_node0003
user_name                  | dbadmin
client_hostname            | 127.0.0.1:56367
client_pid                 | 1191
login_timestamp            | 2011-01-03 15:31:44.939302-05
session_id                 | stress06-25663:0xbec
client_label               |
transaction_start          | 2011-01-03 15:34:51.05939
transaction_id             | 54043195528458775
transaction_description    | user dbadmin (COPY Mart_Fact FROM
'/data/Mart_Fact.tbl'
                             DELIMITER '|' NULL '\\n' DIRECT;)
statement_start            | 2011-01-03 15:35:46.436748
statement_id               | 5
last_statement_duration_us | 1591403
current_statement          | COPY Mart_Fact FROM '/data/Mart_Fact.tbl' DELIMITER
'|'
                             NULL '\\n' DIRECT;
ssl_state                  | None
authentication_method      | Trust
```

Interrupt the COPY DIRECT statement running in stress06-25663:0xbec:

```
vmartkp=> \x
Expanded display is off.
vmartkp=> SELECT INTERRUPT_STATEMENT('stress06-25663:0x1537', 5);
                      interrupt_statement
-----------------------------------------------------------------
 Statement interrupt sent. Check v_monitor.sessions for progress.
(1 row)
```

Verify that the interrupted statement is no longer active by looking at the current_statement column in the SESSIONS system table. This column becomes blank when the statement has been interrupted:

```
=> SELECT * FROM SESSIONS;
-[ RECORD 1
]--------------+--------------------------------------------------
node_name                  | v_vmartdb_node0001
user_name                  | dbadmin
client_hostname            | 127.0.0.1:52110
client_pid                 | 4554
login_timestamp            | 2011-01-03 14:05:40.252625-05
session_id                 | stress04-4325:0x14
client_label               |
transaction_start          | 2011-01-03 14:05:44.325781
transaction_id             | 45035996273728326
```

```
transaction_description    | user dbadmin (select * from sessions;)
statement_start            | 2011-01-03 15:36:13.896288
statement_id               | 10
last_statement_duration_us | 14978
current_statement          | select * from sessions;
ssl_state                  | None
authentication_method      | Trust
-[ RECORD 2
]--------------+-----------------------------------------------------
node_name                  | v_vmartdb_node0003
user_name                  | dbadmin
client_hostname            | 127.0.0.1:56367
client_pid                 | 1191
login_timestamp            | 2011-01-03 15:31:44.939302-05
session_id                 | stress06-25663:0xbec
client_label               |
transaction_start          | 2011-01-03 15:34:51.05939
transaction_id             | 54043195528458775
transaction_description    | user dbadmin (COPY Mart_Fact FROM
'/data/Mart_Fact.tbl'
                             DELIMITER '|' NULL '\\n' DIRECT;)
statement_start            | 2011-01-03 15:35:46.436748
statement_id               | 5
last_statement_duration_us | 1591403
current_statement          |
ssl_state                  | None
authentication_method      | Trust
```

See Also

SESSIONS (page 741)

Managing Sessions and Configuration Parameters in the Administrator's Guide

IMPORT_STATISTICS

Imports statistics from the XML file generated by the EXPORT_STATISTICS command.

Syntax

```
IMPORT_STATISTICS ( filename )
```

Parameters

filename	Specifies the path and name of the XML input file (which is the output of EXPORT_STATISTICS function).

Notes

- Imported statistics override existing statistics for all projections on the specified table.
- For use cases, see Collecting Statistics in the Administrator's Guide

See Also

ANALYZE_STATISTICS (page 327)

DROP_STATISTICS (page 343)

EXPORT_STATISTICS (page 353)

ISUTF8

Tests whether a string is a valid UTF-8 string. Returns true if the string conforms to UTF-8 standards, and false otherwise. This function is useful to test strings for UTF-8 compliance before passing them to one of the regular expression functions, such as ***REGEXP_LIKE*** (page 379), which expect UTF-8 characters by default.

Syntax

```
ISUTF8(string);
```

Parameters

`string`	The string to test for UTF-8 compliance.

Examples

```
=> SELECT ISUTF8(E'\xC2\xBF'); -- UTF-8 INVERTED QUESTION MARK
 ISUTF8
--------
 t
(1 row)

=> SELECT ISUTF8(E'\xC2\xC0'); -- UNDEFINED UTF-8 CHARACTER
 ISUTF8
--------
 f
(1 row)
```

MAKE_AHM_NOW

Sets the Ancient History Mark (AHM) to the greatest allowable value, and lets you drop any projections that existed before the issue occurred.

Caution: This function is intended for use by Administrators only.

Syntax

```
MAKE_AHM_NOW ( [ true ] )
```

Parameters

true	[Optional] Allows AHM to advance when nodes are down. **Note:** If the AHM is advanced after the last good epoch of the failed nodes, those nodes must recover all data from scratch. Use with care.

Notes

- The MAKE_AHM_NOW function performs the following operations:
  - Advances the epoch.
  - Performs a moveout operation on all projections.
  - Sets the AHM to LGE — at least to the current epoch at the time MAKE_AHM_NOW() was issued.
- All history is lost and you cannot perform historical queries prior to the current epoch.

Example

```
=> SELECT MAKE_AHM_NOW();
         MAKE_AHM_NOW
------------------------------
 AHM set (New AHM Epoch: 683)
(1 row)
```

The following command allows the AHM to advance, even though node 2 is down:

```
=> SELECT MAKE_AHM_NOW(true);
WARNING:  Received no response from v_vmartdb_node0002 in get cluster LGE
WARNING:  Received no response from v_vmartdb_node0002 in get cluster LGE
WARNING:  Received no response from v_vmartdb_node0002 in set AHM
         MAKE_AHM_NOW
------------------------------
 AHM set (New AHM Epoch: 684)
(1 row)
```

See Also

DROP PROJECTION (page 585)

MARK_DESIGN_KSAFE (page 365)

SET_AHM_EPOCH (page 389)

SET_AHM_TIME (page 391)

MARK_DESIGN_KSAFE

Enables or disables high availability in your environment, in case of a failure. Before enabling recovery, MARK_DESIGN_KSAFE queries the catalog to determine whether a cluster's physical schema design meets the following requirements:

- Dimension tables are replicated on all nodes.
- Fact table superprojections are segmented with each segment on a different node.
- Each fact table projection has at least one buddy projection for K-Safety=1 (or two buddy projections for K-Safety=2).

  Buddy projections are also segmented across database nodes, but the distribution is modified so that segments that contain the same data are distributed to different nodes. See High Availability Through Projections in the Concepts Guide.

  Note: Projections are considered to be buddies if they contain the same columns and have the same segmentation. They can have different sort orders.

MARK_DESIGN_KSAFE does not change the physical schema in any way.

Syntax

```
SELECT MARK_DESIGN_KSAFE ( k )
```

Parameters

k	2 enables high availability if the schema design meets requirements for K-Safety=2 1 enables high availability if the schema design meets requirements for K-Safety=1 0 disables high availability

If you specify a *k* value of one (1) or two (2), Vertica returns one of the following messages.

Success:

```
Marked design n-safe
```

Failure:

```
The schema does not meet requirements for K=n.
Fact table projection projection-name
has insufficient "buddy" projections.
```

n in the message is 1 or 2 and represents the *k* value.

Notes

- The database's internal recovery state persists across database restarts but it is not checked at startup time.
- If a database has automatic recovery enabled, you must temporarily disable automatic recovery before creating a new table.
- When one node fails on a system marked K-safe=1, the remaining nodes are available for DML operations.

Examples

```
=> SELECT MARK_DESIGN_KSAFE(1);
  mark_design_ksafe
----------------------
 Marked design 1-safe
(1 row)
```

If the physical schema design is not K-Safe, messages indicate which projections do not have a buddy:

```
=> SELECT MARK_DESIGN_KSAFE(1);
The given K value is not correct; the schema is 0-safe
Projection pp1 has 0 buddies, which is smaller that the given K of 1
Projection pp2 has 0 buddies, which is smaller that the given K of 1
.
.
.
(1 row)
```

See Also

SYSTEM (page 751)

High Availability and Recovery in the Concepts Guide

SQL System Tables (Monitoring APIs) (page 660) topic in the Administrator's Guide

Using Identically Segmented Projections in the Programmer's Guide

Failure Recovery in the Troubleshooting Guide

MEASURE_LOCATION_PERFORMANCE

Measures disk performance for the location specified.

Syntax

```
MEASURE_LOCATION_PERFORMANCE ( path , node )
```

Parameters

path	Specifies where the storage location to measure is mounted.
node	Is the Vertica node where the location to be measured is available..

Notes

- If you intend to create a tiered disk architecture in which projections, columns, and partitions are stored on different disks based on predicted or measured access patterns, you need to measure storage location performance for each location in which data is stored. You do not need to measure storage location performance for temp data storage locations because temporary files are stored based on available space.
- This method of measuring storage location performance applies only to configured clusters. If you want to measure a disk before configuring a cluster see Measuring Location Performance.

- Storage location performance equates to the amount of time it takes to read a fixed amount of data from the disk. This read time equates to the disk throughput in MB per second plus the time it takes to seek data based on the number of seeks per second, as follows:

  Read Time (seconds) = 1/Throughput (MB/second) + 1/Latency (seeks/second)

  Therefore, a disk is faster than another disk if its Read Time is smaller.

Example

The following example measures the performance of a storage location on node2:

```
=> SELECT MEASURE_LOCATION_PERFORMANCE('/secondVerticaStorageLocation/' ,
'node2');

WARNING:  measure_location_performance can take a long time. Please check logs for
progress
           measure_location_performance
-------------------------------------------------
 Throughput : 122 MB/sec. Latency : 140 seeks/sec
```

See Also

ADD_LOCATION (page 318)

ALTER_LOCATION_USE (page 320)

RETIRE_LOCATION (page 388)

Measuring Location Performance in the Administrator's Guide

MERGE_PARTITIONS

Merges ROS containers that have data belonging to partitions in a specified partition key range: `[ partitionKeyFrom, partitionKeyTo ] .`

Syntax

```
MERGE_PARTITIONS [ ( table_name ) ,
... ( partition_key_from ) , ( partition_key_to ) ]
```

Parameters

table_name	Specifies the name of the table
partition_key_from	Specifies the start point of the partition
partition_key_to	Specifies the end point of the partition

Notes

- Partitioning functions take immutable functions only, in order that the same information be available across all nodes.
- The edge values are included in the range, and `partition_key_from` must be less than or equal to `partition_key_to`.

- Inclusion of partitions in the range is based on the application of less than(<)/greater than(>) operators of the corresponding data type.

  Note: No restrictions are placed on a partition key's data type.
- If `partition_key_from` is the same as `partition_key_to`, all ROS containers of the partition key are merged into one ROS.

Users must be the table owner to drop a partition. They must have MODIFY (INSERT | UPDATE | DELETE) permissions in order to:

- Partition a projection/table
- Merge partitions
- Run mergeout, moveout or purge operations on a projection

Examples

```
=> SELECT MERGE_PARTITIONS('T1', '200', '400');
=> SELECT MERGE_PARTITIONS('T1', '800', '800');
=> SELECT MERGE_PARTITIONS('T1', 'CA', 'MA');
=> SELECT MERGE_PARTITIONS('T1', 'false', 'true');
=> SELECT MERGE_PARTITIONS('T1', '06/06/2008', '06/07/2008');
=> SELECT MERGE_PARTITIONS('T1', '02:01:10', '04:20:40');
=> SELECT MERGE_PARTITIONS('T1', '06/06/2008 02:01:10', '06/07/2008 02:01:10');
=> SELECT MERGE_PARTITIONS('T1', '8 hours', '1 day 4 hours 20 seconds');
```

PARTITION_PROJECTION

Forces a split of ROS containers of the specified projection.

Syntax

`PARTITION_PROJECTION ( projection_name )`

Parameters

projection_name	Specifies the name of the projection.

Notes

Partitioning expressions take immutable functions only, in order that the same information be available across all nodes.

`PARTITION_PROJECTION()` is similar to `PARTITION_TABLE (page 369)()`, except that `PARTITION_PROJECTION` works only on the specified projection, instead of the table.

Vertica internal operations (mergeout, refresh, and recovery) maintain partition separation except in certain cases:

- Recovery of a projection when the buddy projection from which the partition is recovering is identically sorted. If the projection is undergoing a full rebuild, it is recovered one ROS container at a time. The projection ends up with a storage layout identical to its buddy and is, therefore, properly segmented.

Note: In the case of a partial rebuild, all recovered data goes into a single ROS container and must be partitioned manually.

- Manual tuple mover operations often output a single storage container, combining any existing partitions; for example, after executing any of the `PURGE()` operations.

Users must be the table owner to drop a partition. They must have MODIFY (INSERT | UPDATE | DELETE) permissions in order to:

- Partition a projection/table
- Merge partitions
- Run mergeout, moveout or purge operations on a projection

`PARTITION_PROJECTION()` purges data while partitioning ROS containers if deletes were applied before the AHM epoch.

Example

The following command forces a split of ROS containers on the `states_p_node01` projection:

```
=> SELECT PARTITION_PROJECTION ('states_p_node01');
  partition_projection
------------------------
 Projection partitioned
(1 row)
```

See Also

DO_TM_TASK (page 339)

DROP_PARTITION (page 341)

DUMP_PARTITION_KEYS (page 346)

DUMP_PROJECTION_PARTITION_KEYS (page 347)

DUMP_TABLE_PARTITION_KEYS (page 348)

PARTITION_TABLE (page 369)

Partitioning Tables in the Administrator's Guide

PARTITION_TABLE

Forces the system to break up any ROS containers that contain multiple distinct values of the partitioning expression. Only ROS containers with more than one distinct value participate in the split.

Syntax

`PARTITION_TABLE ( '`*`table_name`*`' )`

Parameters

table_name	Specifies the name of the table.

Notes

PARTITION_TABLE is similar to ***PARTITION_PROJECTION*** (page 368), except that PARTITION_TABLE works on the specified table.

Vertica internal operations (mergeout, refresh, and recovery) maintain partition separation except in certain cases:

- Recovery of a projection when the buddy projection from which the partition is recovering is identically sorted. If the projection is undergoing a full rebuild, it is recovered one ROS container at a time. The projection ends up with a storage layout identical to its buddy and is, therefore, properly segmented.

  Note: In the case of a partial rebuild, all recovered data goes into a single ROS container and must be partitioned manually.
- Manual tuple mover operations often output a single storage container, combining any existing partitions; for example, after executing any of the `PURGE()` operations.

Users must be the table owner to drop a partition. They must have MODIFY (INSERT | UPDATE | DELETE) permissions in order to:

- Partition a projection/table
- Merge partitions
- Run mergeout, moveout or purge operations on a projection

Partitioning functions take immutable functions only, in order that the same information be available across all nodes.

Example

The following example creates a simple table called `states` and partitions data by state.

```
=> CREATE TABLE states (
          year INTEGER NOT NULL,
          state VARCHAR NOT NULL)
   PARTITION BY state;
=> CREATE PROJECTION states_p (state, year) AS
   SELECT * FROM states
   ORDER BY state, year UNSEGMENTED ALL NODES;
```

Now issue the command to partition table `states`:

```
=> SELECT PARTITION_TABLE('states');
                  PARTITION_TABLE
-----------------------------------------------------
partition operation for projection 'states_p_node0004'
partition operation for projection 'states_p_node0003'
partition operation for projection 'states_p_node0002'
partition operation for projection 'states_p_node0001'
(1 row)
```

See Also

DO_TM_TASK (page 339)

DROP_PARTITION (page 341)

DUMP_PARTITION_KEYS (page 346)

DUMP_PROJECTION_PARTITION_KEYS (page 347)

DUMP_TABLE_PARTITION_KEYS (page 348)

PARTITION_PROJECTION (page 368)

Partitioning Tables in the Administrator's Guide

PURGE

Purges all projections in the physical schema. Permanently removes deleted data from physical storage so that the disk space can be reused. You can purge historical data up to and including the epoch in which the Ancient History Mark is contained.

Syntax

```
PURGE()
```

Notes

- PURGE() was formerly named PURGE_ALL_PROJECTIONS. Vertica supports both function calls.
- Manual tuple mover operations, such as the PURGE() operations, often output a single storage container, combining any existing partitions. For example, if PURGE() is used on a non-partitioned table, all ROS containers are combined into a single container. Non-partitioned tables cannot be re-partitioned into multiple ROS containers. A purge operation on a partitioned table also results in a single ROS.
- To re-partition the data into multiple ROS containers, use the ***PARTITION_TABLE*** (page 369)() function.

Caution: PURGE could temporarily take up significant disk space while the data is being purged.

See Also

MERGE_PARTITIONS (page 367)

PARTITION_TABLE (page 369)

PURGE_PROJECTION (page 372)

PURGE_TABLE (page 372)

STORAGE_CONTAINERS (page 743)

Purging Deleted Data in the Administrator's Guide

PURGE_PROJECTION

Purges the specified projection. Permanently removes deleted data from physical storage so that the disk space can be reused. You can purge historical data up to and including the epoch in which the Ancient History Mark is contained.

Caution: PURGE_PROJECTION could temporarily take up significant disk space while the data is being purged.

Syntax

```
PURGE_PROJECTION ( [ schema-name.]projection_name )
```

Parameters

projection_name	Is the name of a specific projection. When using more than one schema, specify the schema that contains the projection.

Notes

See ***PURGE*** (page 371) for notes about the outcome of purge operations.

See Also

MERGE_PARTITIONS (page 367)

PURGE_TABLE (page 372)

STORAGE_CONTAINERS (page 743)

Purging Deleted Data in the Administrator's Guide

PURGE_TABLE

Note: This function was formerly named PURGE_TABLE_PROJECTIONS(). Vertica still supports the former function name.

Purges all projections of the specified table. Permanently removes deleted data from physical storage so that the disk space can be reused. You can purge historical data up to and including the epoch in which the Ancient History Mark is contained.

Syntax

```
PURGE_TABLE ( [ schema_name.]table_name )
```

Parameters

[*schema_name.*]*table_name*	Is the name of a specific table in the optionally-specified logical schema. When using more than one schema, specify the schema that contains the projection.

Caution: PURGE_TABLE could temporarily take up significant disk space while the data is being purged.

Example

The following example purges all projections for the store sales fact table located in the Vmart schema:

```
=> SELECT PURGE_TABLE('store.store_sales_fact');
```

See Also

PURGE (page 371) for notes about the outcome of purge operations.

MERGE_PARTITIONS (page 367)

PURGE_TABLE (page 372)

STORAGE_CONTAINERS (page 743)

Purging Deleted Data in the Administrator's Guide

REENABLE_DUPLICATE_KEY_ERROR

Restores the default behavior of error reporting by reversing the effects of DISABLE_DUPLICATE_KEY_ERROR. Effects are session scoped.

Syntax

```
REENABLE_DUPLICATE_KEY_ERROR();
```

Examples

For examples and usage see ***DISABLE_DUPLICATE_KEY_ERROR*** (page 336).

See Also

ANALYZE_CONSTRAINTS (page 321)

REFRESH

Performs a synchronous, optionally-targeted refresh of a specified table's projections.

Information about a refresh operation—whether successful or unsuccessful—is maintained in the ***PROJECTION_REFRESHES*** (page 717) system table until either the ***CLEAR_PROJECTION_REFRESHES*** (page 329)() function is executed or the storage quota for the table is exceeded. The `PROJECTION_REFRESHES.IS_EXECUTING` column returns a boolean value that indicates whether the refresh is currently running (t) or occurred in the past (f).

Syntax

```
REFRESH ( [schema_name.]table_name [ , ... ] )
```

Parameters

[*schema_name.*]*table_name*	In the optionally-specified schema, `table_name` is the name of a specific table that contains the projections to be refreshed. When using more than one schema, specify the schema that contains the table.

Returns

Column Name	Description
Projection Name	The name of the projection that is targeted for refresh.
Anchor Table	The name of the projection's associated anchor table.
Status	The status of the projection: ▪ Queued — Indicates that a projection is queued for refresh. ▪ Refreshing — Indicates that a refresh for a projection is in process. ▪ Refreshed — Indicates that a refresh for a projection has successfully completed. ▪ Failed — Indicates that a refresh for a projection did not successfully complete.
Refresh Method	The method used to refresh the projection: ▪ Buddy – Uses the contents of a buddy to refresh the projection. This method maintains historical data. This enables the projection to be used for historical queries. ▪ Scratch – Refreshes the projection without using a buddy. This method does not generate historical data. This means that the projection cannot participate in historical queries from any point before the projection was refreshed.
Error Count	The number of times a refresh failed for the projection.
Duration (sec)	The length of time that the projection refresh ran in seconds.

Notes

- Unlike START_REFRESH(), which runs in the background, REFRESH() runs in the foreground of the caller's session.
- The REFRESH() function refreshes only the projections in the specified table.
- If you run REFRESH() without arguments, it refreshes all non up-to-date projections. If the function returns a header string with no results, then no projections needed refreshing.

Example

The following command refreshes the projections in tables `t1` and `t2`:

```
=> SELECT REFRESH('t1, t2');
refresh
-------------------------------------------------------------------------------------
 Refresh completed with the following outcomes:
Projection Name: [Anchor Table] [Status] [Refresh Method] [Error Count] [Duration (sec)]
-------------------------------------------------------------------------------------
"public"."t1_p": [t1] [refreshed] [scratch] [0] [0]
"public"."t2_p": [t2] [refreshed] [scratch] [0] [0]
```

This next command shows that only the projection on table `t` was refreshed:

```
=> SELECT REFRESH('allow, public.deny, t');"
refresh
-------------------------------------------------------------------------------------
 Refresh completed with the following outcomes:
Projection Name: [Anchor Table] [Status] [Refresh Method] [Error Count] [Duration (sec)]
-------------------------------------------------------------------------------------
"n/a"."n/a": [n/a] [failed: insufficient permissions on table "allow"] [] [1] [0]
"n/a"."n/a": [n/a] [failed: insufficient permissions on table "public.deny"] [] [1] [0]
"public"."t_p1": [t] [refreshed] [scratch] [0] [0]
```

See Also

CLEAR_PROJECTION_REFRESHES (page 329)

PROJECTION_REFRESHES (page 717)

START_REFRESH (page 394)

Clearing PROJECTION_REFRESHES History in the Administrator's Guide

REGEXP_COUNT

Returns the number times a regular expression matches a string.

Syntax

REGEXP_COUNT(*string*, *pattern* [, *position* [, *regexp_modifier*]])

Parameters

string	The string to be searched for matches.
pattern	The regular expression to search for within the string. The syntax of the regular expression is compatible with the Perl 5 regular expression syntax. See the ***Perl Regular Expressions Documentation*** (***http://perldoc.perl.org/perlre.html***) for details.
position	The number of characters from the start of the string where the function should start searching for matches. The default value, 1, means to start searching for a match at the first (leftmost) character. Setting this parameter to a value greater than 1 starts searching for a match to the pattern that many characters into the string.

regexp_modifier	A string containing one or more single-character flags that change how the regular expression is matched against the string: `b` Treat strings as binary octets rather than UTF-8 characters. `c` Forces the match to be case sensitive (the default). `i` Forces the match to be case insensitive. `m` Treats the string being matched as multiple lines. With this modifier, the start of line (`^`) and end of line (`$`) regular expression operators match line breaks (`\n`) within the string. Ordinarily, these operators only match the start and end of the string. `n` Allows the single character regular expression operator `.` to match a newline (`\n`). Normally, the `.` operator will match any character except a newline. `x` Allows you to document your regular expressions. It causes all unescaped space characters and comments in the regular expression to be ignored. Comments start with a hash character (#) and end with a newline. All spaces in the regular expression that you want to be matched in strings must be escaped with a backslash (\) character.

Notes

This function operates on UTF-8 strings using the default locale, even if the locale has been set to something else.

If you are porting a regular expression query from an Oracle database, remember that Oracle considers a zero-length string to be equivalent to NULL, while Vertica does not.

Examples

Count the number of occurrences of the substring "an" in the string "A man, a plan, a canal, Panama."

```
=> SELECT REGEXP_COUNT('a man, a plan, a canal: Panama', 'an');
 REGEXP_COUNT
--------------
            4
(1 row)
```

Find the number of occurrences of the substring "an" in the string "a man, a plan, a canal: Panama" starting with the fifth character.

```
=> SELECT REGEXP_COUNT('a man, a plan, a canal: Panama', 'an',5);
```

```
 REGEXP_COUNT
--------------
            3
(1 row)
```

Find the number of occurrences of a substring containing a lower-case character followed by "an." In the first example, the query does not have a modifier. In the second example, the "i" query modifier is used to force the regular expression to ignore case.

```
=> SELECT REGEXP_COUNT('a man, a plan, a canal: Panama', '[a-z]an');
 REGEXP_COUNT
--------------
            3
(1 row)
=> SELECT REGEXP_COUNT('a man, a plan, a canal: Panama', '[a-z]an', 1, 'i');
 REGEXP_COUNT
--------------
            4
```

REGEXP_INSTR

Returns the starting or ending position in a string where a regular expression matches. This function returns 0 if no match for the regular expression is found in the string.

Syntax

REGEXP_INSTR(*string*, *pattern* [, *position* [, *occurrence* [, *return_position* [, *regexp_modifier*]]]])

Parameters

string	The string to search for the pattern.
pattern	The regular expression to search for within the string. The syntax of the regular expression is compatible with the Perl 5 regular expression syntax. See the ***Perl Regular Expressions Documentation*** (***http://perldoc.perl.org/perlre.html***) for details.
position	The number of characters from the start of the string where the function should start searching for matches. The default value, 1, means to start searching for a match at the first (leftmost) character. Setting this parameter to a value greater than 1 starts searching for a match to the pattern that many characters into the string.
occurrence	Controls which occurrence of a match between the string and the pattern is returned. With the default value (1), the function returns the position of the first substring that matches the pattern. You can use this parameter to find the position of additional matches between the string and the pattern. For example, set this parameter to 3 to find the position of the third substring that matched the pattern.
return_position	Sets the position within the string that is returned. When

	set to the default value (0), this function returns the position in the string of the first character of the substring that matched the pattern. If you set this value to 1, the function returns the position of the first character after the end of the matching substring.
regexp_modifier	A string containing one or more single-character flags that change how the regular expression is matched against the string: `b` Treat strings as binary octets rather than UTF-8 characters. `c` Forces the match to be case sensitive (the default). `i` Forces the match to be case insensitive. `m` Treats the string being matched as multiple lines. With this modifier, the start of line (`^`) and end of line (`$)` regular expression operators match line breaks (`\n`) within the string. Ordinarily, these operators only match the start and end of the string. `n` Allows the single character regular expression operator `(.)` to match a newline (`\n`). Normally, the `.` operator will match any character except a newline. `x` Allows you to document your regular expressions. It causes all unescaped space characters and comments in the regular expression to be ignored. Comments start with a hash character (#) and end with a newline. All spaces in the regular expression that you want to be matched in strings must be escaped with a backslash (\) character.

Notes

This function operates on UTF-8 strings using the default locale, even if the locale has been set to something else.

If you are porting a regular expression query from an Oracle database, remember that Oracle considers a zero-length string to be equivalent to NULL, while Vertica does not.

Examples

Find the first occurrence of a sequence of letters starting with the letter e and ending with the letter y in the phrase "easy come, easy go."

```
=> SELECT REGEXP_INSTR('easy come, easy go','e\w*y');
 REGEXP_INSTR
--------------
            1
```

```
(1 row)
```

Find the first occurrence of a sequence of letters starting with the letter e and ending with the letter y starting at the second character in the string "easy come, easy go."

```
=> SELECT REGEXP_INSTR('easy come, easy go','e\w*y',2);
 REGEXP_INSTR
--------------
           12
(1 row)
```

Find the second sequence of letters starting with the letter e and ending with the letter y in the string "easy come, easy go" starting at the first character.

```
=> SELECT REGEXP_INSTR('easy come, easy go','e\w*y',1,2);
 REGEXP_INSTR
--------------
           12
(1 row)
```

Find the position of the first character after the first whitespace in the string "easy come, easy go."

```
=> SELECT REGEXP_INSTR('easy come, easy go','\s',1,1,1);
 REGEXP_INSTR
--------------
            6
(1 row)
```

REGEXP_LIKE

Returns true if the string matches the regular expression. This function is similar to the ***LIKE-predicate*** (page 55), except that it uses regular expressions rather than simple wildcard character matching.

Syntax

```
REGEXP_LIKE(string, pattern [, modifiers])
```

Parameters

string	The string to match against the regular expression.
pattern	A string containing the regular expression to match against the string. The syntax of the regular expression is compatible with the Perl 5 regular expression syntax. See the ***Perl Regular Expressions Documentation*** (***http://perldoc.perl.org/perlre.html***) for details.
modifiers	A string containing one or more single-character flags that change how the regular expression is matched against the string: `b` Treat strings as binary octets rather than UTF-8 characters. `c` Forces the match to be case sensitive (the default).

	i	Forces the match to be case insensitive.
	m	Treats the string being matched as multiple lines. With this modifier, the start of line (^) and end of line ($) regular expression operators match line breaks (\n) within the string. Ordinarily, these operators only match the start and end of the string.
	n	Allows the single character regular expression operator (.) to match a newline (\n). Normally, the . operator will match any character except a newline.
	x	Allows you to document your regular expressions. It causes all unescaped space characters and comments in the regular expression to be ignored. Comments start with a hash character (#) and end with a newline. All spaces in the regular expression that you want to be matched in strings must be escaped with a backslash (\) character.

Notes

This function operates on UTF-8 strings using the default locale, even if the locale has been set to something else.

If you are porting a regular expression query from an Oracle database, remember that Oracle considers a zero-length string to be equivalent to NULL, while Vertica does not.

Examples

This example creates a table containing several strings to demonstrate regular expressions.

```
=> create table t (v varchar);
CREATE TABLE
=> create projection t1 as select * from t;
CREATE PROJECTION
=> COPY t FROM stdin;
Enter data to be copied followed by a newline.
End with a backslash and a period on a line by itself.
>> aaa
>> Aaa
>> abc
>> abc1
>> 123
>> \.
=> SELECT * FROM t;
   v
-------
 aaa
 Aaa
 abc
```

```
 abc1
 123
(5 rows)
```

Select all records in the table that contain the letter "a."

```
=> SELECT v FROM t WHERE REGEXP_LIKE(v,'a');
  v
------
 Aaa
 aaa
 abc
 abc1
(4 rows)
```

Select all of the rows in the table that start with the letter "a."

```
=> SELECT v FROM t WHERE REGEXP_LIKE(v,'^a');
  v
------
 aaa
 abc
 abc1
(3 rows)
```

Select all rows that contain the substring "aa."

```
=> SELECT v FROM t WHERE REGEXP_LIKE(v,'aa');
  v
-----
 Aaa
 aaa
(2 rows)
```

Select all rows that contain a digit.

```
=> SELECT v FROM t WHERE REGEXP_LIKE(v,'\d');
  v
------
 123
 abc1
(2 rows)
```

Select all rows that contain the substring "aaa."

```
=> SELECT v FROM t WHERE REGEXP_LIKE(v,'aaa');
  v
-----
 aaa
(1 row)
```

Select all rows that contain the substring "aaa" using case insensitive matching.

```
=> SELECT v FROM t WHERE REGEXP_LIKE(v,'aaa', 'i');
```

```
  v
-----
 Aaa
 aaa
(2 rows)
```

Select rows that contain the substring "a b c."

```
=> SELECT v FROM t WHERE REGEXP_LIKE(v,'a b c');
 v
(0 rows)
```

Select rows that contain the substring "a b c" ignoring space within the regular expression.

```
=> SELECT v FROM t WHERE REGEXP_LIKE(v,'a b c','x');
  v
------
 abc
 abc1
(2 rows)
```

Add multi-line rows to demonstrate using the "m" modifier.

```
=> COPY t FROM stdin RECORD TERMINATOR '!';
Enter data to be copied followed by a newline.
End with a backslash and a period on a line by itself.
>> Record 1 line 1
>> Record 1 line 2
>> Record 1 line 3!
>> Record 2 line 1
>> Record 2 line 2
>> Record 2 line 3!
>> \.
```

Select rows that start with the substring "Record" and end with the substring "line 2."

```
=> SELECT v from t WHERE REGEXP_LIKE(v,'^Record.*line 2$'); v
(0 rows)
```

Select rows that start with the substring "Record" and end with the substring "line 2," treating multiple lines as separate strings.

```
=> SELECT v from t WHERE REGEXP_LIKE(v,'^Record.*line 2$','m'); v
-----------------------------------------------

Record 2 line 1
Record 2 line 2
Record 2 line 3
 Record 1 line 1
Record 1 line 2
Record 1 line 3
(2 rows)
```

REGEXP_REPLACE

Replace all occurrences of a substring that match a regular expression with another substring. It is similar to the ***REPLACE*** (page 290) function, except it uses a regular expression to select the substring to be replaced.

Syntax

```
REGEXP_REPLACE(string, target [, replacement [, position [, occurrence [,
regexp_modifiers]]]])
```

Parameters

string	The string whose to be searched and replaced.
target	The regular expression to search for within the string. The syntax of the regular expression is compatible with the Perl 5 regular expression syntax. See the ***Perl Regular Expressions Documentation*** (***http://perldoc.perl.org/perlre.html***) for details.
replacement	The string to replace matched substrings. If not supplied, the matched substrings are deleted. This string can contain backreferences for substrings captured by the regular expression. The first captured substring is inserted into the replacement string using `\1`, the second `\2`, and so on.
position	The number of characters from the start of the string where the function should start searching for matches. The default value, 1, means to start searching for a match at the first (leftmost) character. Setting this parameter to a value greater than 1 starts searching for a match to the pattern that many characters into the string.
occurrence	Controls which occurrence of a match between the string and the pattern is replaced. With the default value (0), the function replaces all matching substrings with the replacement string. For any value above zero, the function replaces just a single occurrence. For example, set this parameter to 3 to replace the third substring that matched the pattern.
regexp_modifier	A string containing one or more single-character flags that change how the regular expression is matched against the string: `b` Treat strings as binary octets rather than UTF-8 characters. `c` Forces the match to be case sensitive (the default). `i` Forces the match to be case insensitive.

	m	Treats the string being matched as multiple lines. With this modifier, the start of line (^) and end of line ($) regular expression operators match line breaks (\n) within the string. Ordinarily, these operators only match the start and end of the string.
	n	Allows the single character regular expression operator (.) to match a newline (\n). Normally, the . operator will match any character except a newline.
	x	Allows you to document your regular expressions. It causes all unescaped space characters and comments in the regular expression to be ignored. Comments start with a hash character (#) and end with a newline. All spaces in the regular expression that you want to be matched in strings must be escaped with a backslash (\) character.

Notes

This function operates on UTF-8 strings using the default locale, even if the locale has been set to something else.

If you are porting a regular expression query from an Oracle database, remember that Oracle considers a zero-length string to be equivalent to NULL, while Vertica does not.

Examples

Find groups of "word characters" (letters, numbers and underscore) ending with "thy" in the string "healthy, wealthy, and wise" and replace them with nothing.

```
=> SELECT REGEXP_REPLACE('healthy, wealthy, and wise','\w+thy');
 REGEXP_REPLACE
----------------
 , , and wise
(1 row)
```

Find groups of word characters ending with "thy" and replace with the string "something."

```
=> SELECT REGEXP_REPLACE('healthy, wealthy, and wise','\w+thy', 'something');
         REGEXP_REPLACE
--------------------------------
 something, something, and wise
(1 row)
```

Find groups of word characters ending with "thy" and replace with the string "something" starting at the third character in the string.

```
=> SELECT REGEXP_REPLACE('healthy, wealthy, and wise','\w+thy', 'something', 3);
          REGEXP_REPLACE
```

```
---------------------------------
 hesomething, something, and wise
(1 row)
```

Replace the second group of word characters ending with "thy" with the string "something."

```
=> SELECT REGEXP_REPLACE('healthy, wealthy, and wise','\w+thy', 'something', 1,
2);
        REGEXP_REPLACE
------------------------------
 healthy, something, and wise
(1 row)
```

Find groups of word characters ending with "thy" capturing the letters before the "thy", and replace with the captured letters plus the letters "ish."

```
=> SELECT REGEXP_REPLACE('healthy, wealthy, and wise','(\w+)thy', '\1ish');
       REGEXP_REPLACE
---------------------------
 healish, wealish, and wise
(1 row)
```

Create a table to demonstrate replacing strings in a query.

```
=> CREATE TABLE customers (name varchar(50), phone varchar(11));
CREATE TABLE
=> CREATE PROJECTION customers1 AS SELECT * FROM customers;
CREATE PROJECTION
=> COPY customers FROM stdin;
Enter data to be copied followed by a newline.
End with a backslash and a period on a line by itself.
>> Able, Adam|17815551234
>> Baker,Bob|18005551111
>> Chu,Cindy|16175559876
>> Dodd,Dinara|15083452121
>> \.
```

Query the customers, using REGEXP_REPLACE to format the phone numbers.

```
=> SELECT name, REGEXP_REPLACE(phone, '(\d)(\d{3})(\d{3})(\d{4})', '\1-(\2)
\3-\4') as phone FROM customers;
    name     |      phone
-------------+------------------
 Able, Adam  | 1-(781) 555-1234
 Baker,Bob   | 1-(800) 555-1111
 Chu,Cindy   | 1-(617) 555-9876
 Dodd,Dinara | 1-(508) 345-2121
(4 rows)
```

REGEXP_SUBSTR

Returns the substring that matches a regular expression within a string. If no matches are found, this function returns NULL. This is different than an empty string, which can be returned by this function if the regular expression matches a zero-length string.

Syntax

```
REGEXP_SUBSTR(string, pattern [, position [,  occurrence [, regexp_modifier]]])
```

Parameters

string	The string to search for the pattern.
pattern	The regular expression to find the substring to be extracted. The syntax of the regular expression is compatible with the Perl 5 regular expression syntax. See the ***Perl Regular Expressions Documentation*** (***http://perldoc.perl.org/perlre.html***) for details.
position	The character in the string where the search for a match should start. The default value, 1, starts the search at the beginning of the string. If you supply a value larger than 1 for this parameter, the function will start searching that many characters into the string.
occurrence	Controls which matching substring is returned by the function. When given the default value (1), the function will return the first matching substring it finds in the string. By setting this value to a number greater than 1, this function will return subsequent matching substrings. For example, setting this parameter to 3 will return the third substring that matches the regular expression within the string.
regexp_modifier	A string containing one or more single-character flags that change how the regular expression is matched against the string: `b` Treat strings as binary octets rather than UTF-8 characters. `c` Forces the match to be case sensitive (the default). `i` Forces the match to be case insensitive. `m` Treats the string being matched as multiple lines. With this modifier, the start of line (`^`) and end of line (`$`) regular expression operators match line breaks (`\n`) within the string. Ordinarily, these operators only match the start and end of the string. `n` Allows the single character regular expression operator (`.`) to match a newline (`\n`). Normally, the `.` operator will match any character except a newline.

	x	Allows you to document your regular expressions. It causes all unescaped space characters and comments in the regular expression to be ignored. Comments start with a hash character (#) and end with a newline. All spaces in the regular expression that you want to be matched in strings must be escaped with a backslash (\) character.

Notes

This function operates on UTF-8 strings using the default locale, even if the locale has been set to something else.

If you are porting a regular expression query from an Oracle database, remember that Oracle considers a zero-length string to be equivalent to NULL, while Vertica does not.

Examples

Select the first substring of letters that end with "thy."

```
=> SELECT REGEXP_SUBSTR('healthy, wealthy, and wise','\w+thy');
 REGEXP_SUBSTR
---------------
 healthy
(1 row)
```

Select the first substring of letters that ends with "thy" starting at the second character in the string.

```
=> SELECT REGEXP_SUBSTR('healthy, wealthy, and wise','\w+thy',2);
 REGEXP_SUBSTR
---------------
 ealthy
(1 row)
```

Select the second substring of letters that ends with "thy."

```
=> SELECT REGEXP_SUBSTR('healthy, wealthy, and wise','\w+thy',1,2);
 REGEXP_SUBSTR
---------------
 wealthy
(1 row)
```

RESTORE_LOCATION

Restores the retired location specified.

Syntax

```
RESTORE_LOCATION ( path , node )
```

Parameters

path	Specifies where the retired storage location is mounted.
node	Is the Vertica node where the retired location is available.

Notes

Once restored, Vertica re-ranks the storage locations and use the restored location to process queries as determined by its rank.

Example

The following example restores the retired storage location on node3:

```
=> SELECT RESTORE_LOCATION ('/thirdVerticaStorageLocation/' , 'node3');
```

See Also

ADD_LOCATION (page 318)

RETIRE_LOCATION (page 388)

Modifying Storage Locations in the Administrator's Guide

RETIRE_LOCATION

Makes the specified storage location inactive.

Syntax

```
RETIRE_LOCATION ( 'path' , 'site' )
```

Parameters

path	Specifies where the storage location to retire is mounted.
site	Is the Vertica site where the location is available.

Notes

- Before retiring a location, be sure that at least one location remains for storing data and temp files. Data and temp files can be stored in either one storage location or separate storage locations.
- Once retired, no new data can be stored on the location unless the location is restored through the ***RESTORE_LOCATION*** (page 387) function.
- If the storage location stored data, the data is not moved. Instead, it is removed through one or more mergeouts. Therefore, the location cannot be dropped.
- If the storage site was used to store only temp files, it can be dropped. See Dropping Storage Locations in the Administrators Guide and the ***DROP_LOCATION*** (page 340) function.

Example

```
=> SELECT RETIRE_LOCATION ('/secondVerticaStorageLocation/' , 'node2');
```

See Also

ADD_LOCATION (page 318)

RESTORE_LOCATION (page 387)

Retiring Storage Locations in the Administrator's Guide

SAVE_QUERY_REPOSITORY

Triggers Vertica to save query data to the query repository immediately.

Syntax

```
SAVE_QUERY_REPOSITORY()
```

Notes

- Vertica saves data based on the established query repository configuration parameters. For example, it will use the value of the QueryRepoRetentionTime parameter to determine the maximum number of days worth of queries to save. (See Configuring Query Repository in the Troubleshooting Guide.)
- Before you can save a query repository, you have to enable it:
  ```
  SELECT SET_CONFIG_PARAMETER('QueryRepositoryEnabled',1);
  ```

Example

```
=> SELECT SAVE_QUERY_REPOSITORY();
 SAVE_QUERY_REPOSITORY
-----------------------
 Query Repository Saved
(1 row)
```

See Also

Collecting Query Information in the Troubleshooting Guide

SET_AHM_EPOCH

Sets the Ancient History Mark (AHM) to the specified epoch. This function allows deleted data up to and including the AHM epoch to be purged from physical storage.

SET_AHM_EPOCH is normally used for testing purposes. Consider ***SET_AHM_TIME*** (page 391) instead, which is easier to use.

Syntax

```
SET_AHM_EPOCH ( epoch, [ true ] )
```

Parameters

epoch	Specifies one of the following: ▪ The number of the epoch in which to set the AHM ▪ Zero (0) (the default) disables ***purge*** (page 371)

true	Optionally allows the AHM to advance when nodes are down. **Note:** If the AHM is advanced after the last good epoch of the failed nodes, those nodes must recover all data from scratch. Use with care.

Notes

If you use SET_AHM_EPOCH , the number of the specified epoch must be:

- Greater than the current AHM epoch
- Less than the current epoch
- Less than or equal to the cluster last good epoch (the minimum of the last good epochs of the individual nodes in the cluster)
- Less than or equal to the cluster refresh epoch (the minimum of the refresh epochs of the individual nodes in the cluster)

Use the ***SYSTEM*** (page 751) table to see current values of various epochs related to the AHM; for example:

```
=> SELECT * from SYSTEM;
-[ RECORD 1 ]------------+--------------------------
current_timestamp        | 2009-08-11 17:09:54.651413
current_epoch            | 1512
ahm_epoch                | 961
last_good_epoch          | 1510
refresh_epoch            | -1
designed_fault_tolerance | 1
node_count               | 4
node_down_count          | 0
current_fault_tolerance  | 1
catalog_revision_number  | 1590
wos_used_bytes           | 0
wos_row_count            | 0
ros_used_bytes           | 41490783
ros_row_count            | 1298104
total_used_bytes         | 41490783
total_row_count          | 1298104
```

All nodes must be up. You cannot use SET_AHM_EPOCH when any node in the cluster is down, except by using the optional *true* parameter.

When a node is down and you issue `SELECT MAKE_AHM_NOW()`, the following error is printed to the vertica.log:

```
Some nodes were excluded from setAHM. If their LGE is before the AHM they will perform full recovery.
```

Examples

The following command sets the AHM to a specified epoch of 12:

```
=> SELECT SET_AHM_EPOCH(12);
```

The following command sets the AHM to a specified epoch of 2 and allows the AHM to advance despite a failed node:

```
=> SELECT SET_AHM_EPOCH(2, true);
```

See Also

MAKE_AHM_NOW (page 363)

SET_AHM_TIME (page 391)

SYSTEM (page 751)

SET_AHM_TIME

Sets the Ancient History Mark (AHM) to the epoch corresponding to the specified time on the initiator node. This function allows historical data up to and including the AHM epoch to be purged from physical storage.

Syntax

```
SET_AHM_TIME ( time , [ true ] )
```

Parameters

time	Is a ***TIMESTAMP*** (page 87) value that is automatically converted to the appropriate epoch number.
true	[Optional] Allows the AHM to advance when nodes are down. **Note:** If the AHM is advanced after the last good epoch of the failed nodes, those nodes must recover all data from scratch.

Notes

- SET_AHM_TIME returns a TIMESTAMP WITH TIME ZONE value representing the end point of the AHM epoch.
- You cannot change the AHM when any node in the cluster is down, except by using the optional *true* parameter.
- When a node is down and you issue `SELECT MAKE_AHM_NOW()`, the following error is printed to the vertica.log:

  ```
  Some nodes were excluded from setAHM. If their LGE is before the AHM they
     will perform full recovery.
  ```

Examples

Epochs depend on a configured epoch advancement interval. If an epoch includes a three-minute range of time, the purge operation is accurate only to within minus three minutes of the specified timestamp:

```
=> SELECT SET_AHM_TIME('2008-02-27 18:13');
            set_ahm_time
-----------------------------------
 AHM set to '2008-02-27 18:11:50-05'
(1 row)
```

Note: The -05 part of the output string is a time zone value, an offset in hours from UTC (Universal Coordinated Time, traditionally known as Greenwich Mean Time, or GMT).

In the above example, the actual AHM epoch ends at 18:11:50, roughly one minute before the specified timestamp. This is because SET_AHM_TIME selects the epoch that ends at or before the specified timestamp. It does not select the epoch that ends after the specified timestamp because that would purge data deleted as much as three minutes after the AHM.

For example, using only hours and minutes, suppose that epoch 9000 runs from 08:50 to 11:50 and epoch 9001 runs from 11:50 to 15:50. `SET_AHM_TIME('11:51')` chooses epoch 9000 because it ends roughly one minute before the specified timestamp.

In the next example, if given an environment variable set as `date =`date`;` the following command fails if a node is down:

```
=> SELECT SET_AHM_TIME('$date');
```

In order to force the AHM to advance, issue the following command instead:

```
=> SELECT SET_AHM_TIME('$date', true);
```

See Also

MAKE_AHM_NOW (page 363)

SET_AHM_EPOCH (page 389) for a description of the range of valid epoch numbers.

SET DATESTYLE (page 634) for information about specifying a ***TIMESTAMP*** (page 87) value.

SET_LOCATION_PERFORMANCE

Sets disk performance for the location specified.

Syntax

```
SET_LOCATION_PERFORMANCE ( path , node , throughput , average_latency )
```

Parameters

node	Is the Vertica node where the location to be set is available. If this parameter is omitted, *node* defaults to the initiator.
path	Specifies where the storage location to set is mounted.
throughput	Specifies the throughput for the location, which must be 1 or more.
average_latency	Specifies the average latency for the location. The *average_latency* must be 1 or more.

Notes

To obtain the throughput and average latency for the location, run the ***MEASURE_LOCATION_PERFORMANCE*** (page 366) function before you attempt to set the location's performance.

Example

The following example sets the performance of a storage location on node2 to a throughput of 122 megabytes per second and a latency of 140 seeks per second.

```
=> SELECT MEASURE_LOCATION_PERFORMANCE('node2','/secondVerticaStorageLocation/','122','140');
```

See Also

ADD_LOCATION (page 318)

MEASURE_LOCATION_PERFORMANCE (page 366)

Measuring Location Performance and Setting Location Performance in the Administrator's Guide

SHUTDOWN

Forces a database to shut down, even if there are users connected.

Syntax

```
SHUTDOWN ( [ 'false' | 'true' ] )
```

Parameters

false	[Default] Returns a message if users are connected. Has the same effect as supplying no parameters.
true	Performs a moveout operation and forces the database to shut down, disallowing further connections.

Notes

- Quotes around the `true` or `false` arguments are optional.
- Issuing the shutdown command without arguments or with the default (false) argument returns a message if users are connected, and the shutdown fails. If no users are connected, the database performs a moveout operation and shuts down.
- Issuing the `SHUTDOWN('true')` command forces the database to shut down whether users are connected or not.
- You can check the status of the shutdown operation in the `vertica.log file`:
  ```
  2010-03-09 16:51:52.625 unknown:0x7fc6d6d2e700 [Init] <INFO> Shutdown
     complete. Exiting.
  ```
- As an alternative to SHUTDOWN(), you can also temporarily set MaxClientSessions to 0 and then use CLOSE_ALL_SESSIONS(). New client connections cannot connect unless they connect using the dbadmin account. See ***CLOSE_ALL_SESSIONS*** (page 333) for details.

Examples

The following command attempts to shut down the database. Because users are connected, the command fails:

```
=> SELECT SHUTDOWN('false');
NOTICE:  Cannot shut down while users are connected
          SHUTDOWN
```

```
----------------------------
 Shutdown: aborting shutdown
(1 row)
```

Note that `SHUTDOWN()` and `SHUTDOWN('false')` perform the same operation:

```
=> SELECT SHUTDOWN();
NOTICE:  Cannot shut down while users are connected
          SHUTDOWN
----------------------------
 Shutdown: aborting shutdown
(1 row)
```

Using the `'true'` parameter forces the database to shut down, even though clients might be connected:

```
=> SELECT SHUTDOWN('true');
          SHUTDOWN
----------------------------
 Shutdown: moveout complete
(1 row)
```

See Also

SESSIONS (page 741)

START_REFRESH

Transfers data to projections that are not able to participate in query execution due to missing or out-of-date data.

Syntax

```
START_REFRESH()
```

Notes

- When a design is deployed through the Database Designer, it is automatically refreshed. See Deploying Designs in the Administrator's Guide.
- All nodes must be up in order to start a refresh.
- START_REFRESH() has no effect if a refresh is already running.
- A refresh is run asynchronously.
- Shutting down the database ends the refresh.
- To view the progress of the refresh, see the ***PROJECTION_REFRESHES*** (page 717) and ***PROJECTIONS*** (page 673) system tables.
- If a projection is updated from scratch, the data stored in the projection represents the table columns as of the epoch in which the refresh commits. As a result, the query optimizer might not choose the new projection for AT EPOCH queries that request historical data at epochs older than the refresh epoch of the projection. Projections refreshed from buddies retain history and can be used to answer historical queries.

Vertica internal operations (mergeout, refresh, and recovery) maintain partition separation except in certain cases:

- Recovery of a projection when the buddy projection from which the partition is recovering is identically sorted. If the projection is undergoing a full rebuild, it is recovered one ROS container at a time. The projection ends up with a storage layout identical to its buddy and is, therefore, properly segmented.

  Note: In the case of a partial rebuild, all recovered data goes into a single ROS container and must be partitioned manually.
- Manual tuple mover operations often output a single storage container, combining any existing partitions; for example, after executing any of the `PURGE()` operations.

Example

The following command starts the refresh operation:

```
=> SELECT START_REFRESH();
             start_refresh
---------------------------------------
 Starting refresh background process.
```

See Also

CLEAR_PROJECTION_REFRESHES (page 329)

MARK_DESIGN_KSAFE (page 365)

PROJECTION_REFRESHES (page 717)

PROJECTIONS (page 673)

Clearing PROJECTION_REFRESHES History in the Administrator's Guide

Catalog Management Functions

This section contains catalog management functions specific to Vertica.

DUMP_CATALOG

Returns an internal representation of the Vertica catalog. This function is used for diagnostic purposes.

Syntax

```
DUMP_CATALOG()
```

Notes

To obtain an internal representation of the Vertica catalog for diagnosis, run the query:

```
SELECT DUMP_CATALOG();
```

The output is written to the specified file:

```
\o /tmp/catalog.txt
SELECT DUMP_CATALOG();
\o
```

Send the output to ***Technical Support*** (on page 1).

EXPORT_CATALOG

Generates a SQL script that can be used to recreate a physical schema design in its current state on a different cluster.

Syntax

```
EXPORT_CATALOG ( [ destination ] , [ type ] )
```

Parameters

destination	Specifies the path and name of the SQL output file. An empty string (' '), which is the default, dumps the script to standard output. A user who is not a DBA can only specify an empty string.
type	Determines what is exported: ▪ design — Exports schemas, tables, constraints, views, and projections to which the user has access. This is the default value. ▪ design_all — Exports all the design objects plus system objects created in Database Designer (for example, design contexts and their tables). The objects that are exported are only the ones to which the user has access. ▪ tables— Exports all tables, constraints, and projections for those tables for which the user has permissions. See also ***EXPORT_TABLES*** (page 354).

Notes

- Exporting a design is useful for quickly moving a design to another cluster.

- The script generated by this function:
  - Creates only the non-virtual objects for which the user has access.
  - Automatically runs MARK_DESIGN_KSAFE() with the correct K-Safety value to ensure the design copy has the same same K-Safety value as the original design.
  - Exports catalog objects in their Oid order.
- Use the design_all parameter when adding a node to a cluster. See Modifying Database Designs for Updated Nodes.
- If a projection is created with no sort order, Vertica implicitly assigns a sort order based on the SELECT columns in the projection definition. The sort order is explicitly defined in the exported script.

Restrictions

The export script Vertica generates is portable as long as all the projections were generated using UNSEGMENTED ALL NODES or SEGMENTED ALL NODES. Projections might not exist on ALL NODES for the following reasons:

- A projection was dropped from a node.
- A projection was created only on a subset of nodes.
- An additional node was added since the projection set was created and the design wasn't extended through Database Designer deployment.

Example

The following example exports the design to standard output:

```
SELECT EXPORT_CATALOG(' ','DESIGN');
```

EXPORT_OBJECTS

Generates a SQL script that can be used to recreate catalog objects on a different cluster.

Syntax

```
EXPORT_OBJECTS( [ destination ] , [ scope ] , [ bool_value ] )
```

Parameters

destination	Specifies the path and name of the SQL output file. An empty string (' '), which is the default, dumps the script to standard output. A user who is not a DBA can only specify an empty string.

scope	Determines the set of catalog objects to be exported where scope is one of the following: ▪ an empty string (' ')—exports all non-virtual objects to which the user has access, including constraints. (Note that constraints are not objects which can be passed as individual arguments.) This is the default if no scope is specified. ▪ a comma-delimited list of items in which each item can be one of the following: ▪ —'<schema>.<obj>'—matches the named object. The named object can be a table, projection, or view. ▪ —'<obj>'—matches the named object within the current search path. The named object can be a schema, table, projection, or view. If the named object is a schema, Vertica exports all non-virtual objects to which the user has access within that schema. If a schema and table both have the same name, the schema takes precedence. EXPORT_OBJECTS returns an error if: ▪ an explicitly-specified object does not exist. ▪ the user has no access to the specified object.
bool-value	Use one of the following: ▪ true—incorporates a MAKE_DESIGN_KSAFE statement with the correct K-Safety value for the database at the end of the output script. ▪ false—omits the MAKE_DESIGN_KSAFE statement from the script. Adding the MAKE_DESIGN_KSAFE statement is useful if you are planning to import the script into a new database and you want the new database to inherit the K-Safety value from the original database. By default, this parameter is true.

Notes

- The script generated by this function:
  - Creates only the non-virtual objects for which the user has access.
  - Exports catalog objects in their Oid order.
- None of the parameters for EXPORT_OBJECTS accepts a NULL value as input.

Example

The following example exports the all the non-virtual objects to which the user has access to standard output. It does not incorporates the MAKE_DESIGN_KSAFE statement at the end of the file.

```
SELECT EXPORT_OBJECTS(' ',' ',false);
```

INSTALL_LICENSE

SELECT INSTALL_LICENSE(<FILENAME>) installs the license key in the global catalog.

description

Syntax

```
INSTALL_LICENSE( 'filename' )
```

Parameters

filename	specifies the absolute pathname of a valid license file.

Notes

See Managing Your License Key in the Administrator's Guide for more information about license keys.

Examples

```
SELECT INSTALL_LICENSE('/tmp/vlicense.txt');
```

MARK_DESIGN_KSAFE

Enables or disables high availability in your environment, in case of a failure. Before enabling recovery, MARK_DESIGN_KSAFE queries the catalog to determine whether a cluster's physical schema design meets the following requirements:

- Dimension tables are replicated on all nodes.
- Fact table superprojections are segmented with each segment on a different node.
- Each fact table projection has at least one buddy projection for K-Safety=1 (or two buddy projections for K-Safety=2).

  Buddy projections are also segmented across database nodes, but the distribution is modified so that segments that contain the same data are distributed to different nodes. See High Availability Through Projections in the Concepts Guide.

  Note: Projections are considered to be buddies if they contain the same columns and have the same segmentation. They can have different sort orders.

MARK_DESIGN_KSAFE does not change the physical schema in any way.

Syntax

```
SELECT MARK_DESIGN_KSAFE ( k )
```

Parameters

k	2 enables high availability if the schema design meets requirements for K-Safety=2 1 enables high availability if the schema design meets requirements for K-Safety=1 0 disables high availability

If you specify a *k* value of one (1) or two (2), Vertica returns one of the following messages.

Success:

```
Marked design n-safe
```

Failure:

```
The schema does not meet requirements for K=n.
Fact table projection projection-name
has insufficient "buddy" projections.
```

n in the message is 1 or 2 and represents the *k* value.

Notes

- The database's internal recovery state persists across database restarts but it is not checked at startup time.
- If a database has automatic recovery enabled, you must temporarily disable automatic recovery before creating a new table.
- When one node fails on a system marked K-safe=1, the remaining nodes are available for DML operations.

Examples

```
=> SELECT MARK_DESIGN_KSAFE(1);
  mark_design_ksafe
----------------------
 Marked design 1-safe
(1 row)
```

If the physical schema design is not K-Safe, messages indicate which projections do not have a buddy:

```
=> SELECT MARK_DESIGN_KSAFE(1);
The given K value is not correct; the schema is 0-safe
Projection pp1 has 0 buddies, which is smaller that the given K of 1
Projection pp2 has 0 buddies, which is smaller that the given K of 1
.
.
.
(1 row)
```

See Also

SYSTEM (page 751)

High Availability and Recovery in the Concepts Guide

SQL System Tables (Monitoring APIs) (page 660) topic in the Administrator's Guide

Using Identically Segmented Projections in the Programmer's Guide

Failure Recovery in the Troubleshooting Guide

Constraint Management Functions

This section contains constraint management functions specific to Vertica.

ANALYZE_CONSTRAINTS

Analyzes and reports on constraint violations within the current schema search path.

You can check for constraint violations by passing an empty argument (which returns violations on all tables within the current schema), by passing a single table argument, or by passing two arguments containing a table name and a column or list of columns.

Syntax

```
ANALYZE_CONSTRAINTS [ ( '' )
... | ( schema.table )
... | [ ( schema.table , column ) ]
```

Parameters

('')	Analyzes and reports on all tables within the current schema search path.
table	Analyzes and reports on all constraints referring to the specified table.

column	Analyzes and reports on all constraints referring to specified table that contains the specified columns.

Notes

- ANALYZE_CONSTRAINTS(), takes locks in the same way that `SELECT * FROM t1` holds a lock on table `t1`. See ***LOCKS*** (page 712) for additional information.
- Use ***COPY*** (page 497) with NO COMMIT keywords to incorporate detection of constraint violations into the load process. Vertica checks for constraint violations when queries are run, not when data is loaded. To avoid constraint violations, load data without committing it and then perform a post-load check of your data using the ANALYZE_CONSTRAINTS function. If the function finds constraint violations, you can roll back the load because you have not committed it.
- ANALYZE_CONSTRAINTS() fails if the database cannot perform constraint checks, such as when the system is out of resources. Vertica returns an error that identifies the specific condition that caused the failure.
- When ANALYZE_CONSTRAINTS finds violations, such as when you insert a duplicate value into a primary key, you can correct errors using the following functions. Effects last until the end of the session only:
  - SELECT ***DISABLE_DUPLICATE_KEY_ERROR*** (page 336)
  - SELECT ***REENABLE_DUPLICATE_KEY_ERROR*** (page 373)
- If you specify the wrong table, the system returns an error message:

```
SELECT ANALYZE_CONSTRAINTS('abc');
ERROR: 'abc' is not a table in the current search path
```

- If you issue the function using incorrect syntax, the system returns an error message with a hint:

```
ANALYZE ALL CONSTRAINT;
```

Or

```
ANALYZE CONSTRAINT abc;
ERROR: ANALYZE CONSTRAINT is not supported.
HINT: You may consider using analyze_constraints().
```

- ANALYZE_CONSTRAINTS returns an error if run from a non-default locale; for example:

```
=> \locale LEN
INFO:  Canonical locale: 'en'
INFO:    English
INFO:  Standard collation: 'LEN'
=> SELECT ANALYZE_CONSTRAINTS('t1');
ERROR:  ANALYZE_CONSTRAINTS is currently not supported in non-default
   locales
HINT:  Set the locale in this session to en_US@collation=binary using
   the
command "\locale en_US@collation=binary"
```

Return Values

ANALYZE_CONSTRAINTS() returns results in a structured set (see table below) that lists the schema name, table name, column name, constraint name, constraint type, and the column values that caused the violation.

If the result set is empty, then no constraint violations exist; for example:

```
SELECT ANALYZE_CONSTRAINTS ('public.product_dimension', 'product_key');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+---------------
(0 rows)
```

The following result set, on the other hand, shows a primary key violation, along with the value that caused the violation (`'10'`):

```
SELECT ANALYZE_CONSTRAINTS ('');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+---------------
 store         t1           c1             pk_t1             PRIMARY           ('10')
(1 row)
```

The result set columns are described in further detail in the following table:

Column Name	Data Type	Description
`Schema Name`	VARCHAR	The name of the schema.
`Table Name`	VARCHAR	The name of the table, if specified.

`Column Names`	VARCHAR	Names of columns containing constraints. Multiple columns are in a comma-separated list:
		`store_key,`
		`store_key, date_key,`

`Constraint Name`	VARCHAR	The given name of the primary key, foreign key, unique, or not null constraint, if specified.
`Constraint Type`	VARCHAR	Identified by one of the following strings: 'PRIMARY KEY', 'FOREIGN KEY', 'UNIQUE', or 'NOT NULL'.

`Column Values`	VARCHAR	Value of the constraint column, in the same order in which `Column Names` contains the value of that column in the violating row.
		When interpreted as SQL, the value of this column forms a list of values of the same type as the columns in `Column Names`; for example:
		`('1'),`
		`('1', 'z')`

Examples

Given the following inputs, Vertica returns one row, indicating one violation, because the same primary key value (10) was inserted into table t1 twice:

```
CREATE TABLE t1(c1 INT);
ALTER TABLE t1 ADD CONSTRAINT pk_t1 PRIMARY KEY (c1);
CREATE PROJECTION t1_p (c1) AS SELECT * FROM t1 UNSEGMENTED ALL NODES;
```

```
INSERT INTO t1 values (10);
INSERT INTO t1 values (10); --Duplicate primary key value
SELECT ANALYZE_CONSTRAINTS('t1');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+---------------
 public       t1           c1             pk_t1             PRIMARY           ('10')
(1 row)
```

If the second INSERT statement above had contained any different value, the result would have been 0 rows (no violations).

In this example, create a table that contains 3 integer columns, one a unique key and one a primary key:

```
CREATE TABLE fact_1(
  f INTEGER,
  f_UK INTEGER UNIQUE,
  f_PK  INTEGER PRIMARY KEY
);
```

Try issuing a command that refers to a nonexistent column:

```
SELECT ANALYZE_CONSTRAINTS('f_BB', 'f2');
ERROR: 'f_BB' is not a table name in the current search path
```

Insert some values into table `fact_1` and commit the changes:

```
INSERT INTO fact_1 values (1, 1, 1);
COMMIT;
```

Now issue the ANALYZE_CONSTRAINTS command on table `fact_1`. No constraint violations are expected and none are found:

```
SELECT ANALYZE_CONSTRAINTS('fact_1');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+---------------
(0 rows)
```

Now insert duplicate unique and primary key values and run ANALYZE_CONSTRAINTS on table `fact_1` again. The system shows two violations: one against the primary key and one against the unique key:

```
INSERT INTO fact_1 VALUES (1, 1, 1);
COMMIT;
SELECT ANALYZE_CONSTRAINTS('fact_1');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+---------------
 public      | fact_1     | f_pk         | -               | PRIMARY         | ('1')
 public      | fact_1     | f_uk         | -               | UNIQUE          | ('1')
(2 rows)
```

The following command looks for constraint validation on only the unique key in table `fact_1`:

```
SELECT ANALYZE_CONSTRAINTS('fact_1', 'f_UK');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+---------------
 public      | fact_1     | f_uk         | C_UNIQUE        | UNIQUE          | ('1')
(1 row)
```

The following example shows that you can specify the same column more than once; the function, however, returns the violation once only:

```
SELECT ANALYZE_CONSTRAINTS('fact_1', 'f_PK, F_PK');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+---------------
 public      | fact_1     | f_pk         | C_PRIMARY       | PRIMARY         | ('1')
(1 row)
```

The following example creates a new dimension table, dim_1, and inserts a foreign key and different (character) data types:

```
CREATE TABLE dim_1 (b VARCHAR(3), b_PK VARCHAR(4), b_FK INTEGER REFERENCES fact_1(f_PK));
```

Alter the table to create a multicolumn unique key and multicolumn foreign key and create superprojections:

```
ALTER TABLE dim_1 ADD CONSTRAINT dim_1_multiuk PRIMARY KEY (b, b_PK);
```

The following command inserts a missing foreign key (0) in table dim_1 and commits the changes:

```
INSERT INTO dim_1 VALUES ('r1', 'Xpk1', 0);
COMMIT;
```

Checking for constraints on table dim_1 detects a foreign key violation:

```
SELECT ANALYZE_CONSTRAINTS('dim_1');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+---------------
 public      | dim_1      | b_fk         | C_FOREIGN       | FOREIGN         | ('0')
(1 row)
```

Now add a duplicate value into the unique key and commit the changes:

```
INSERT INTO dim_1 values ('r2', 'Xpk1', 1);
INSERT INTO dim_1 values ('r1', 'Xpk1', 1);
COMMIT;
```

Checking for constraint violations on table dim_1 detects the duplicate unique key error:

```
SELECT ANALYZE_CONSTRAINTS('dim_1');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+----------------
 public      | dim_1      | b, b_pk      | dim_1_multiuk   | PRIMARY         | ('r1', 'Xpk1')
 public      | dim_1      | b_fk         | C_FOREIGN       | FOREIGN         | ('0')
(2 rows)
```

Now create a table with multicolumn foreign key and create the superprojections:

```
CREATE TABLE dim_2(z_fk1 VARCHAR(3), z_fk2 VARCHAR(4));
ALTER TABLE dim_2 ADD CONSTRAINT dim_2_multifk FOREIGN KEY (z_fk1, z_fk2) REFERENCES dim_1(b, b_PK);
```

Now insert a foreign key that matches a foreign key in table dim_1 and commit the changes:

```
INSERT INTO dim_2 VALUES ('r1', 'Xpk1');
COMMIT;
```

Checking for constraints on table dim_2 detects no violations:

```
SELECT ANALYZE_CONSTRAINTS('dim_2');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+---------------
(0 rows)
```

Add a value that does not match and commit the change:

```
INSERT INTO dim_2 values ('r1', 'NONE');
COMMIT;
```

Checking for constraints on table dim_2 detects a foreign key violation:

```
SELECT ANALYZE_CONSTRAINTS('dim_2');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+----------------
 public      | dim_2      | z_fk1, z_fk2 | dim_2_multifk   | FOREIGN         | ('r1', 'NONE')
(1 row)
```

Now analyze all constraints on all tables:

```
SELECT ANALYZE_CONSTRAINTS('');
 Schema Name | Table Name | Column Names | Constraint Name | Constraint Type | Column Values
-------------+------------+--------------+-----------------+-----------------+---------------
 public      | dim_1      | b, b_pk      | dim_1_multiuk   | PRIMARY         | ('r1', 'Xpk1')
 public      | dim_1      | b_fk         | C_FOREIGN       | FOREIGN         | ('0')
 public      | dim_2      | z_fk1, z_fk2 | dim_2_multifk   | FOREIGN         | ('r1', 'NONE')
 public      | fact_1     | f_pk         | C_PRIMARY       | PRIMARY         | ('1')
 public      | fact_1     | f_uk         | C_UNIQUE        | UNIQUE          | ('1')
(5 rows)
```

To quickly clean up your database, issue the following command:

```
DROP TABLE fact_1 cascade;
DROP TABLE dim_1 cascade;
DROP TABLE dim_2 cascade;
```

To learn how to remove violating rows, see the ***DISABLE_DUPLICATE_KEY_ERROR*** (page 336) function.

See Also

Adding Constraints in the Administrator's Guide

COPY (page 497)

ALTER TABLE (page 488)

CREATE TABLE (page 546)

DISABLE_DUPLICATE_KEY_ERROR

Disables error messaging when Vertica finds duplicate PRIMARY KEY/UNIQUE KEY values at run time. Queries execute as though no constraints are defined on the schema. Effects are session scoped.

CAUTION: When called, DISABLE_DUPLICATE_KEY_ERROR() suppresses data integrity checking and can lead to incorrect query results. Use this function only after you insert duplicate primary keys into a dimension table in the presence of a prejoin projection. Then correct the violations and turn integrity checking back on with ***REENABLE_DUPLICATE_KEY_ERROR*** (page 373)().

Syntax

```
DISABLE_DUPLICATE_KEY_ERROR();
```

Notes

The following series of commands create a table named `dim` and the corresponding projection:

```
CREATE TABLE dim (pk INTEGER PRIMARY KEY, x INTEGER);
CREATE PROJECTION dim_p (pk, x) AS SELECT * FROM dim ORDER BY x UNSEGMENTED ALL
NODES;
```

The next two statements create a table named `fact` and the pre-join projection that joins `fact` to `dim`.

```
CREATE TABLE fact(fk INTEGER REFERENCES dim(pk));
CREATE PROJECTION prejoin_p (fk, pk, x) AS SELECT * FROM fact, dim WHERE pk=fk ORDER
BY x;
```

The following statements load values into table `dim`. Notice the last statement inserts a duplicate primary key value of 1:

```
INSERT INTO dim  values (1,1);
INSERT INTO dim  values (2,2);
INSERT INTO dim  values (1,2); --Constraint violation
COMMIT;
```

Table `dim` now contains duplicate primary key values, but you cannot delete the violating row because of the presence of the pre-join projection. Any attempt to delete the record results in the following error message:

```
ROLLBACK:  Duplicate primary key detected in FK-PK join Hash-Join (x dim_p), value
1
```

In order to remove the constraint violation `(pk=1)`, use the following sequence of commands, which puts the database back into the state just before the duplicate primary key was added.

To remove the violation:

1. First save the original `dim` rows that match the duplicated primary key.

   ```
   CREATE TEMP TABLE dim_temp(pk integer, x integer);
   INSERT INTO dim_temp SELECT * FROM dim WHERE pk=1 AND x=1; -- original
      dim row
   ```

2. Temporarily disable error messaging on duplicate constraint values:

   ```
   SELECT DISABLE_DUPLICATE_KEY_ERROR();
   ```

   Caution: Remember that issuing this command suppresses the enforcement of data integrity checking.

3. Remove the the original row that contains duplicate values:

   ```
   DELETE FROM dim WHERE pk=1;
   ```

4. Allow the database to resume data integrity checking:

   ```
   SELECT REENABLE_DUPLICATE_KEY_ERROR();
   ```

5. Reinsert the original values back into the dimension table:

   ```
   INSERT INTO dim SELECT * from dim_temp;
   COMMIT;
   ```

6. Validate your dimension and fact tables.

If you receive the following error message, it means that the duplicate records you want to delete are not identical. That is, the records contain values that differ in at least one column that is not a primary key; for example, (1,1) and (1,2).

```
ROLLBACK: Delete: could not find a data row to delete (data integrity violation?)
```

The difference between this message and the rollback message in the previous example is that a fact row contains a foreign key that matches the duplicated primary key, which has been inserted. Thus, a row with values from the fact and dimension table is now in the prejoin projection. In order for the DELETE statement (Step 3 in the following example) to complete successfully, extra predicates are required to identify the original dimension table values (the values that are in the prejoin).

This example is nearly identical to the previous example, except that an additional INSERT statement joins the fact table to the dimension table by a primary key value of 1:

```
INSERT INTO dim  values (1,1);
INSERT INTO dim  values (2,2);
INSERT INTO fact values (1);   -- New insert statement joins fact with dim on
primary key value=1
INSERT INTO dim  values (1,2); -- Duplicate primary key value=1
COMMIT;
```

To remove the violation:

1. First save the original `dim` and `fact` rows that match the duplicated primary key:

   ```
   CREATE TEMP TABLE dim_temp(pk integer, x integer);
   CREATE TEMP TABLE fact_temp(fk integer);
   INSERT INTO dim_temp SELECT * FROM dim WHERE pk=1 AND x=1; -- original
      dim row
   INSERT INTO fact_temp SELECT * FROM fact WHERE fk=1;
   ```

2. Temporarily suppresses the enforcement of data integrity checking:

   ```
   SELECT DISABLE_DUPLICATE_KEY_ERROR();
   ```

3. Remove the duplicate primary keys. These steps implicitly remove all fact rows with the matching foreign key, as well.

   a) Remove the the original row that contains duplicate values:

   ```
   DELETE FROM dim WHERE pk=1 AND x=1;
   ```

   Note: The extra predicate (`x=1`) specifies removal of the original (`1,1`) row, rather than the newly inserted (`1,2`) values that caused the violation.

   b) Remove all remaining rows:

   ```
   DELETE FROM dim WHERE pk=1;
   ```

4. Turn on integrity checking:

   ```
   SELECT REENABLE_DUPLICATE_KEY_ERROR();
   ```

5. Reinsert the original values back into the fact and dimension table:

   ```
   INSERT INTO dim SELECT * from dim_temp;
   INSERT INTO fact SELECT * from fact_temp;
   COMMIT;
   ```

6. Validate your dimension and fact tables.

See Also

ANALYZE_CONSTRAINTS (page 321)

REENABLE_DUPLICATE_KEY_ERROR (page 373)

LAST_INSERT_ID

Returns the last value of a column whose value is automatically incremented through the AUTO_INCREMENT or IDENTITY ***column-constraint*** (page 556).

Behavior Type

Volatile

Syntax

```
LAST_INSERT_ID()
```

Notes

- This function works only with auto-increment and identity columns. See ***column-constraints*** (page 556) for the ***CREATE TABLE*** (page 546) statement.
- LAST_INSERT_ID does not work with sequence generators created through the ***CREATE SEQUENCE*** (page 540) statement.

Examples

Create a sample table called `customer4`. Notice that the IDENTITY column has a seed of 2, which specifies the value for the first row loaded into the table, and an increment of 2, which specifies the value that is added to identity value of the previous row.

```
CREATE TABLE customer4(
  ID IDENTITY(2,2),
  lname VARCHAR(25),
  fname VARCHAR(25),
  membership_card INTEGER
);
INSERT INTO customer4(lname, fname, membership_card)
VALUES ('Gupta', 'Saleem', 475987);
```

Query the table you just created:

```
SELECT * FROM customer4;
 ID | lname | fname  | membership_card
----+-------+--------+-----------------
  2 | Gupta | Saleem |          475987
(1 row)
```

Insert some additional values:

```
INSERT INTO customer4(lname, fname, membership_card)
VALUES ('Lee', 'Chen', 598742);
```

Call the LAST_INSERT_ID function:

```
SELECT LAST_INSERT_ID();
last_insert_id
---------------
              4
(1 row)
```

Query the table again:

```
SELECT * FROM customer4;
 ID | lname | fname  | membership_card
----+-------+--------+-----------------
  2 | Gupta | Saleem |          475987
  4 | Lee   | Chen   |          598742
(2 rows)
```

Add another row:

```
INSERT INTO customer4(lname, fname, membership_card)
VALUES ('Davis', 'Bill', 469543);
```

Call the LAST_INSERT_ID function:

```
SELECT LAST_INSERT_ID();
 LAST_INSERT_ID
----------------
              6
(1 row)
```

Query the table again:

```
SELECT * FROM customer4;
 ID | lname | fname  | membership_card
----+-------+--------+-----------------
  2 | Gupta | Saleem |          475987
  4 | Lee   | Chen   |          598742
  6 | Davis | Bill   |          469543
(3 rows)
```

See Also

ALTER SEQUENCE (page 485)

CREATE SEQUENCE (page 540)

DROP SEQUENCE (page 587)

Using Sequences and Sequence Privileges in the Administrator's Guide

REENABLE_DUPLICATE_KEY_ERROR

Restores the default behavior of error reporting by reversing the effects of DISABLE_DUPLICATE_KEY_ERROR. Effects are session scoped.

Syntax

```
REENABLE_DUPLICATE_KEY_ERROR();
```

Examples

For examples and usage see ***DISABLE_DUPLICATE_KEY_ERROR*** (page 336).

See Also

ANALYZE_CONSTRAINTS (page 321)

Database Management Functions

This section contains the database management functions specific to Vertica.

CLEAR_QUERY_REPOSITORY

Triggers Vertica to clear query data from the query repository immediately.

Syntax

```
CLEAR_QUERY_REPOSITORY()
```

Notes

Before using this function:

1. Note the value of the QueryRepoRetentionTime parameter.
2. Set the QueryRepoRetentionTime parameter to zero (0). (See Configuring Query Repository in the Troubleshooting Guide.)

   ```
   => SELECT SET_CONFIG_PARAMETER('QueryRepoRetentionTime','0');
   ```

Once you have cleared the query repository, set the QueryRepoRetentionTime parameter back to the original value (before you changed it to zero). The default value is 100.

Example

```
SELECT CLEAR_QUERY_REPOSITORY();
  CLEAR_QUERY_REPOSITORY
--------------------------
 Query Repository Cleaned
(1 row)
```

See Also

Collecting Query Information in the Troubleshooting Guide

Configuration Parameters in the Administrator's Guide

CLEAR_RESOURCE_REJECTIONS

Clears the content of the ***RESOURCE_REJECTIONS*** (page 735) and ***DISK_RESOURCE_REJECTIONS*** (page 698) system tables. Normally, these tables are only cleared during a node restart. This function lets you clear the tables whenever you need. For example, you may want to clear the tables after having resolved a disk space issue that caused disk resource rejections.

DISPLAY_LICENSE

Returns license information.

Syntax

```
DISPLAY_LICENSE()
```

Examples

```
SELECT DISPLAY_LICENSE();
```

```
                   display_license
-----------------------------------------------------
 Vertica Systems, Inc.
2007-08-03
Perpetual
0
500GB

(1 row)
```

DUMP_LOCKTABLE

Returns information about deadlocked clients and the resources they are waiting for.

Syntax

```
DUMP_LOCKTABLE()
```

Notes

Use DUMP_LOCKTABLE if Vertica becomes unresponsive:

1. Open an additional vsql connection.
2. Execute the query:
   SELECT DUMP_LOCKTABLE();
   The output is written to vsql. See Monitoring the Log Files.
3. Copy the output and send it to ***Technical Support*** (on page 1).

You can also see who is connected using the following command:

```
SELECT * FROM SESSIONS;
```

Close all sessions using the following command:

```
SELECT CLOSE_ALL_SESSIONS();
```

Close a single session using the following command:

How to close a single session:

```
SELECT CLOSE_SESSION('session_id');
```

You get the session_id value from the ***V_MONITOR.SESSIONS*** (page 741) system table.

See Also

CLOSE_ALL_SESSIONS (page 333)

CLOSE_SESSION (page 330)

LOCKS (page 712)

V_MONITOR.SESSIONS (page 741)

DUMP_PARTITION_KEYS

Dumps the partition keys of all projections in the system.

Syntax

```
DUMP_PARTITION_KEYS( )
```

Example

```
SELECT DUMP_PARTITION_KEYS( );
```

See Also

DO_TM_TASK (page 339)

DROP_PARTITION (page 341)

DUMP_PROJECTION_PARTITION_KEYS (page 347)

DUMP_TABLE_PARTITION_KEYS (page 348)

PARTITIONS (page 716) system table

PARTITION_PROJECTION (page 368)

PARTITION_TABLE (page 369)

Partitioning Tables in the Administrator's Guide

EXPORT_TABLES

Generates a SQL script that can be used to recreate a logical schema (schemas, tables, constraints, and views) on a different cluster.

Syntax

```
EXPORT_TABLES ( [ destination ] , [ scope ] )
```

Parameters

destination	Specifies the path and name of the SQL output file. An empty string (' '), which is the default, dumps the script to standard output. A user who is not a DBA can only specify an empty string.
scope	Determines the tables to be exported where scope is one of the following: ▪ an empty string (' ')—exports all non-virtual objects to which the user has access, including constraints. (Note that constraints are not objects which can be passed as individual arguments.) This is the default if no scope is specified. ▪ a comma-delimited list of items in which each item can be one of the following: ▪ —'<schema>.<obj>'—matches the named object. The named object can be a table or view. ▪ —'<obj>'--matches the named object within the current search path. The named object can be a schema, table, or view. If the named object is a schema, Vertica exports all non-virtual objects to which the user has access within that schema. If a schema and table both have the same name, the schema takes precedence. EXPORT_TABLES returns an error if: ▪ an explicitly-specified object does not exist. ▪ The user has no access to the specified object.

Notes

- The script generated by this function:
  - Creates only the non-virtual objects for which the user has access.
  - Exports catalog objects in their Oid order.
- If projections are specified in the scope parameter, they are ignored.
- None of the parameters for EXPORT_TABLES accepts a NULL value as input.

Example

The following example exports the store.store_orders_fact table to standard output:

```
=> SELECT EXPORT_TABLES(' ','store.store_orders_fact');
```

SAVE_QUERY_REPOSITORY

Triggers Vertica to save query data to the query repository immediately.

Syntax

```
SAVE_QUERY_REPOSITORY()
```

Notes

- Vertica saves data based on the established query repository configuration parameters. For example, it will use the value of the QueryRepoRetentionTime parameter to determine the maximum number of days worth of queries to save. (See Configuring Query Repository in the Troubleshooting Guide.)
- Before you can save a query repository, you have to enable it:
  ```
  SELECT SET_CONFIG_PARAMETER('QueryRepositoryEnabled',1);
  ```

Example

```
=> SELECT SAVE_QUERY_REPOSITORY();
 SAVE_QUERY_REPOSITORY
-----------------------
 Query Repository Saved
(1 row)
```

See Also

Collecting Query Information in the Troubleshooting Guide

SET_CONFIG_PARAMETER

Use SET_CONFIG_PARAMETER to set a configuration parameter.

Note: Vertica is designed to operate with minimal configuration changes. Use this function sparingly and carefully follow any documented guidelines for that parameter.

Syntax

```
SELECT SET_CONFIG_PARAMETER('parameter', value)
```

Parameters

parameter	Specifies the name of the parameter value being set
value	▪ Specifies the value of the parameter. Data type is variable.

Notes

- The syntax of value will vary depending upon the parameter and its expected data type. For strings, it must be enclosed in single quotes, for integers, it is unquoted. See Configuration Parameters for a list of parameters, their function and examples of usage.
- **Caution**: If a node is down when this function is issued, the changes will only be done on the UP nodes. You must re-issue the function after the node is recovered in order for the changes to take effect there. Alternatively, use the Administration Tools to copy the files - See Distributing Configuration Files to the New Host.

SET_LOGLEVEL

Use SET_LOGLEVEL to set the logging level in the Vertica database log files.

Syntax

```
SELECT SET_LOGLEVEL(n)
```

Parameters

n	Logging Level	Description
0	DISABLE	No logging
1	CRITICAL	Errors requiring database recovery
2	WARNING	Errors indicating problems of lesser magnitude
3	INFO	Informational messages
4	DEBUG	Debugging messages
5	TRACE	Verbose debugging messages
6	TIMING	Verbose debugging messages

SHUTDOWN

Forces a database to shut down, even if there are users connected.

Syntax

```
SHUTDOWN ( [ 'false' | 'true' ] )
```

Parameters

false	[Default] Returns a message if users are connected. Has the same effect as supplying no parameters.
true	Performs a moveout operation and forces the database to shut down, disallowing further connections.

Notes

- Quotes around the `true` or `false` arguments are optional.
- Issuing the shutdown command without arguments or with the default (false) argument returns a message if users are connected, and the shutdown fails. If no users are connected, the database performs a moveout operation and shuts down.
- Issuing the `SHUTDOWN('true')` command forces the database to shut down whether users are connected or not.
- You can check the status of the shutdown operation in the `vertica.log file`:

```
2010-03-09 16:51:52.625 unknown:0x7fc6d6d2e700 [Init] <INFO> Shutdown
   complete. Exiting.
```

- As an alternative to SHUTDOWN(), you can also temporarily set MaxClientSessions to 0 and then use CLOSE_ALL_SESSIONS(). New client connections cannot connect unless they connect using the dbadmin account. See ***CLOSE_ALL_SESSIONS*** (page 333) for details.

Examples

The following command attempts to shut down the database. Because users are connected, the command fails:

```
=> SELECT SHUTDOWN('false');
NOTICE:  Cannot shut down while users are connected
          SHUTDOWN
----------------------------
 Shutdown: aborting shutdown
(1 row)
```

Note that `SHUTDOWN()` and `SHUTDOWN('false')` perform the same operation:

```
=> SELECT SHUTDOWN();
NOTICE:  Cannot shut down while users are connected
          SHUTDOWN
----------------------------
 Shutdown: aborting shutdown
(1 row)
```

Using the `'true'` parameter forces the database to shut down, even though clients might be connected:

```
=> SELECT SHUTDOWN('true');
          SHUTDOWN
----------------------------
 Shutdown: moveout complete
(1 row)
```

See Also

SESSIONS (page 741)

Epoch Management Functions

This section contains the epoch management functions specific to Vertica.

ADVANCE_EPOCH

Manually closes the current epoch and begins a new epoch.

Syntax

```
ADVANCE_EPOCH ( [ integer ] )
```

Parameters

integer	Specifies the number of epochs to advance. If the EpochAdvancementMode parameter is set to DML (the default), the number of epochs to advance defaults to zero (0). If the EpochAdvancementMode is set to AdvanceEpochInterval, the number of epochs to advance defaults to one(1). Note that the AdvanceEpochInterval parameter is ignored by default. See Configuration Parameters in the Administrator's Guide for more information about the EpochAdvancementMode parameter.

Note

This function is primarily maintained for backward compatibility with earlier versions of Vertica that advance epochs based on the ADVANCEEPOCHINTERVAL.

Example

The following command increments the epoch number by 1:

```
=> SELECT ADVANCE_EPOCH(1);
```

See Also

ALTER PROJECTION (page 479)

GET_AHM_EPOCH

Returns the number of the epoch in which the Ancient History Mark is located. Data deleted up to and including the AHM epoch can be purged from physical storage.

Syntax

```
GET_AHM_EPOCH()
```

Note: The AHM epoch is 0 (zero) by default (purge is disabled).

Examples

```
SELECT GET_AHM_EPOCH();
    get_ahm_epoch
----------------------
 Current AHM epoch: 0
(1 row)
```

GET_AHM_TIME

Returns a TIMESTAMP value representing the Ancient History Mark. Data deleted up to and including the AHM epoch can be purged from physical storage.

Syntax

```
GET_AHM_TIME()
```

Examples

```
SELECT GET_AHM_TIME();
                  GET_AHM_TIME
-------------------------------------------------
 Current AHM Time: 2010-05-13 12:48:10.532332-04
(1 row)
```

See Also

SET DATESTYLE (page 634) for information about valid ***TIMESTAMP*** (page 87) values.

GET_CURRENT_EPOCH

Returns the number of the current epoch. The epoch into which data (COPY, INSERT, UPDATE, and DELETE operations) is currently being written. The current epoch advances automatically every three minutes.

Syntax

```
GET_CURRENT_EPOCH()
```

Examples

```
SELECT GET_CURRENT_EPOCH();
 GET_CURRENT_EPOCH
-------------------
               683
(1 row)
```

GET_LAST_GOOD_EPOCH

Returns the number of the last good epoch. A term used in manual recovery, LGE (Last Good Epoch) refers to the most recent epoch that can be recovered.

Syntax

```
GET_LAST_GOOD_EPOCH()
```

Examples

```
SELECT GET_LAST_GOOD_EPOCH();
 GET_LAST_GOOD_EPOCH
---------------------
                 682
(1 row)
```

MAKE_AHM_NOW

Sets the Ancient History Mark (AHM) to the greatest allowable value, and lets you drop any projections that existed before the issue occurred.

Caution: This function is intended for use by Administrators only.

Syntax

```
MAKE_AHM_NOW ( [ true ] )
```

Parameters

true	[Optional] Allows AHM to advance when nodes are down. **Note:** If the AHM is advanced after the last good epoch of the failed nodes, those nodes must recover all data from scratch. Use with care.

Notes

- The MAKE_AHM_NOW function performs the following operations:
  - Advances the epoch.
  - Performs a moveout operation on all projections.
  - Sets the AHM to LGE — at least to the current epoch at the time MAKE_AHM_NOW() was issued.
- All history is lost and you cannot perform historical queries prior to the current epoch.

Example

```
=> SELECT MAKE_AHM_NOW();
         MAKE_AHM_NOW
------------------------------
 AHM set (New AHM Epoch: 683)
(1 row)
```

The following command allows the AHM to advance, even though node 2 is down:

```
=> SELECT MAKE_AHM_NOW(true);
WARNING:  Received no response from v_vmartdb_node0002 in get cluster LGE
WARNING:  Received no response from v_vmartdb_node0002 in get cluster LGE
WARNING:  Received no response from v_vmartdb_node0002 in set AHM
         MAKE_AHM_NOW
------------------------------
 AHM set (New AHM Epoch: 684)
(1 row)
```

See Also

DROP PROJECTION (page 585)

MARK_DESIGN_KSAFE (page 365)

SET_AHM_EPOCH (page 389)

SET_AHM_TIME (page 391)

SET_AHM_EPOCH

Sets the Ancient History Mark (AHM) to the specified epoch. This function allows deleted data up to and including the AHM epoch to be purged from physical storage.

SET_AHM_EPOCH is normally used for testing purposes. Consider ***SET_AHM_TIME*** (page 391) instead, which is easier to use.

Syntax

```
SET_AHM_EPOCH ( epoch, [ true ] )
```

Parameters

epoch	Specifies one of the following: ▪ The number of the epoch in which to set the AHM ▪ Zero (0) (the default) disables ***purge*** (page 371)
true	Optionally allows the AHM to advance when nodes are down. **Note:** If the AHM is advanced after the last good epoch of the failed nodes, those nodes must recover all data from scratch. Use with care.

Notes

If you use SET_AHM_EPOCH , the number of the specified epoch must be:

- Greater than the current AHM epoch
- Less than the current epoch
- Less than or equal to the cluster last good epoch (the minimum of the last good epochs of the individual nodes in the cluster)
- Less than or equal to the cluster refresh epoch (the minimum of the refresh epochs of the individual nodes in the cluster)

Use the ***SYSTEM*** (page 751) table to see current values of various epochs related to the AHM; for example:

```
=> SELECT * from SYSTEM;
-[ RECORD 1 ]------------+---------------------------
current_timestamp        | 2009-08-11 17:09:54.651413
current_epoch            | 1512
ahm_epoch                | 961
last_good_epoch          | 1510
refresh_epoch            | -1
designed_fault_tolerance | 1
node_count               | 4
node_down_count          | 0
current_fault_tolerance  | 1
catalog_revision_number  | 1590
wos_used_bytes           | 0
wos_row_count            | 0
ros_used_bytes           | 41490783
ros_row_count            | 1298104
total_used_bytes         | 41490783
total_row_count          | 1298104
```

All nodes must be up. You cannot use SET_AHM_EPOCH when any node in the cluster is down, except by using the optional *true* parameter.

When a node is down and you issue `SELECT MAKE_AHM_NOW()`, the following error is printed to the vertica.log:

```
Some nodes were excluded from setAHM. If their LGE is before the AHM they will perform full recovery.
```

Examples

The following command sets the AHM to a specified epoch of 12:

```
=> SELECT SET_AHM_EPOCH(12);
```

The following command sets the AHM to a specified epoch of 2 and allows the AHM to advance despite a failed node:

```
=> SELECT SET_AHM_EPOCH(2, true);
```

See Also

MAKE_AHM_NOW (page 363)

SET_AHM_TIME (page 391)

SYSTEM (page 751)

SET_AHM_TIME

Sets the Ancient History Mark (AHM) to the epoch corresponding to the specified time on the initiator node. This function allows historical data up to and including the AHM epoch to be purged from physical storage.

Syntax

```
SET_AHM_TIME ( time , [ true ] )
```

Parameters

time	Is a ***TIMESTAMP*** (page 87) value that is automatically converted to the appropriate epoch number.
true	[Optional] Allows the AHM to advance when nodes are down. **Note:** If the AHM is advanced after the last good epoch of the failed nodes, those nodes must recover all data from scratch.

Notes

- SET_AHM_TIME returns a TIMESTAMP WITH TIME ZONE value representing the end point of the AHM epoch.
- You cannot change the AHM when any node in the cluster is down, except by using the optional *true* parameter.
- When a node is down and you issue `SELECT MAKE_AHM_NOW()`, the following error is printed to the vertica.log:

  ```
  Some nodes were excluded from setAHM. If their LGE is before the AHM they
     will perform full recovery.
  ```

Examples

Epochs depend on a configured epoch advancement interval. If an epoch includes a three-minute range of time, the purge operation is accurate only to within minus three minutes of the specified timestamp:

```
=> SELECT SET_AHM_TIME('2008-02-27 18:13');
           set_ahm_time
-----------------------------------
 AHM set to '2008-02-27 18:11:50-05'
(1 row)
```

Note: The -05 part of the output string is a time zone value, an offset in hours from UTC (Universal Coordinated Time, traditionally known as Greenwich Mean Time, or GMT).

In the above example, the actual AHM epoch ends at 18:11:50, roughly one minute before the specified timestamp. This is because SET_AHM_TIME selects the epoch that ends at or before the specified timestamp. It does not select the epoch that ends after the specified timestamp because that would purge data deleted as much as three minutes after the AHM.

For example, using only hours and minutes, suppose that epoch 9000 runs from 08:50 to 11:50 and epoch 9001 runs from 11:50 to 15:50. `SET_AHM_TIME('11:51')` chooses epoch 9000 because it ends roughly one minute before the specified timestamp.

In the next example, if given an environment variable set as `date =`date`;` the following command fails if a node is down:

```
=> SELECT SET_AHM_TIME('$date');
```

In order to force the AHM to advance, issue the following command instead:

```
=> SELECT SET_AHM_TIME('$date', true);
```

See Also

MAKE_AHM_NOW (page 363)

SET_AHM_EPOCH (page 389) for a description of the range of valid epoch numbers.

SET DATESTYLE (page 634) for information about specifying a ***TIMESTAMP*** (page 87) value.

Partition Management Functions

This section contains partition management functions specific to Vertica.

DROP_PARTITION

Forces the partition of projections (if needed) and then drops the specified partition.

Syntax

```
DROP_PARTITION [ ( table_name ) , ( partition_value ) ]
```

Parameters

table-name	Specifies the name of the table. Note: The specified table_name argument cannot be used as a

	dimension table in a pre-joined projection and cannot contain projections that are not up to date (have not been refreshed)
partition_value	Must be specified as a string (within quotes) for all data types; for example: `DROP_PARTITION('trade', '2006');`

Notes and Restrictions

In general, if a ROS container has data that belongs to *n*+1 partitions and you want to drop a specific partition, the DROP_PARTITION operation:

1. Forces the partition of data into two containers where
   - one container holds the data that belongs to the partition that is to be dropped
   - another container holds the remaining *n* partitions
2. Drops the specified partition.

You can also use the ***MERGE_PARTITIONS*** (page 367) function to merges ROS containers that have data belonging to partitions in a specified partition key range; for example, `[partitionKeyFrom, partitionKeyTo]`.

DROP_PARTITION forces a moveout if there is data in the WOS (WOS is not partition aware).

DROP_PARTITION acquires an exclusive lock on the table to prevent DELETE | UPDATE | INSERT | COPY statements from affecting the table, as well as any SELECT statements issued at SERIALIZABLE isolation level.

Users must be the table owner to drop a partition. They must have MODIFY (INSERT | UPDATE | DELETE) permissions in order to:

- Partition a projection/table
- Merge partitions
- Run mergeout, moveout or purge operations on a projection

DROP_PARTITION operations cannot be performed on tables with projections that are not up to date (have not been refreshed).

Examples

Using the example schema in Defining Partitions, the following command explicitly drops the 2006 partition key from table `trade`:

```
 SELECT DROP_PARTITION('trade', 2006);
  DROP_PARTITION
-------------------
 Partition dropped
(1 row)
```

Here, the partition key is specified:

```
SELECT DROP_PARTITION('trade', EXTRACT('year' FROM '2006-01-01'::date));
  DROP_PARTITION
-------------------
 Partition dropped
(1 row)
```

The following example creates a table called dates and partitions the table by year:

```
CREATE TABLE dates (
    year INTEGER NOT NULL,
    month VARCHAR(8) NOT NULL)
PARTITION BY year * 12 + month;
```

The following statement drops the partition using a constant for Oct 2007 (2007*12 + 10 = 24094):

```
 SELECT DROP_PARTITION('dates', '24094');
  DROP_PARTITION
-------------------
 Partition dropped
(1 row)
```

Alternatively, the expression can be placed in line: `SELECT DROP_PARTITION('dates', 2007*12 + 10);`

See Also

ADVANCE EPOCH (page 320)

ALTER PROJECTION (page 479)

COLUMN_STORAGE (page 691)

CREATE TABLE (page 546)

DO_TM_TASK (page 339)

DUMP_PARTITION_KEYS (page 346)

DUMP_PROJECTION_PARTITION_KEYS (page 347)

DUMP_TABLE_PARTITION_KEYS (page 348)

MERGE_PARTITIONS (page 367)

PARTITION_PROJECTION (page 368)

PARTITION_TABLE (page 369)

PROJECTIONS (page 673)

Dropping Partitions in the Administrator's Guide

DUMP_PROJECTION_PARTITION_KEYS

Dumps the partition keys of the specified projection.

Syntax

```
DUMP_PROJECTION_PARTITION_KEYS(  'projection_name' )
```

Parameters

projection_name	Specifies the name of the projection.

Example

The following example creates a simple table called `states` and partitions the data by state:

```
CREATE TABLE states (
    year INTEGER NOT NULL,
    state VARCHAR NOT NULL)
PARTITION BY state;
CREATE PROJECTION states_p (state, year) AS SELECT * FROM states
ORDER BY state, year UNSEGMENTED ALL NODES;
```

Now drop the partition key of the specified projection:

```
SELECT DUMP_PROJECTION_PARTITION_KEYS( 'states_p_node0001' );
 Partition keys on node helios_node0001
  Projection 'states_p_node0001'
   No of partition keys: 1
 Partition keys on node helios_node0002
 ...
(1 row)
```

See Also

DO_TM_TASK (page 339)

DROP_PARTITION (page 341)

DUMP_PARTITION_KEYS (page 346)

DUMP_TABLE_PARTITION_KEYS (page 348)

PARTITION_PROJECTION (page 368)

PARTITION_TABLE (page 369)

PROJECTIONS (page 673) system table

Partitioning Tables in the Administrator's Guide

DUMP_TABLE_PARTITION_KEYS

Dumps the partition keys of all projections anchored on the specified table.

Syntax

```
DUMP_TABLE_PARTITION_KEYS ( 'table_name' )
```

Parameters

table_name	Specifies the name of the table.

Example

The following example creates a simple table called `states` and partitions the data by state:

```
CREATE TABLE states (
    year INTEGER NOT NULL,
```

```
    state VARCHAR NOT NULL)
PARTITION BY state;
CREATE PROJECTION states_p (state, year) AS SELECT * FROM states
ORDER BY state, year UNSEGMENTED ALL NODES;
```

Now drop the partition keys of all projections anchored on table `states`:

```
SELECT DUMP_TABLE_PARTITION_KEYS( 'states' );
 Partition keys on helios_node0001
  Projection 'states_p_node0004'
   No of partition keys: 1
  Projection 'states_p_node0003'
   No of partition keys: 1
  Projection 'states_p_node0002'
   No of partition keys: 1
  Projection 'states_p_node0001'
   No of partition keys: 1
 Partition keys on helios_node0002
...
(1 row)
```

See Also

DO_TM_TASK (page 339)

DROP_PARTITION (page 341)

DUMP_PARTITION_KEYS (page 347)

DUMP_PROJECTION_PARTITION_KEYS (page 348)

PARTITION_PROJECTION (page 368)

PARTITION_TABLE (page 369)

Partitioning Tables in the Administrator's Guide

MERGE_PARTITIONS

Merges ROS containers that have data belonging to partitions in a specified partition key range: `[ partitionKeyFrom, partitionKeyTo ]` .

Syntax

```
MERGE_PARTITIONS [ ( table_name ) ,
... ( partition_key_from ) , ( partition_key_to ) ]
```

Parameters

table_name	Specifies the name of the table
partition_key_from	Specifies the start point of the partition
partition_key_to	Specifies the end point of the partition

Notes

- Partitioning functions take immutable functions only, in order that the same information be available across all nodes.
- The edge values are included in the range, and `partition_key_from` must be less than or equal to `partition_key_to`.
- Inclusion of partitions in the range is based on the application of less than(<)/greater than(>) operators of the corresponding data type.

  Note: No restrictions are placed on a partition key's data type.
- If `partition_key_from` is the same as `partition_key_to`, all ROS containers of the partition key are merged into one ROS.

Users must be the table owner to drop a partition. They must have MODIFY (INSERT | UPDATE | DELETE) permissions in order to:

- Partition a projection/table
- Merge partitions
- Run mergeout, moveout or purge operations on a projection

Examples

```
=> SELECT MERGE_PARTITIONS('T1', '200', '400');
=> SELECT MERGE_PARTITIONS('T1', '800', '800');
=> SELECT MERGE_PARTITIONS('T1', 'CA', 'MA');
=> SELECT MERGE_PARTITIONS('T1', 'false', 'true');
=> SELECT MERGE_PARTITIONS('T1', '06/06/2008', '06/07/2008');
=> SELECT MERGE_PARTITIONS('T1', '02:01:10', '04:20:40');
=> SELECT MERGE_PARTITIONS('T1', '06/06/2008 02:01:10', '06/07/2008 02:01:10');
=> SELECT MERGE_PARTITIONS('T1', '8 hours', '1 day 4 hours 20 seconds');
```

PARTITION_PROJECTION

Forces a split of ROS containers of the specified projection.

Syntax

`PARTITION_PROJECTION ( projection_name )`

Parameters

projection_name	Specifies the name of the projection.

Notes

Partitioning expressions take immutable functions only, in order that the same information be available across all nodes.

`PARTITION_PROJECTION()` is similar to `PARTITION_TABLE (page 369)()`, except that `PARTITION_PROJECTION` works only on the specified projection, instead of the table.

Vertica internal operations (mergeout, refresh, and recovery) maintain partition separation except in certain cases:

- Recovery of a projection when the buddy projection from which the partition is recovering is identically sorted. If the projection is undergoing a full rebuild, it is recovered one ROS container at a time. The projection ends up with a storage layout identical to its buddy and is, therefore, properly segmented.

  Note: In the case of a partial rebuild, all recovered data goes into a single ROS container and must be partitioned manually.
- Manual tuple mover operations often output a single storage container, combining any existing partitions; for example, after executing any of the `PURGE()` operations.

Users must be the table owner to drop a partition. They must have MODIFY (INSERT | UPDATE | DELETE) permissions in order to:

- Partition a projection/table
- Merge partitions
- Run mergeout, moveout or purge operations on a projection

`PARTITION_PROJECTION()` purges data while partitioning ROS containers if deletes were applied before the AHM epoch.

Example

The following command forces a split of ROS containers on the `states_p_node01` projection:

```
=> SELECT PARTITION_PROJECTION ('states_p_node01');
  partition_projection
------------------------
 Projection partitioned
(1 row)
```

See Also

DO_TM_TASK (page 339)

DROP_PARTITION (page 341)

DUMP_PARTITION_KEYS (page 346)

DUMP_PROJECTION_PARTITION_KEYS (page 347)

DUMP_TABLE_PARTITION_KEYS (page 348)

PARTITION_TABLE (page 369)

Partitioning Tables in the Administrator's Guide

PARTITION_TABLE

Forces the system to break up any ROS containers that contain multiple distinct values of the partitioning expression. Only ROS containers with more than one distinct value participate in the split.

Syntax

```
PARTITION_TABLE ( 'table_name' )
```

Parameters

table_name	Specifies the name of the table.

Notes

PARTITION_TABLE is similar to ***PARTITION_PROJECTION*** (page 368), except that PARTITION_TABLE works on the specified table.

Vertica internal operations (mergeout, refresh, and recovery) maintain partition separation except in certain cases:

- Recovery of a projection when the buddy projection from which the partition is recovering is identically sorted. If the projection is undergoing a full rebuild, it is recovered one ROS container at a time. The projection ends up with a storage layout identical to its buddy and is, therefore, properly segmented.

  Note: In the case of a partial rebuild, all recovered data goes into a single ROS container and must be partitioned manually.
- Manual tuple mover operations often output a single storage container, combining any existing partitions; for example, after executing any of the `PURGE()` operations.

Users must be the table owner to drop a partition. They must have MODIFY (INSERT | UPDATE | DELETE) permissions in order to:

- Partition a projection/table
- Merge partitions
- Run mergeout, moveout or purge operations on a projection

Partitioning functions take immutable functions only, in order that the same information be available across all nodes.

Example

The following example creates a simple table called `states` and partitions data by state.

```
=> CREATE TABLE states (
          year INTEGER NOT NULL,
          state VARCHAR NOT NULL)
   PARTITION BY state;
=> CREATE PROJECTION states_p (state, year) AS
   SELECT * FROM states
   ORDER BY state, year UNSEGMENTED ALL NODES;
```

Now issue the command to partition table `states`:

```
=> SELECT PARTITION_TABLE('states');
                  PARTITION_TABLE
-----------------------------------------------------
partition operation for projection 'states_p_node0004'
```

```
partition operation for projection 'states_p_node0003'
partition operation for projection 'states_p_node0002'
partition operation for projection 'states_p_node0001'
(1 row)
```

See Also

DO_TM_TASK (page 339)

DROP_PARTITION (page 341)

DUMP_PARTITION_KEYS (page 346)

DUMP_PROJECTION_PARTITION_KEYS (page 347)

DUMP_TABLE_PARTITION_KEYS (page 348)

PARTITION_PROJECTION (page 368)

Partitioning Tables in the Administrator's Guide

Projection Management Functions

This section contains projection management functions specific to Vertica.

EVALUATE_DELETE_PERFORMANCE

Evaluates projections for potential ***DELETE*** (page 580) performance issues. If there are issues found, a warning message is displayed. For steps you can take to resolve delete and update performance issues, see Optimizing Deletes and Updates for Performance in the Administrator's Guide. This function uses data sampling to determine whether there are any issues with a projection. Therefore, it does not generate false-positives warnings, but it can miss some cases where there are performance issues.

Note: Optimizing for delete performance is the same as optimizing for update performance. So, you can use this function to help optimize a projection for updates as well as deletes.

Syntax

```
EVALUATE_DELETE_PERFORMANCE ( 'target' )
```

Parameters

target	The name of a projection or table. If you supply the name of a projection, only that projection is evaluated for DELETE performance issues. If you supply the name of a table, then all of the projections anchored to the table will be evaluated for issues. If you do not provide a projection or table name, EVALUATE_DELETE_PERFORMANCE examines all of the projections that you can access for DELETE performance issues. Depending on the size you your database, this may take a long time.

Note: When evaluating multiple projections, EVALUATE_DELETE_PERFORMANCE reports up to ten projections that have issues, and refers you to a table that contains the full list of issues it has found.

Example

The following example demonstrates how you can use EVALUATE_DELETE_PERFORMANCE to evaluate your projections for slow DELETE performance.

```
=> create table example (A int, B int,C int);
CREATE TABLE
=> create projection one_sort (A,B,C) as (select A,B,B from example) order by A;
CREATE PROJECTION
=> create projection two_sort (A,B,C) as (select A,B,C from example) order by A,B;
CREATE PROJECTION
=> select evaluate_delete_performance('one_sort');
            evaluate_delete_performance
-------------------------------------------------
 No projection delete performance concerns found.
(1 row)
=> select evaluate_delete_performance('two_sort');
            evaluate_delete_performance
-------------------------------------------------
 No projection delete performance concerns found.
(1 row)
```

The previous example showed that there was no structural issues with the projection that would cause poor DELETE performance. However, the data contained within the projection can create potential delete issues if the sorted columns do not uniquely identify a row or small number of rows. In the following example, Perl is used to populate the table with data using a nested series of loops. The inner loop populates column C, the middle loop populates column B, and the outer loop populates column A. The result is column A is contains only three distinct values (0, 1, and 2), while column B slowly varies between 20 and 0 and column C changes in each row. EVALUATE_DELETE_PERFORMANCE is run against the projections again to see if the data within the projections causes any potential DELETE performance issues.

```
=> \! perl -e 'for ($i=0; $i<3; $i++) { for ($j=0; $j<21; $j++) { for ($k=0; $k<19; $k++) { printf
"%d,%d,%d\n", $i,$j,$k;}}}' | /opt/vertica/bin/vsql -c "copy example from stdin delimiter ',' direct;"
Password:
=> select * from example;

 A | B  | C
-------------
 0 | 20 | 18
 0 | 20 | 17
 0 | 20 | 16
 0 | 20 | 15
 0 | 20 | 14
 0 | 20 | 13
 0 | 20 | 12
 0 | 20 | 11
 0 | 20 | 10
 0 | 20 |  9
 0 | 20 |  8
 0 | 20 |  7
 0 | 20 |  6
 0 | 20 |  5
 0 | 20 |  4
 0 | 20 |  3
 0 | 20 |  2
 0 | 20 |  1
 0 | 20 |  0
 0 | 19 | 18
 1157 rows omitted
 2 |  1 |  0
 2 |  0 | 18
 2 |  0 | 17
 2 |  0 | 16
```

```
 2 |  0 | 15
 2 |  0 | 14
 2 |  0 | 13
 2 |  0 | 12
 2 |  0 | 11
 2 |  0 | 10
 2 |  0 |  9
 2 |  0 |  8
 2 |  0 |  7
 2 |  0 |  6
 2 |  0 |  5
 2 |  0 |  4
 2 |  0 |  3
 2 |  0 |  2
 2 |  0 |  1
 2 |  0 |  0


=> SELECT COUNT (*) FROM example;
 COUNT
-------
  1197
(1 row)
=> SELECT COUNT (DISTINCT A) FROM example;
 COUNT
-------
     3
(1 row)

=> select evaluate_delete_performance('one_sort');
            evaluate_delete_performance
-----------------------------------------------------
 Projection exhibits delete performance concerns.
(1 row)
release=> select evaluate_delete_performance('two_sort');
            evaluate_delete_performance
-----------------------------------------------------
 No projection delete performance concerns found.
(1 row)
```

The one_sort projection has potential delete issues since it only sorts on column A which has few distinct values. This means that each value in the sort column corresponds to many rows in the projection, which negatively impacts DELETE performance. Since the two_sort projection is sorted on columns A and B, each distinct combination of values in the two sort columns identify just a few rows, allowing deletes to be performed faster.

Not supplying a projection name results in all of the projections you can access being evaluated for DELETE performance issues.

```
=> select evaluate_delete_performance();
                                                  evaluate_delete_performance
-----------------------------------------------------------------------------------------------------------
------------------------------
 The following projection exhibits delete performance concerns:
        "public"."one_sort"
See v_internal.comments for more details.
(1 row)
```

GET_PROJECTION_STATUS

Returns information relevant to the status of a projection.

Syntax

```
GET_PROJECTION_STATUS ( [ schema-name.]projection );
```

Parameters

[*schema-name.*]*projection*	Is the name of the projection for which to display status. When using more than one schema, specify the schema that contains the projection.

Description

GET_PROJECTION_STATUS returns information relevant to the status of a projection:

- The current K-Safety status of the database
- The number of nodes in the database
- Whether the projection is segmented
- The number and names of buddy projections
- Whether the projection is safe
- Whether the projection is up-to-date
- Whether statistics have been computed for the projection

Notes

- You can use GET_PROJECTION_STATUS to monitor the progress of a projection data refresh. See ***ALTER PROJECTION*** (page 479).
- When using GET_PROJECTION_STATUS or GET_PROJECTIONS you must provide the name and node (for example, `ABC_NODE01)` instead of just `ABC`.
- To view a list of the nodes in a database, use the View Database Command in the Administration Tools.

Examples

```
=> SELECT GET_PROJECTION_STATUS('public.customer_dimension_site01');

                                    GET_PROJECTION_STATUS
-------------------------------------------------------------------------------------------------
 Current system K is 1.
# of Nodes: 4.
public.customer_dimension_site01 [Segmented: No] [Seg Cols: ] [K: 3]
[public.customer_dimension_site04, public.customer_dimension_site03,
public.customer_dimension_site02] [Safe: Yes] [UptoDate: Yes][Stats: Yes]
```

See Also

ALTER PROJECTION (page 479)

GET_PROJECTIONS (page 358)

GET_PROJECTIONS, GET_TABLE_PROJECTIONS

Note: This function was formerly named GET_TABLE_PROJECTIONS(). Vertica still supports the former function name.

Returns information relevant to the status of a table:

- The current K-Safety status of the database
- The number of sites (nodes) in the database
- The number of projections for which the specified table is the anchor table
- For each projection:
  - The projection's buddy projections
  - Whether the projection is segmented
  - Whether the projection is safe
  - Whether the projection is up-to-date

Syntax

```
GET_PROJECTIONS ( [ schema-name.]table )
```

Parameters

[*schema-name.*]*table*	Is the name of the table for which to list projections. When using more than one schema, specify the schema that contains the table.

Notes

- You can use GET_PROJECTIONS to monitor the progress of a projection data refresh. See ***ALTER PROJECTION*** (page 479).
- When using GET_PROJECTIONS or GET_PROJECTION_STATUS for replicated projections created using the ALL NODES syntax, you must provide the name and node (for example, ABC_NODE01 instead of just ABC).
- To view a list of the nodes in a database, use the View Database Command in the Administration Tools.

Examples

The following example gets information about the store_dimension table in the VMart schema:

```
=> SELECT GET_PROJECTIONS('store.store_dimension');
-------------------------------------------------------------------------------------------
Current system K is 1.
# of Nodes: 4.
Table store.store_dimension has 4 projections.

Projection Name: [Segmented] [Seg Cols] [# of Buddies] [Buddy Projections] [Safe] [UptoDate]
-----------------------------------------------------------
store.store_dimension_node0004 [Segmented: No] [Seg Cols: ] [K: 3] [store.store_dimension_node0003,
store.store_dimension_node0002, store.store_dimension_node0001] [Safe: Yes] [UptoDate: Yes][Stats:
Yes]
store.store_dimension_node0003 [Segmented: No] [Seg Cols: ] [K: 3] [store.store_dimension_node0004,
store.store_dimension_node0002, store.store_dimension_node0001] [Safe: Yes] [UptoDate: Yes][Stats:
Yes]
store.store_dimension_node0002 [Segmented: No] [Seg Cols: ] [K: 3] [store.store_dimension_node0004,
store.store_dimension_node0003, store.store_dimension_node0001] [Safe: Yes] [UptoDate: Yes][Stats:
Yes]
store.store_dimension_node0001 [Segmented: No] [Seg Cols: ] [K: 3] [store.store_dimension_node0004,
store.store_dimension_node0003, store.store_dimension_node0002] [Safe: Yes] [UptoDate: Yes][Stats:
Yes]
(1 row)
```

See Also

ALTER PROJECTION (page 479)

GET_PROJECTION_STATUS (page 357)

REFRESH

Performs a synchronous, optionally-targeted refresh of a specified table's projections.

Information about a refresh operation—whether successful or unsuccessful—is maintained in the ***PROJECTION_REFRESHES*** (page 717) system table until either the ***CLEAR_PROJECTION_REFRESHES*** (page 329)() function is executed or the storage quota for the table is exceeded. The `PROJECTION_REFRESHES.IS_EXECUTING` column returns a boolean value that indicates whether the refresh is currently running (t) or occurred in the past (f).

Syntax

```
REFRESH ( [schema_name.]table_name [ , ... ] )
```

Parameters

`[schema_name.]table_name`	In the optionally-specified schema, `table_name` is the name of a specific table that contains the projections to be refreshed. When using more than one schema, specify the schema that contains the table.

Returns

Column Name	Description
`Projection Name`	The name of the projection that is targeted for refresh.
`Anchor Table`	The name of the projection's associated anchor table.
`Status`	The status of the projection: ▪ Queued — Indicates that a projection is queued for refresh. ▪ Refreshing — Indicates that a refresh for a projection is in process. ▪ Refreshed — Indicates that a refresh for a projection has successfully completed. ▪ Failed — Indicates that a refresh for a projection did not successfully complete.
`Refresh Method`	The method used to refresh the projection: ▪ Buddy – Uses the contents of a buddy to refresh the projection. This method maintains historical data. This enables the projection to be used for historical queries. ▪ Scratch – Refreshes the projection without using a buddy. This method does not generate historical data. This means that the projection cannot participate in historical queries from any point before the projection

	was refreshed.
Error Count	The number of times a refresh failed for the projection.
Duration (sec)	The length of time that the projection refresh ran in seconds.

Notes

- Unlike START_REFRESH(), which runs in the background, REFRESH() runs in the foreground of the caller's session.
- The REFRESH() function refreshes only the projections in the specified table.
- If you run REFRESH() without arguments, it refreshes all non up-to-date projections. If the function returns a header string with no results, then no projections needed refreshing.

Example

The following command refreshes the projections in tables `t1` and `t2`:

```
=> SELECT REFRESH('t1, t2');
refresh
-------------------------------------------------------------------------------------------
 Refresh completed with the following outcomes:
Projection Name: [Anchor Table] [Status] [Refresh Method] [Error Count] [Duration (sec)]
-------------------------------------------------------------------------------------------
"public"."t1_p": [t1] [refreshed] [scratch] [0] [0]
"public"."t2_p": [t2] [refreshed] [scratch] [0] [0]
```

This next command shows that only the projection on table `t` was refreshed:

```
=> SELECT REFRESH('allow, public.deny, t');"
refresh
-------------------------------------------------------------------------------------------
 Refresh completed with the following outcomes:
Projection Name: [Anchor Table] [Status] [Refresh Method] [Error Count] [Duration (sec)]
-------------------------------------------------------------------------------------------
"n/a"."n/a": [n/a] [failed: insufficient permissions on table "allow"] [] [1] [0]
"n/a"."n/a": [n/a] [failed: insufficient permissions on table "public.deny"] [] [1] [0]
"public"."t_p1": [t] [refreshed] [scratch] [0] [0]
```

See Also

CLEAR_PROJECTION_REFRESHES (page 329)

PROJECTION_REFRESHES (page 717)

START_REFRESH (page 394)

Clearing PROJECTION_REFRESHES History in the Administrator's Guide

START_REFRESH

Transfers data to projections that are not able to participate in query execution due to missing or out-of-date data.

Syntax

```
START_REFRESH()
```

Notes

- When a design is deployed through the Database Designer, it is automatically refreshed. See Deploying Designs in the Administrator's Guide.
- All nodes must be up in order to start a refresh.
- START_REFRESH() has no effect if a refresh is already running.
- A refresh is run asynchronously.
- Shutting down the database ends the refresh.
- To view the progress of the refresh, see the ***PROJECTION_REFRESHES*** (page 717) and ***PROJECTIONS*** (page 673) system tables.
- If a projection is updated from scratch, the data stored in the projection represents the table columns as of the epoch in which the refresh commits. As a result, the query optimizer might not choose the new projection for AT EPOCH queries that request historical data at epochs older than the refresh epoch of the projection. Projections refreshed from buddies retain history and can be used to answer historical queries.

Vertica internal operations (mergeout, refresh, and recovery) maintain partition separation except in certain cases:

- Recovery of a projection when the buddy projection from which the partition is recovering is identically sorted. If the projection is undergoing a full rebuild, it is recovered one ROS container at a time. The projection ends up with a storage layout identical to its buddy and is, therefore, properly segmented.

  Note: In the case of a partial rebuild, all recovered data goes into a single ROS container and must be partitioned manually.
- Manual tuple mover operations often output a single storage container, combining any existing partitions; for example, after executing any of the `PURGE()` operations.

Example

The following command starts the refresh operation:

```
=> SELECT START_REFRESH();
             start_refresh
---------------------------------------
 Starting refresh background process.
```

See Also

CLEAR_PROJECTION_REFRESHES (page 329)

MARK_DESIGN_KSAFE (page 365)

PROJECTION_REFRESHES (page 717)

PROJECTIONS (page 673)

Clearing PROJECTION_REFRESHES History in the Administrator's Guide

Purge Functions

This section contains purge functions specific to Vertica.

PURGE

Purges all projections in the physical schema. Permanently removes deleted data from physical storage so that the disk space can be reused. You can purge historical data up to and including the epoch in which the Ancient History Mark is contained.

Syntax

```
PURGE()
```

Notes

- PURGE() was formerly named PURGE_ALL_PROJECTIONS. Vertica supports both function calls.
- Manual tuple mover operations, such as the PURGE() operations, often output a single storage container, combining any existing partitions. For example, if PURGE() is used on a non-partitioned table, all ROS containers are combined into a single container. Non-partitioned tables cannot be re-partitioned into multiple ROS containers. A purge operation on a partitioned table also results in a single ROS.
- To re-partition the data into multiple ROS containers, use the ***PARTITION_TABLE*** (page 369)() function.

Caution: PURGE could temporarily take up significant disk space while the data is being purged.

See Also

MERGE_PARTITIONS (page 367)

PARTITION_TABLE (page 369)

PURGE_PROJECTION (page 372)

PURGE_TABLE (page 372)

STORAGE_CONTAINERS (page 743)

Purging Deleted Data in the Administrator's Guide

PURGE_PROJECTION

Purges the specified projection. Permanently removes deleted data from physical storage so that the disk space can be reused. You can purge historical data up to and including the epoch in which the Ancient History Mark is contained.

Caution: PURGE_PROJECTION could temporarily take up significant disk space while the data is being purged.

Syntax

```
PURGE_PROJECTION ( [ schema-name.]projection_name )
```

Parameters

projection_name	Is the name of a specific projection. When using more than one schema, specify the schema that contains the projection.

Notes

See ***PURGE*** (page 371) for notes about the outcome of purge operations.

See Also

MERGE_PARTITIONS (page 367)

PURGE_TABLE (page 372)

STORAGE_CONTAINERS (page 743)

Purging Deleted Data in the Administrator's Guide

PURGE_TABLE

Note: This function was formerly named PURGE_TABLE_PROJECTIONS(). Vertica still supports the former function name.

Purges all projections of the specified table. Permanently removes deleted data from physical storage so that the disk space can be reused. You can purge historical data up to and including the epoch in which the Ancient History Mark is contained.

Syntax

```
PURGE_TABLE ( [ schema_name.]table_name )
```

Parameters

[*schema_name.*]*table_name*	Is the name of a specific table in the optionally-specified logical schema. When using more than one schema, specify the schema that contains the projection.

Caution: PURGE_TABLE could temporarily take up significant disk space while the data is being purged.

Example

The following example purges all projections for the store sales fact table located in the Vmart schema:

```
=> SELECT PURGE_TABLE('store.store_sales_fact');
```

See Also

PURGE (page 371) for notes about the outcome of purge operations.

MERGE_PARTITIONS (page 367)

PURGE_TABLE (page 372)

STORAGE_CONTAINERS (page 743)

Purging Deleted Data in the Administrator's Guide

Regular Expression Functions

A regular expression lets you perform pattern matching on strings of characters. The regular expression syntax allows you to very precisely define the pattern used to match strings, giving you much greater control than the wildcard matching used in the ***LIKE*** (page 55) predicate. Vertica's regular expression functions let you perform tasks such as determining if a string value matches a pattern, extracting a portion of a string that matches a pattern, or counting the number of times a string matches a pattern.

Vertica uses the ***Perl Compatible Regular Expression library http://www.pcre.org/*** (PCRE) to evaluate regular expressions. As its name implies, PCRE's regular expression syntax is compatible with the syntax used by the Perl 5 programming language. You can read ***PCRE's documentation on its regular expression syntax http://vcs.pcre.org/viewvc/code/trunk/doc/html/pcrepattern.html?view=co***. However, you may find the ***Perl Regular Expressions Documentation*** (***http://perldoc.perl.org/perlre.html***) to be a better introduction, especially if you are unfamiliar with regular expressions.

Note: The regular expression functions operate on UTF-8 strings by default. You may want to use the ***ISUTF8*** (page 363) function to ensure the strings you want to pass to the regular expression functions are actually valid UTF-8 strings.

ISUTF8

Tests whether a string is a valid UTF-8 string. Returns true if the string conforms to UTF-8 standards, and false otherwise. This function is useful to test strings for UTF-8 compliance before passing them to one of the regular expression functions, such as ***REGEXP_LIKE*** (page 379), which expect UTF-8 characters by default.

Syntax

```
ISUTF8(string);
```

Parameters

string	The string to test for UTF-8 compliance.

Examples

```
=> SELECT ISUTF8(E'\xC2\xBF'); -- UTF-8 INVERTED QUESTION MARK
 ISUTF8
--------
 t
(1 row)

=> SELECT ISUTF8(E'\xC2\xC0'); -- UNDEFINED UTF-8 CHARACTER
 ISUTF8
--------
 f
```

```
(1 row)
```

REGEXP_COUNT

Returns the number times a regular expression matches a string.

Syntax

```
REGEXP_COUNT(string, pattern [, position [, regexp_modifier]])
```

Parameters

string	The string to be searched for matches.
pattern	The regular expression to search for within the string. The syntax of the regular expression is compatible with the Perl 5 regular expression syntax. See the ***Perl Regular Expressions Documentation*** (***http://perldoc.perl.org/perlre.html***) for details.
position	The number of characters from the start of the string where the function should start searching for matches. The default value, 1, means to start searching for a match at the first (leftmost) character. Setting this parameter to a value greater than 1 starts searching for a match to the pattern that many characters into the string.
regexp_modifier	A string containing one or more single-character flags that change how the regular expression is matched against the string: `b` Treat strings as binary octets rather than UTF-8 characters. `c` Forces the match to be case sensitive (the default). `i` Forces the match to be case insensitive. `m` Treats the string being matched as multiple lines. With this modifier, the start of line (`^`) and end of line (`$)` regular expression operators match line breaks (`\n`) within the string. Ordinarily, these operators only match the start and end of the string. `n` Allows the single character regular expression operator `(.)` to match a newline (`\n`). Normally, the `.` operator will match any character except a newline.

	x	Allows you to document your regular expressions. It causes all unescaped space characters and comments in the regular expression to be ignored. Comments start with a hash character (#) and end with a newline. All spaces in the regular expression that you want to be matched in strings must be escaped with a backslash (\) character.

Notes

This function operates on UTF-8 strings using the default locale, even if the locale has been set to something else.

If you are porting a regular expression query from an Oracle database, remember that Oracle considers a zero-length string to be equivalent to NULL, while Vertica does not.

Examples

Count the number of occurrences of the substring "an" in the string "A man, a plan, a canal, Panama."

```
=> SELECT REGEXP_COUNT('a man, a plan, a canal: Panama', 'an');
 REGEXP_COUNT
--------------
            4
(1 row)
```

Find the number of occurrences of the substring "an" in the string "a man, a plan, a canal: Panama" starting with the fifth character.

```
=> SELECT REGEXP_COUNT('a man, a plan, a canal: Panama', 'an',5);
 REGEXP_COUNT
--------------
            3
(1 row)
```

Find the number of occurrences of a substring containing a lower-case character followed by "an." In the first example, the query does not have a modifier. In the second example, the "i" query modifier is used to force the regular expression to ignore case.

```
=> SELECT REGEXP_COUNT('a man, a plan, a canal: Panama', '[a-z]an');
```

```
 REGEXP_COUNT
--------------
             3
(1 row)
=> SELECT REGEXP_COUNT('a man, a plan, a canal: Panama', '[a-z]an', 1, 'i');
 REGEXP_COUNT
--------------
             4
```

REGEXP_INSTR

Returns the starting or ending position in a string where a regular expression matches. This function returns 0 if no match for the regular expression is found in the string.

Syntax

```
REGEXP_INSTR(string, pattern [, position [, occurrence [, return_position [,
regexp_modifier]]]])
```

Parameters

string	The string to search for the pattern.
pattern	The regular expression to search for within the string. The syntax of the regular expression is compatible with the Perl 5 regular expression syntax. See the ***Perl Regular Expressions Documentation*** (***http://perldoc.perl.org/perlre.html***) for details.
position	The number of characters from the start of the string where the function should start searching for matches. The default value, 1, means to start searching for a match at the first (leftmost) character. Setting this parameter to a value greater than 1 starts searching for a match to the pattern that many characters into the string.
occurrence	Controls which occurrence of a match between the string and the pattern is returned. With the default value (1), the function returns the position of the first substring that matches the pattern. You can use this parameter to find the position of additional matches between the string and the pattern. For example, set this parameter to 3 to find the position of the third substring that matched the pattern.
return_position	Sets the position within the string that is returned. When set to the default value (0), this function returns the position in the string of the first character of the substring that matched the pattern. If you set this value to 1, the function returns the position of the first character after the end of the matching substring.
regexp_modifier	A string containing one or more single-character flags that change how the regular expression is matched against the string:

	b	Treat strings as binary octets rather than UTF-8 characters.
	c	Forces the match to be case sensitive (the default).
	i	Forces the match to be case insensitive.
	m	Treats the string being matched as multiple lines. With this modifier, the start of line (^) and end of line ($) regular expression operators match line breaks (\n) within the string. Ordinarily, these operators only match the start and end of the string.
	n	Allows the single character regular expression operator (.) to match a newline (\n). Normally, the . operator will match any character except a newline.
	x	Allows you to document your regular expressions. It causes all unescaped space characters and comments in the regular expression to be ignored. Comments start with a hash character (#) and end with a newline. All spaces in the regular expression that you want to be matched in strings must be escaped with a backslash (\) character.

Notes

This function operates on UTF-8 strings using the default locale, even if the locale has been set to something else.

If you are porting a regular expression query from an Oracle database, remember that Oracle considers a zero-length string to be equivalent to NULL, while Vertica does not.

Examples

Find the first occurrence of a sequence of letters starting with the letter e and ending with the letter y in the phrase "easy come, easy go."

```
=> SELECT REGEXP_INSTR('easy come, easy go','e\w*y');
 REGEXP_INSTR
--------------
            1
(1 row)
```

Find the first occurrence of a sequence of letters starting with the letter e and ending with the letter y starting at the second character in the string "easy come, easy go."

```
=> SELECT REGEXP_INSTR('easy come, easy go','e\w*y',2);
 REGEXP_INSTR
--------------
           12
```

```
(1 row)
```

Find the second sequence of letters starting with the letter e and ending with the letter y in the string "easy come, easy go" starting at the first character.

```
=> SELECT REGEXP_INSTR('easy come, easy go','e\w*y',1,2);
 REGEXP_INSTR
--------------
           12
(1 row)
```

Find the position of the first character after the first whitespace in the string "easy come, easy go."

```
=> SELECT REGEXP_INSTR('easy come, easy go','\s',1,1,1);
 REGEXP_INSTR
--------------
            6
(1 row)
```

REGEXP_LIKE

Returns true if the string matches the regular expression. This function is similar to the ***LIKE-predicate*** (page 55), except that it uses regular expressions rather than simple wildcard character matching.

Syntax

```
REGEXP_LIKE(string, pattern [, modifiers])
```

Parameters

string	The string to match against the regular expression.
pattern	A string containing the regular expression to match against the string. The syntax of the regular expression is compatible with the Perl 5 regular expression syntax. See the ***Perl Regular Expressions Documentation*** (***http://perldoc.perl.org/perlre.html***) for details.
modifiers	A string containing one or more single-character flags that change how the regular expression is matched against the string: `b` Treat strings as binary octets rather than UTF-8 characters. `c` Forces the match to be case sensitive (the default). `i` Forces the match to be case insensitive. `m` Treats the string being matched as multiple lines. With this modifier, the start of line (`^`) and end of line (`$`) regular expression operators match line breaks (`\n`) within the string. Ordinarily, these operators only match the start and end of the string.

	n	Allows the single character regular expression operator (.) to match a newline (\n). Normally, the . operator will match any character except a newline.
	x	Allows you to document your regular expressions. It causes all unescaped space characters and comments in the regular expression to be ignored. Comments start with a hash character (#) and end with a newline. All spaces in the regular expression that you want to be matched in strings must be escaped with a backslash (\) character.

Notes

This function operates on UTF-8 strings using the default locale, even if the locale has been set to something else.

If you are porting a regular expression query from an Oracle database, remember that Oracle considers a zero-length string to be equivalent to NULL, while Vertica does not.

Examples

This example creates a table containing several strings to demonstrate regular expressions.

```
=> create table t (v varchar);
CREATE TABLE
=> create projection t1 as select * from t;
CREATE PROJECTION
=> COPY t FROM stdin;
Enter data to be copied followed by a newline.
End with a backslash and a period on a line by itself.
>> aaa
>> Aaa
>> abc
>> abc1
>> 123
>> \.
=> SELECT * FROM t;
   v
-------
 aaa
 Aaa
 abc
 abc1
 123
(5 rows)
```

Select all records in the table that contain the letter "a."

```
=> SELECT v FROM t WHERE REGEXP_LIKE(v,'a');
  v
```

```
------
 Aaa
 aaa
 abc
 abc1
(4 rows)
```

Select all of the rows in the table that start with the letter "a."

```
=> SELECT v FROM t WHERE REGEXP_LIKE(v,'^a');
  v
------
 aaa
 abc
 abc1
(3 rows)
```

Select all rows that contain the substring "aa."

```
=> SELECT v FROM t WHERE REGEXP_LIKE(v,'aa');
  v
-----
 Aaa
 aaa
(2 rows)
```

Select all rows that contain a digit.

```
=> SELECT v FROM t WHERE REGEXP_LIKE(v,'\d');
  v
------
 123
 abc1
(2 rows)
```

Select all rows that contain the substring "aaa."

```
=> SELECT v FROM t WHERE REGEXP_LIKE(v,'aaa');
  v
-----
 aaa
(1 row)
```

Select all rows that contain the substring "aaa" using case insensitive matching.

```
=> SELECT v FROM t WHERE REGEXP_LIKE(v,'aaa', 'i');
  v
-----
 Aaa
 aaa
(2 rows)
```

Select rows that contain the substring "a b c."

```
=> SELECT v FROM t WHERE REGEXP_LIKE(v,'a b c');
 v
---
(0 rows)
```

Select rows that contain the substring "a b c" ignoring space within the regular expression.

```
=> SELECT v FROM t WHERE REGEXP_LIKE(v,'a b c','x');
  v
------
 abc
 abc1
(2 rows)
```

Add multi-line rows to demonstrate using the "m" modifier.

```
=> COPY t FROM stdin RECORD TERMINATOR '!';
Enter data to be copied followed by a newline.
End with a backslash and a period on a line by itself.
>> Record 1 line 1
>> Record 1 line 2
>> Record 1 line 3!
>> Record 2 line 1
>> Record 2 line 2
>> Record 2 line 3!
>> \.
```

Select rows that start with the substring "Record" and end with the substring "line 2."

```
=> SELECT v from t WHERE REGEXP_LIKE(v,'^Record.*line 2$'); v
---
(0 rows)
```

Select rows that start with the substring "Record" and end with the substring "line 2," treating multiple lines as separate strings.

```
=> SELECT v from t WHERE REGEXP_LIKE(v,'^Record.*line 2$','m'); v
------------------------------------------------

Record 2 line 1
Record 2 line 2
Record 2 line 3
 Record 1 line 1
Record 1 line 2
Record 1 line 3
(2 rows)
```

REGEXP_REPLACE

Replace all occurrences of a substring that match a regular expression with another substring. It is similar to the ***REPLACE*** (page 290) function, except it uses a regular expression to select the substring to be replaced.

Syntax

```
REGEXP_REPLACE(string, target [, replacement [, position [, occurrence [,
regexp_modifiers]]]])
```

Parameters

string	The string whose to be searched and replaced.
target	The regular expression to search for within the string. The syntax of the regular expression is compatible with the Perl 5 regular expression syntax. See the ***Perl Regular Expressions Documentation*** (***http://perldoc.perl.org/perlre.html***) for details.
replacement	The string to replace matched substrings. If not supplied, the matched substrings are deleted. This string can contain backreferences for substrings captured by the regular expression. The first captured substring is inserted into the replacement string using `\1`, the second `\2`, and so on.
position	The number of characters from the start of the string where the function should start searching for matches. The default value, 1, means to start searching for a match at the first (leftmost) character. Setting this parameter to a value greater than 1 starts searching for a match to the pattern that many characters into the string.
occurrence	Controls which occurrence of a match between the string and the pattern is replaced. With the default value (0), the function replaces all matching substrings with the replacement string. For any value above zero, the function replaces just a single occurrence. For example, set this parameter to 3 to replace the third substring that matched the pattern.
regexp_modifier	A string containing one or more single-character flags that change how the regular expression is matched against the string: `b` Treat strings as binary octets rather than UTF-8 characters. `c` Forces the match to be case sensitive (the default). `i` Forces the match to be case insensitive. `m` Treats the string being matched as multiple lines. With this modifier, the start of line (`^`) and end of line (`$)` regular expression operators match line breaks (`\n`) within the string. Ordinarily, these operators only match the start and end of the string.

	n	Allows the single character regular expression operator (.) to match a newline (\n). Normally, the . operator will match any character except a newline.
	x	Allows you to document your regular expressions. It causes all unescaped space characters and comments in the regular expression to be ignored. Comments start with a hash character (#) and end with a newline. All spaces in the regular expression that you want to be matched in strings must be escaped with a backslash (\) character.

Notes

This function operates on UTF-8 strings using the default locale, even if the locale has been set to something else.

If you are porting a regular expression query from an Oracle database, remember that Oracle considers a zero-length string to be equivalent to NULL, while Vertica does not.

Examples

Find groups of "word characters" (letters, numbers and underscore) ending with "thy" in the string "healthy, wealthy, and wise" and replace them with nothing.

```
=> SELECT REGEXP_REPLACE('healthy, wealthy, and wise','\w+thy');
 REGEXP_REPLACE
----------------
 , , and wise
(1 row)
```

Find groups of word characters ending with "thy" and replace with the string "something."

```
=> SELECT REGEXP_REPLACE('healthy, wealthy, and wise','\w+thy', 'something');
         REGEXP_REPLACE
--------------------------------
 something, something, and wise
(1 row)
```

Find groups of word characters ending with "thy" and replace with the string "something" starting at the third character in the string.

```
=> SELECT REGEXP_REPLACE('healthy, wealthy, and wise','\w+thy', 'something', 3);
          REGEXP_REPLACE
---------------------------------
 hesomething, something, and wise
(1 row)
```

Replace the second group of word characters ending with "thy" with the string "something."

```
=> SELECT REGEXP_REPLACE('healthy, wealthy, and wise','\w+thy', 'something', 1,
2);
        REGEXP_REPLACE
------------------------------
 healthy, something, and wise
(1 row)
```

Find groups of word characters ending with "thy" capturing the letters before the "thy", and replace with the captured letters plus the letters "ish."

```
=> SELECT REGEXP_REPLACE('healthy, wealthy, and wise','(\w+)thy', '\1ish');
       REGEXP_REPLACE
---------------------------
 healish, wealish, and wise
(1 row)
```

Create a table to demonstrate replacing strings in a query.

```
=> CREATE TABLE customers (name varchar(50), phone varchar(11));
CREATE TABLE
=> CREATE PROJECTION customers1 AS SELECT * FROM customers;
CREATE PROJECTION
=> COPY customers FROM stdin;
Enter data to be copied followed by a newline.
End with a backslash and a period on a line by itself.
>> Able, Adam|17815551234
>> Baker,Bob|18005551111
>> Chu,Cindy|16175559876
>> Dodd,Dinara|15083452121
>> \.
```

Query the customers, using REGEXP_REPLACE to format the phone numbers.

```
=> SELECT name, REGEXP_REPLACE(phone, '(\d)(\d{3})(\d{3})(\d{4})', '\1-(\2)
\3-\4') as phone FROM customers;
    name     |      phone
-------------+------------------
 Able, Adam  | 1-(781) 555-1234
 Baker,Bob   | 1-(800) 555-1111
 Chu,Cindy   | 1-(617) 555-9876
 Dodd,Dinara | 1-(508) 345-2121
(4 rows)
```

REGEXP_SUBSTR

Returns the substring that matches a regular expression within a string. If no matches are found, this function returns NULL. This is different than an empty string, which can be returned by this function if the regular expression matches a zero-length string.

Syntax

```
REGEXP_SUBSTR(string, pattern [, position [,  occurrence [, regexp_modifier]]])
```

Parameters

string	The string to search for the pattern.
pattern	The regular expression to find the substring to be extracted. The syntax of the regular expression is compatible with the Perl 5 regular expression syntax. See the ***Perl Regular Expressions Documentation*** (***http://perldoc.perl.org/perlre.html***) for details.
position	The character in the string where the search for a match should start. The default value, 1, starts the search at the beginning of the string. If you supply a value larger than 1 for this parameter, the function will start searching that many characters into the string.
occurrence	Controls which matching substring is returned by the function. When given the default value (1), the function will return the first matching substring it finds in the string. By setting this value to a number greater than 1, this function will return subsequent matching substrings. For example, setting this parameter to 3 will return the third substring that matches the regular expression within the string.
regexp_modifier	A string containing one or more single-character flags that change how the regular expression is matched against the string: `b` Treat strings as binary octets rather than UTF-8 characters. `c` Forces the match to be case sensitive (the default). `i` Forces the match to be case insensitive. `m` Treats the string being matched as multiple lines. With this modifier, the start of line (`^`) and end of line (`$`) regular expression operators match line breaks (`\n`) within the string. Ordinarily, these operators only match the start and end of the string. `n` Allows the single character regular expression operator (`.`) to match a newline (`\n`). Normally, the `.` operator will match any character except a newline.

	x	Allows you to document your regular expressions. It causes all unescaped space characters and comments in the regular expression to be ignored. Comments start with a hash character (#) and end with a newline. All spaces in the regular expression that you want to be matched in strings must be escaped with a backslash (\) character.

Notes

This function operates on UTF-8 strings using the default locale, even if the locale has been set to something else.

If you are porting a regular expression query from an Oracle database, remember that Oracle considers a zero-length string to be equivalent to NULL, while Vertica does not.

Examples

Select the first substring of letters that end with "thy."

```
=> SELECT REGEXP_SUBSTR('healthy, wealthy, and wise','\w+thy');
 REGEXP_SUBSTR
---------------
 healthy
(1 row)
```

Select the first substring of letters that ends with "thy" starting at the second character in the string.

```
=> SELECT REGEXP_SUBSTR('healthy, wealthy, and wise','\w+thy',2);
 REGEXP_SUBSTR
---------------
 ealthy
(1 row)
```

Select the second substring of letters that ends with "thy."

```
=> SELECT REGEXP_SUBSTR('healthy, wealthy, and wise','\w+thy',1,2);
 REGEXP_SUBSTR
---------------
 wealthy
(1 row)
```

Session Management Functions

This section contains session management functions specific to Vertica.

CLOSE_ALL_SESSIONS

Closes all external sessions except the one issuing the CLOSE_ALL_SESSIONS functions.

Syntax

```
CLOSE_ALL_SESSIONS()
```

Notes

Closing of the sessions is processed asynchronously. It might take some time for the session to be closed. Check the ***SESSIONS*** (page 741) table for the status.

Database shutdown is prevented if new sessions connect after the CLOSE_SESSION or CLOSE_ALL_SESSIONS() command is invoked (and before the database is actually shut down). See **Controlling Sessions** below.

Message

```
close_all_sessions | Close all sessions command sent.
Check SESSIONS for progress.
```

Examples

Two user sessions opened, each on a different node:

```
vmartdb=> SELECT * FROM sessions;
-[ RECORD 1
]--------------+-----------------------------------------------------
node_name                  | v_vmartdb_node0001
user_name                  | dbadmin
client_hostname            | 127.0.0.1:52110
client_pid                 | 4554
login_timestamp            | 2011-01-03 14:05:40.252625-05
session_id                 | stress04-4325:0x14
client_label               |
transaction_start          | 2011-01-03 14:05:44.325781
transaction_id             | 45035996273728326
transaction_description    | user dbadmin (select * from sessions;)
statement_start            | 2011-01-03 15:36:13.896288
statement_id               | 10
last_statement_duration_us | 14978
current_statement          | select * from sessions;
ssl_state                  | None
authentication_method      | Trust
-[ RECORD 2
]--------------+-----------------------------------------------------
node_name                  | v_vmartdb_node0002
user_name                  | dbadmin
client_hostname            | 127.0.0.1:57174
client_pid                 | 30117
login_timestamp            | 2011-01-03 15:33:00.842021-05
session_id                 | stress05-27944:0xc1a
client_label               |
transaction_start          | 2011-01-03 15:34:46.538102
transaction_id             | -1
transaction_description    | user dbadmin (COPY Mart_Fact FROM
'/data/mart_Fact.tbl'
                             DELIMITER '|' NULL '\\n';)
statement_start            | 2011-01-03 15:34:46.538862
```

```
statement_id                | 
last_statement_duration_us | 26250
current_statement           | COPY Mart_Fact FROM '/data/Mart_Fact.tbl' DELIMITER
'|'
                              NULL '\\n';
ssl_state                   | None
authentication_method       | Trust
-[ RECORD 3
]--------------+-----------------------------------------------------
node_name                   | v_vmartdb_node0003
user_name                   | dbadmin
client_hostname             | 127.0.0.1:56367
client_pid                  | 1191
login_timestamp             | 2011-01-03 15:31:44.939302-05
session_id                  | stress06-25663:0xbec
client_label                | 
transaction_start           | 2011-01-03 15:34:51.05939
transaction_id              | 54043195528458775
transaction_description     | user dbadmin (COPY Mart_Fact FROM
'/data/Mart_Fact.tbl'
                              DELIMITER '|' NULL '\\n' DIRECT;)
statement_start             | 2011-01-03 15:35:46.436748
statement_id                | 
last_statement_duration_us | 1591403
current_statement           | COPY Mart_Fact FROM '/data/Mart_Fact.tbl' DELIMITER
'|'
                              NULL '\\n' DIRECT;
ssl_state                   | None
authentication_method       | Trust
```

Close all sessions:

```
vmartdb=> \x
Expanded display is off.
vmartdb=> SELECT CLOSE_ALL_SESSIONS();
                          CLOSE_ALL_SESSIONS
------------------------------------------------------------------------
 Close all sessions command sent. Check v_monitor.sessions for progress.
(1 row)
```

Sessions contents after issuing the CLOSE_ALL_SESSIONS() command:

```
=> SELECT * FROM SESSIONS;
-[ RECORD 1 ]--------------+---------------------------------------
node_name                  | v_vmartdb_node0001
user_name                  | dbadmin
client_hostname            | 127.0.0.1:52110
client_pid                 | 4554
login_timestamp            | 2011-01-03 14:05:40.252625-05
session_id                 | stress04-4325:0x14
client_label               | 
transaction_start          | 2011-01-03 14:05:44.325781
transaction_id             | 45035996273728326
transaction_description    | user dbadmin (SELECT * FROM sessions;)
statement_start            | 2011-01-03 16:19:56.720071
```

```
statement_id                | 25
last_statement_duration_us | 15605
current_statement           | SELECT * FROM SESSIONS;
ssl_state                   | None
authentication_method       | Trust
```

Controlling Sessions

The database administrator must be able to disallow new incoming connections in order to shut down the database. On a busy system, database shutdown is prevented if new sessions connect after the CLOSE_SESSION or CLOSE_ALL_SESSIONS() command is invoked — and before the database actually shuts down.

One option is for the administrator to issue the `SHUTDOWN('true')` command, which forces the database to shut down and disallow new connections. See ***SHUTDOWN*** (page 393) in the SQL Reference Manual.

Another option is to modify the `MaxClientSessions` parameter from its original value to 0, in order to prevent new non-dbadmin users from connecting to the database.

1. Determine the original value for the `MaxClientSessions` parameter by querying the V_MONITOR.***CONFIGURATIONS_PARAMETERS*** (page 693) system table:

   ```
   => SELECT CURRENT_VALUE FROM CONFIGURATION_PARAMETERS WHERE
      parameter_name='MaxClientSessions';
    CURRENT_VALUE
   ---------------
    50
   (1 row)
   ```

2. Set the `MaxClientSessions` parameter to 0 to prevent new non-dbadmin connections:

   ```
   => SELECT SET_CONFIG_PARAMETER('MaxClientSessions', 0);
   ```

   Note: The previous command allows up to five administrators to log in.

3. Issue the `CLOSE_ALL_SESSIONS`() command to remove existing sessions:

   ```
   => SELECT CLOSE_ALL_SESSIONS();
   ```

4. Query the `SESSIONS` table:

   ```
   => SELECT * FROM SESSIONS;
   ```

   When the session no longer appears in the `SESSIONS` table, disconnect and run the Stop Database command.

5. Restart the database.
6. Restore the `MaxClientSessions` parameter to its original value:

   ```
   => SELECT SET_CONFIG_PARAMETER('MaxClientSessions', 50);
   ```

See Also

CLOSE_SESSION (page 330), ***CONFIGURATION_PARAMETERS*** (page 693), ***SESSIONS*** (page 741), ***SHUTDOWN*** (page 393)

Managing Sessions and Configuration Parameters in the Administrator's Guide

Shutdown Problems in the Troubleshooting Guide

CLOSE_SESSION

Interrupts the specified external session and rolls back the current transaction, if any, and closes the socket.

Syntax

```
CLOSE_SESSION ( sessionid )
```

Parameters

sessionid	A string that specifies the session to close. This identifier is unique within the cluster at any point in time but can be reused when the session closes.

Notes

- Closing of the session is processed asynchronously. It could take some time for the session to be closed. Check the ***SESSIONS*** (page 741) table for the status.
- Database shutdown is prevented if new sessions connect after the CLOSE_SESSION() command is invoked (and before the database is actually shut down. See **Controlling Sessions** below.

Messages

The following are the messages you could encounter:

- For a badly formatted sessionID
  ```
  close_session | Session close command sent. Check SESSIONS for progress.
  Error: invalid Session ID format
  ```
- For an incorrect sessionID parameter
  ```
  Error: Invalid session ID or statement key
  ```

Examples

User session opened. RECORD 2 shows the user session running COPY DIRECT statement.

```
vmartdb=> SELECT * FROM sessions;
-[ RECORD 1 ]--------------+-------------------------------------------------
node_name                  | v_vmartdb_node0001
user_name                  | dbadmin
client_hostname            | 127.0.0.1:52110
client_pid                 | 4554
login_timestamp            | 2011-01-03 14:05:40.252625-05
session_id                 | stress04-4325:0x14
client_label               |
transaction_start          | 2011-01-03 14:05:44.325781
transaction_id             | 45035996273728326
transaction_description    | user dbadmin (SELECT * FROM sessions;)
statement_start            | 2011-01-03 15:36:13.896288
statement_id               | 10
last_statement_duration_us | 14978
current_statement          | select * from sessions;
```

```
ssl_state                   | None
authentication_method       | Trust
-[ RECORD 2 ]---------------+-----------------------------------------------
node_name                   | v_vmartdb_node0002
user_name                   | dbadmin
client_hostname             | 127.0.0.1:57174
client_pid                  | 30117
login_timestamp             | 2011-01-03 15:33:00.842021-05
session_id                  | stress05-27944:0xc1a
client_label                |
transaction_start           | 2011-01-03 15:34:46.538102
transaction_id              | -1
transaction_description     | user dbadmin (COPY ClickStream_Fact FROM
                              '/data/clickstream/1g/ClickStream_Fact.tbl'
                              DELIMITER '|' NULL '\\n' DIRECT;)
statement_start             | 2011-01-03 15:34:46.538862
statement_id                |
last_statement_duration_us  | 26250
current_statement           | COPY ClickStream_Fact FROM '/data/clickstream
                              /1g/ClickStream_Fact.tbl' DELIMITER '|' NULL
                              '\\n' DIRECT;
ssl_state                   | None
authentication_method       | Trust
```

Close user session stress05-27944:0xc1a

```
vmartdb=> \x
Expanded display is off.
vmartdb=> SELECT CLOSE_SESSION('stress05-27944:0xc1a');
                          CLOSE_SESSION
-----------------------------------------------------------------
 Session close command sent. Check v_monitor.sessions for progress.
(1 row)
```

Query the sessions table again for current status, and you can see that the second session has been closed:

```
=> SELECT * FROM SESSIONS;
-[ RECORD 1 ]---------------+-----------------------------------------
node_name                   | v_vmartdb_node0001
user_name                   | dbadmin
client_hostname             | 127.0.0.1:52110
client_pid                  | 4554
login_timestamp             | 2011-01-03 14:05:40.252625-05
session_id                  | stress04-4325:0x14
client_label                |
transaction_start           | 2011-01-03 14:05:44.325781
transaction_id              | 45035996273728326
transaction_description     | user dbadmin (select * from SESSIONS;)
statement_start             | 2011-01-03 16:12:07.841298
statement_id                | 20
last_statement_duration_us  | 2099
current_statement           | SELECT * FROM SESSIONS;
ssl_state                   | None
authentication_method       | Trust
```

Controlling Sessions

The database administrator must be able to disallow new incoming connections in order to shut down the database. On a busy system, database shutdown is prevented if new sessions connect after the CLOSE_SESSION or CLOSE_ALL_SESSIONS() command is invoked — and before the database actually shuts down.

One option is for the administrator to issue the `SHUTDOWN('true')` command, which forces the database to shut down and disallow new connections. See ***SHUTDOWN*** (page 393) in the SQL Reference Manual.

Another option is to modify the `MaxClientSessions` parameter from its original value to 0, in order to prevent new non-dbadmin users from connecting to the database.

1. Determine the original value for the `MaxClientSessions` parameter by querying the V_MONITOR.***CONFIGURATIONS_PARAMETERS*** (page 693) system table:

```
=> SELECT CURRENT_VALUE FROM CONFIGURATION_PARAMETERS WHERE
   parameter_name='MaxClientSessions';
 CURRENT_VALUE
---------------
 50
(1 row)
```

2. Set the `MaxClientSessions` parameter to 0 to prevent new non-dbadmin connections:

```
=> SELECT SET_CONFIG_PARAMETER('MaxClientSessions', 0);
```

   Note: The previous command allows up to five administrators to log in.

3. Issue the `CLOSE_ALL_SESSIONS`() command to remove existing sessions:

```
=> SELECT CLOSE_ALL_SESSIONS();
```

4. Query the `SESSIONS` table:

```
=> SELECT * FROM SESSIONS;
```

   When the session no longer appears in the `SESSIONS` table, disconnect and run the Stop Database command.

5. Restart the database.
6. Restore the `MaxClientSessions` parameter to its original value:

```
=> SELECT SET_CONFIG_PARAMETER('MaxClientSessions', 50);
```

See Also

CLOSE_ALL_SESSIONS (page 333), ***CONFIGURATION_PARAMETERS*** (page 693), ***SESSIONS*** (page 741), ***SHUTDOWN*** (page 393)

Managing Sessions and Configuration Parameters in the Administrator's Guide

Shutdown Problems in the Troubleshooting Guide

GET_NUM_ACCEPTED_ROWS

Returns the number of rows loaded into the database for the last completed load for the current session.

Syntax

```
GET_NUM_ACCEPTED_ROWS();
```

Notes

- Only loads from STDIN or a single file on the initiator are supported. This function cannot be called for multi-node loads.
- Information is not available for a load that is currently running. Check the system table ***LOAD_STREAMS*** (page 710) for its status.
- Data regarding loads does not persist, and is dropped when a new load is initiated.
- GET_NUM_ACCEPTED_ROWS is a meta-function, Do not use it as a value in an INSERT query.

GET_NUM_REJECTED_ROWS

Returns the number of rows that were rejected during the last completed load for the current session.

Syntax

```
GET_NUM_REJECTED_ROWS();
```

Notes

- Only loads from STDIN or a single file on the initiator are supported. This function cannot be called for multi-node loads.
- Information is not available for a load that is currently running. Check the system table ***LOAD_STREAMS*** (page 710) for its status.
- Data regarding loads does not persist, and is dropped when a new load is initiated.
- GET_NUM_REJECTED_ROWS is a meta-function, Do not use it as a value in an INSERT query.

INTERRUPT_STATEMENT

Interrupts the specified statement (within an external session), rolls back the current transaction, and writes a success or failure message to the log file.

Syntax

```
INTERRUPT_STATEMENT( session_id , statement_id )
```

Parameters

session_id	Specifies the session to interrupt. This identifier is unique within the cluster at any point in time.
statement_id	Specifies the statement to interrupt

Notes

- Only statements run by external sessions can be interrupted.
- Sessions can be interrupted during statement execution.
- If the *statement_id* is valid, the statement is interruptible. The command is successfully sent and returns a success message. Otherwise the system returns an error.

Messages

The following list describes messages you might encounter and their meaning:

- `Statement interrupt sent. Check SESSIONS for progress.`
  This message indicates success.
- `Session <id> could not be successfully interrupted: session not found.`
  The session ID argument to the interrupt command does not match a running session.
- `Session <id> could not be successfully interrupted: statement not found.`
  The statement ID does not (or no longer) matches the ID of a running statement (if any).
- `No interruptible statement running`
  The statement is DDL or otherwise non-interruptible.
- `Internal (system) sessions cannot be interrupted.`
  The session is internal, and only statements run by external sessions can be interrupted.

Examples

Two user sessions are open. RECORD 1 shows user session running `SELECT FROM SESSION`, and RECORD 2 shows user session running `COPY DIRECT`:

```
=> SELECT * FROM SESSIONS;
-[ RECORD 1
]--------------+---------------------------------------------------
node_name                   | v_vmartdb_node0001
user_name                   | dbadmin
client_hostname             | 127.0.0.1:52110
client_pid                  | 4554
login_timestamp             | 2011-01-03 14:05:40.252625-05
session_id                  | stress04-4325:0x14
client_label                |
transaction_start           | 2011-01-03 14:05:44.325781
transaction_id              | 45035996273728326
transaction_description     | user dbadmin (select * from sessions;)
statement_start             | 2011-01-03 15:36:13.896288
statement_id                | 10
last_statement_duration_us | 14978
current_statement           | select * from sessions;
ssl_state                   | None
authentication_method       | Trust
-[ RECORD 2
]--------------+---------------------------------------------------
node_name                   | v_vmartdb_node0003
```

```
user_name                   | dbadmin
client_hostname             | 127.0.0.1:56367
client_pid                  | 1191
login_timestamp             | 2011-01-03 15:31:44.939302-05
session_id                  | stress06-25663:0xbec
client_label                |
transaction_start           | 2011-01-03 15:34:51.05939
transaction_id              | 54043195528458775
transaction_description     | user dbadmin (COPY Mart_Fact FROM
'/data/Mart_Fact.tbl'
                              DELIMITER '|' NULL '\\n' DIRECT;)
statement_start             | 2011-01-03 15:35:46.436748
statement_id                | 5
last_statement_duration_us | 1591403
current_statement           | COPY Mart_Fact FROM '/data/Mart_Fact.tbl' DELIMITER
'|'
                              NULL '\\n' DIRECT;
ssl_state                   | None
authentication_method       | Trust
```

Interrupt the COPY DIRECT statement running in stress06-25663:0xbec:

```
vmartkp=> \x
Expanded display is off.
vmartkp=> SELECT INTERRUPT_STATEMENT('stress06-25663:0x1537', 5);
                      interrupt_statement
-----------------------------------------------------------------
 Statement interrupt sent. Check v_monitor.sessions for progress.
(1 row)
```

Verify that the interrupted statement is no longer active by looking at the current_statement column in the SESSIONS system table. This column becomes blank when the statement has been interrupted:

```
=> SELECT * FROM SESSIONS;
-[ RECORD 1
]-------------+-----------------------------------------------------
node_name                   | v_vmartdb_node0001
user_name                   | dbadmin
client_hostname             | 127.0.0.1:52110
client_pid                  | 4554
login_timestamp             | 2011-01-03 14:05:40.252625-05
session_id                  | stress04-4325:0x14
client_label                |
transaction_start           | 2011-01-03 14:05:44.325781
transaction_id              | 45035996273728326
transaction_description     | user dbadmin (select * from sessions;)
statement_start             | 2011-01-03 15:36:13.896288
statement_id                | 10
last_statement_duration_us | 14978
current_statement           | select * from sessions;
ssl_state                   | None
authentication_method       | Trust
-[ RECORD 2
]-------------+-----------------------------------------------------
```

```
node_name                   | v_vmartdb_node0003
user_name                   | dbadmin
client_hostname             | 127.0.0.1:56367
client_pid                  | 1191
login_timestamp             | 2011-01-03 15:31:44.939302-05
session_id                  | stress06-25663:0xbec
client_label                |
transaction_start           | 2011-01-03 15:34:51.05939
transaction_id              | 54043195528458775
transaction_description     | user dbadmin (COPY Mart_Fact FROM
'/data/Mart_Fact.tbl'
                              DELIMITER '|' NULL '\\n' DIRECT;)
statement_start             | 2011-01-03 15:35:46.436748
statement_id                | 5
last_statement_duration_us | 1591403
current_statement           |
ssl_state                   | None
authentication_method       | Trust
```

See Also

SESSIONS (page 741)

Managing Sessions and Configuration Parameters in the Administrator's Guide

Statistic Management Functions

This section contains statistic management functions specific to Vertica.

ANALYZE_STATISTICS

Collects and aggregates data samples and storage information as a background process from all nodes on which a projection is stored, then writes statistics into the catalog so that the statistics can be used by the query optimizer. Without these statistics, the query optimizer would assume uniform distribution of data values and equal storage usage for all projections.

Syntax

```
ANALYZE_STATISTICS { ( '' )
... | ( '[ schema.]table' )
... | ( 'projection' ) }
... | ( 'column-name' )
```

Return Value

- 0 - For success.
- 1 - For failure. Refer to `vertica.log` for details.

Parameters

''	Empty string. Collects statistics for all projections.
[schema.]table	Specifies the name of the table and optional schema. When using more than one schema, specify the schema that contains the projection. Collects statistics for all projections of the specified table.
projection	Specifies the name of the projection. Collects statistics for the specified projection as well as all the projections with the same anchor table.
column-name	Specifies the name of a single table column. Collects statistics for the specified column as well as all the projections with the same anchor table.

Notes

Issuing the command against very large tables/projections could return results more slowly. To return results more quickly, you could issue the command against a single column.

Example

The examples use the Vmart example database.

The following command computes statistics on all projections in the database and returns 0 (success):

```
=> SELECT ANALYZE_STATISTICS ('');
 analyze_statistics
--------------------
                  0
(1 row)
```

The following command computes statistics on the `shipping_dimension` table and returns 0 (success):

```
=> SELECT ANALYZE_STATISTICS ('shipping_dimension');
 analyze_statistics
--------------------
                  0
(1 row)
```

The following command computes statistics on one of the `shipping_dimension` table's projections and returns 0 (success):

```
=> SELECT ANALYZE_STATISTICS('shipping_dimension_site02'); analyze_statistics
--------------------
                  0
(1 row)
```

The following command computes statistics on the `shipping_dimension` table's `shipping_key` column for all projections and returns 0 (success):

```
=> SELECT ANALYZE_STATISTICS('shipping_dimension.shipping_key');
analyze_statistics
--------------------
                  0
(1 row)
```

For use cases, see Collecting Statistics in the Administrator's Guide

See Also

DROP_STATISTICS (page 343)

EXPORT_STATISTICS (page 353)

IMPORT_STATISTICS (page 362)

DROP_STATISTICS

Removes statistics for the specified projection(s).

Syntax

```
DROP_STATISTICS { ( '' ) | ( '[ schema.]table' ) | ( 'projection' ) }
```

Return Value

- 0 - For success.
- 1 - For failure. Refer to *vertica.log* for details.

Parameters

`''`	Empty string. Drops statistics for all projections.
`[schema.]table`	Drops statistics for all projections within the specified table. When using more than one schema, specify the schema that contains the table with the projections you want to delete.

projection	Drops statistics for the specified projection.

Notes

Once dropped, statistics can be time consuming to regenerate.

Example

The following example drops statistics for all projections in the database and returns 0 (success):

```
=> SELECT DROP_STATISTICS ('');
 drop_statistics
-------------------
                 0
(1 row)
```

The following command drops statistics for the shipping_dimension table and returns 0 (success):

```
=> SELECT DROP_STATISTICS ('shipping_dimension');
 drop_statistics
-------------------
                 0
(1 row)
```

The following command drops statistics for one of the shipping_dimension table's projections and returns 0 (success):

```
=> SELECT DROP_STATISTICS('shipping_dimension_site02'); drop_statistics
-------------------
                 0
(1 row)
```

For use cases, see Collecting Statistics in the Administrator's Guide

See Also

ANALYZE_STATISTICS (page 327)

EXPORT_STATISTICS (page 353)

IMPORT_STATISTICS (page 362)

EXPORT_STATISTICS

Generates an XML file that contains statistics for the database.

Syntax

```
EXPORT_STATISTICS ( filename )
```

Parameters

filename	Specifies the path and name of the XML output file. An empty string dumps the script to console.

Notes

- Before you export statistics for the database, be sure to run ***ANALYZE_STATISTICS*** (page 327) to collect and aggregate data samples and storage information. If you do not use ANALYZE_STATISTICS, Database Designer produce a suboptimal projection similar to those created for temporary designs.
- For use cases, see Collecting Statistics in the Administrator's Guide

See Also

ANALYZE_STATISTICS (page 327)

DROP_STATISTICS (page 343)

IMPORT_STATISTICS (page 362)

IMPORT_STATISTICS

Imports statistics from the XML file generated by the EXPORT_STATISTICS command.

Syntax

```
IMPORT_STATISTICS ( filename )
```

Parameters

filename	Specifies the path and name of the XML input file (which is the output of EXPORT_STATISTICS function).

Notes

- Imported statistics override existing statistics for all projections on the specified table.
- For use cases, see Collecting Statistics in the Administrator's Guide

See Also

ANALYZE_STATISTICS (page 327)

DROP_STATISTICS (page 343)

EXPORT_STATISTICS (page 353)

Storage Management Functions

This section contains storage management functions specific to Vertica.

ADD_LOCATION

Adds a location to store data.

Syntax

```
ADD_LOCATION ( path , [ node , usage_string ] )
```

Parameters

path	Specifies where the storage location is mounted. Path must be an empty directory with write permissions for user, group, or all.
node	Is the Vertica node where the location is available. If this parameter is omitted, *node* defaults to the initiator.
usage_string	Is one of the following: ▪ DATA: Only data is stored in the location. ▪ TEMP: Only temporary files that are created during loads or queries are stored in the location. ▪ DATA,TEMP: Both types of files are stored in the location. If this parameter is omitted, the default is DATA,TEMP.

Notes

- By default, the location is used to store both data and temporary files.
- Locations can be added from any node to any node.
- Either node and usage_string must both be specified or neither of them specified.
- Information about storage locations is visible ***V_MONITOR.DISK_STORAGE*** (page 699).
- A storage location annotation called CATALOG indicates the location is used to store the catalog and is visible in V_MONITOR.DISK_STORAGE. However, no new locations can be added, as CATALOG locations and existing CATALOG annotations cannot be removed.

Example

This example adds a location that stores data and temporary files:

```
SELECT ADD_LOCATION('/secondVerticaStorageLocation/');
```

This example adds a location to store data only:

```
SELECT ADD_LOCATION('/secondVerticaStorageLocation/' , 'node2' , 'DATA');
```

See Also

ALTER_LOCATION_USE (page 320)

RETIRE_LOCATION (page 388)

ALTER_LOCATION_USE

Alters the type of files stored in the specified storage location.

Syntax

```
ALTER_LOCATION_USE ( path , [ node ] , usage_string )
```

Parameters

path	Specifies where the storage location is mounted.

node	[Optional] Is the Vertica node where the location is available. If this parameter is omitted, *node* defaults to the initiator.
usage_string	Is one of the following: ▪ DATA: Only data is stored in the location. ▪ TEMP: Only temporary files that are created during loads or queries are stored in the location. ▪ DATA,TEMP: Both types of files are stored in the location.

Notes

- Altering the type of files stored in a particular location is useful if you create additional storage locations and you want to isolate execution engine temporary files from data files.
- After modifying the location's use, at least one location must remain for storing data and temp files. These files can be stored in the same storage location or separate storage locations.
- When a storage location is altered, it stores only the type of information indicated from that point forward. For example:
  - If you modify a storage location that previously stored both temp and data files so that it only stores temp files, the data is eventually merged out through the ATM. You can also merge it out manually.
  - If you modify a storage location that previously stored both temp and data files so that it only stores data files, all currently running statements that use these temp files, such as queries and loads, continue to run. Subsequent statements will no longer use this location.

Example

The following example alters the storage location on node3 to store data only:

```
=> SELECT ALTER_LOCATION_USE ('/thirdVerticaStorageLocation/' , 'node3' ,
'DATA');
```

See Also

ADD_LOCATION (page 318)

RETIRE_LOCATION (page 388)

Modifying Storage Locations in the Administrator's Guide

DROP_LOCATION

Removes the specified storage location.

Syntax

```
DROP_LOCATION ( 'path' , 'site' )
```

Parameters

path	Specifies where the storage location to drop is mounted.

site	Is the Vertica site where the location is available.

Notes

- Dropping a storage location is a permanent operation and cannot be undone. Therefore, Vertica recommends that you retire a storage location before dropping it. This allows you to verify that you actually want to drop a storage location before doing so. Additionally, you can easily restore a retired storage location.
- Dropping storage locations is limited to locations that contain only temp files.
- If a location used to store data and you modified it to store only temp files, the location might still contain data files. If the storage location contains data files, Vertica does not allow you to drop it. You can manually merge out all the data in this location, wait for the ATM to mergeout the data files automatically, or you can drop partitions. Deleting data files does not work.

Example

The following example drops a storage location on node3 that was used to store temp files:

```
=> SELECT DROP_LOCATION('/secondVerticaStorageLocation/' , 'node3');
```

See Also

- ***RETIRE_LOCATION*** (page 388) in this SQL Reference Manual
- Dropping Storage Locations and Retiring Storage Locations in the Administrator's Guide

MEASURE_LOCATION_PERFORMANCE

Measures disk performance for the location specified.

Syntax

```
MEASURE_LOCATION_PERFORMANCE ( path , node )
```

Parameters

path	Specifies where the storage location to measure is mounted.
node	Is the Vertica node where the location to be measured is available..

Notes

- If you intend to create a tiered disk architecture in which projections, columns, and partitions are stored on different disks based on predicted or measured access patterns, you need to measure storage location performance for each location in which data is stored. You do not need to measure storage location performance for temp data storage locations because temporary files are stored based on available space.
- This method of measuring storage location performance applies only to configured clusters. If you want to measure a disk before configuring a cluster see Measuring Location Performance.
- Storage location performance equates to the amount of time it takes to read a fixed amount of data from the disk. This read time equates to the disk throughput in MB per second plus the time it takes to seek data based on the number of seeks per second, as follows:

Read Time (seconds) = 1/Throughput (MB/second) + 1/Latency (seeks/second)

Therefore, a disk is faster than another disk if its Read Time is smaller.

Example

The following example measures the performance of a storage location on node2:

```
=> SELECT MEASURE_LOCATION_PERFORMANCE('/secondVerticaStorageLocation/' ,
'node2');

WARNING:  measure_location_performance can take a long time. Please check logs for
progress
           measure_location_performance
-------------------------------------------------
 Throughput : 122 MB/sec. Latency : 140 seeks/sec
```

See Also

ADD_LOCATION (page 318)

ALTER_LOCATION_USE (page 320)

RETIRE_LOCATION (page 388)

Measuring Location Performance in the Administrator's Guide

RESTORE_LOCATION

Restores the retired location specified.

Syntax

```
RESTORE_LOCATION ( path , node )
```

Parameters

path	Specifies where the retired storage location is mounted.
node	Is the Vertica node where the retired location is available.

Notes

Once restored, Vertica re-ranks the storage locations and use the restored location to process queries as determined by its rank.

Example

The following example restores the retired storage location on node3:

```
=> SELECT RESTORE_LOCATION ('/thirdVerticaStorageLocation/' , 'node3');
```

See Also

ADD_LOCATION (page 318)

RETIRE_LOCATION (page 388)

Modifying Storage Locations in the Administrator's Guide

RETIRE_LOCATION

Makes the specified storage location inactive.

Syntax

```
RETIRE_LOCATION ( 'path' , 'site' )
```

Parameters

path	Specifies where the storage location to retire is mounted.
site	Is the Vertica site where the location is available.

Notes

- Before retiring a location, be sure that at least one location remains for storing data and temp files. Data and temp files can be stored in either one storage location or separate storage locations.
- Once retired, no new data can be stored on the location unless the location is restored through the ***RESTORE_LOCATION*** (page 387) function.
- If the storage location stored data, the data is not moved. Instead, it is removed through one or more mergeouts. Therefore, the location cannot be dropped.
- If the storage site was used to store only temp files, it can be dropped. See Dropping Storage Locations in the Administrators Guide and the ***DROP_LOCATION*** (page 340) function.

Example

```
=> SELECT RETIRE_LOCATION ('/secondVerticaStorageLocation/' , 'node2');
```

See Also

ADD_LOCATION (page 318)

RESTORE_LOCATION (page 387)

Retiring Storage Locations in the Administrator's Guide

SET_LOCATION_PERFORMANCE

Sets disk performance for the location specified.

Syntax

```
SET_LOCATION_PERFORMANCE ( path , node , throughput , average_latency )
```

Parameters

node	Is the Vertica node where the location to be set is available. If this parameter is omitted, *node* defaults to the initiator.
path	Specifies where the storage location to set is mounted.

throughput	Specifies the throughput for the location, which must be 1 or more.
average_latency	Specifies the average latency for the location. The *average_latency* must be 1 or more.

Notes

To obtain the throughput and average latency for the location, run the ***MEASURE_LOCATION_PERFORMANCE*** (page 366) function before you attempt to set the location's performance.

Example

The following example sets the performance of a storage location on node2 to a throughput of 122 megabytes per second and a latency of 140 seeks per second.

```
=> SELECT MEASURE_LOCATION_PERFORMANCE('node2','/secondVerticaStorageLocation/','122','140');
```

See Also

ADD_LOCATION (page 318)

MEASURE_LOCATION_PERFORMANCE (page 366)

Measuring Location Performance and Setting Location Performance in the Administrator's Guide

Tuple Mover Functions

This section contains tuple mover functions specific to Vertica.

DO_TM_TASK

Runs a Tuple Mover operation (moveout) on one or more projections defined on the specified table. You do not need to stop the Tuple Mover to run this function.

Syntax

```
DO_TM_TASK ( 'task' [ , '[ schema.]table' | 'projection' ] )
```

Parameters

task	Is one of the following tuple mover operations: ▪ `'moveout'` — Moves out all projections on the specified table (if a particular projection is not specified). ▪ `'analyze_row_count'` — Automatically collects the number of rows in a projection every 60 seconds and aggregates row counts calculated during loads.
[*schema.*]*table*	Runs a tuple mover operation for all projections within the specified table. When using more than one schema, specify the schema that contains the table with the projections you want to affect.

projection	If *projection* is not passed as an argument, all projections in the system are used. If *projection* is specified, DO_TM_TASK looks for a projection of that name and, if found, uses it; if a named projection is not found, the function looks for a table with that name and, if found, moves out all projections on that table.

Notes

`DO_TM_TASK()` is useful because you can move out all projections from a table or database without having to name each projection individually.

Examples

The following example performs a moveout of all projections for table `t1`:

```
=> SELECT DO_TM_TASK('moveout', 't1');
```

The following example performs a moveout for projections t1_p:

```
=> SELECT DO_TM_TASK('moveout', 't1_p')
```

See Also

COLUMN_STORAGE (page 691)

DROP_PARTITION (page 341)

DUMP_PARTITION_KEYS (page 346)

DUMP_PROJECTION_PARTITION_KEYS (page 347)

DUMP_TABLE_PARTITION_KEYS (page 348)

PARTITION_PROJECTION (page 368)

Partitioning Tables in the Administrator's Guide

Collecting Statistics in the Administrator's Guide

SQL Statements

The primary structure of a SQL query is its statement. Multiple statements are separated by semicolons; for example:

```
CREATE TABLE fact ( ..., date_col date NOT NULL, ...);
CREATE TABLE fact(..., state VARCHAR NOT NULL, ...);
```

ALTER FUNCTION

Alters a SQL Macro by providing a new function or different schema name.

Syntax 1

```
ALTER FUNCTION
... [ schema_name.]function-name ( [ [ argname ] argtype  [, ...] ] )
... RENAME TO new_name
```

Syntax 2

```
ALTER FUNCTION
... [ schema_name.]function-name ( [ [ argname ] argtype  [, ...] ] )
... SET SCHEMA new_schema
```

Parameters

[*schema-name*.]*function-name*	Specifies a name for the SQL Macro (function body) to alter.
argname	Specifies the name of the argument.
argtype	Specifies the data type for argument that is passed to the function. Argument types must match Vertica type names. See ***SQL Data Types*** (page 60).
new_name	Specifies the new name of the function
new_schema	Specifies the new schema name where the function resides.

Notes

Before you can alter a function, you must specify the argument type because there could be several functions that share the same name with different argument types.

Permissions

Only the superuser or owner can alter the function.

Example

This example creates a SQL Macro called `zeroifnull` that accepts an `INTEGER` argument and returns an `INTEGER` result.

```
=> CREATE FUNCTION zeroifnull(x INT) RETURN INT
   AS BEGIN
     RETURN (CASE WHEN (x IS NOT NULL) THEN x ELSE 0 END);
```

```
   END;
```

This next command renames the `zeroifnull` function to `zerowhennull`:

```
=> ALTER FUNCTION zeroifnull(x INT) RENAME TO zerowhennull;
ALTER FUNCTION
```

This command moves the renamed function to a new schema called `macros`:

```
=> ALTER FUNCTION zerowhennull(x INT) SET SCHEMA macros;
ALTER FUNCTION
```

See Also

CREATE FUNCTION (page 515)

DROP FUNCTION (page 582)

GRANT (Function) (page 596)

REVOKE (Function) (page 607)

V_CATALOG.USER_FUNCTIONS (page 683)

Using SQL Macros in the Programmer's Guide

ALTER PROJECTION RENAME

Initiates a rename operation on the specified projection:

Syntax

```
ALTER PROJECTION projection-name RENAME TO new-projection-name
```

Parameters

projection-name	Specifies the projection to change.
new-projection-name	Specifies the new projection name.

Notes

The projection must exist before it can be renamed.

ALTER PROFILE

Changes a profile. Only the database superuser can alter a profile.

Syntax

```
ALTER PROFILE name LIMIT
... [PASSWORD_LIFE_TIME {life-limit | DEFAULT | UNLIMITED}]
... [PASSWORD_GRACE_TIME {grace_period | DEFAULT | UNLIMITED}]
... [FAILED_LOGIN_ATTEMPTS {login-limit | DEFAULT | UNLIMITED}]
... [PASSWORD_LOCK_TIME {lock-period | DEFAULT | UNLIMITED}]
... [PASSWORD_REUSE_MAX {reuse-limit | DEFAULT | UNLIMITED}]
... [PASSWORD_REUSE_TIME {reuse-period | DEFAULT | UNLIMITED}]
... [PASSWORD_MAX_LENGTH {max-length | DEFAULT | UNLIMITED}]
... [PASSWORD_MIN_LENGTH {min-length | DEFAULT | UNLIMITED}]
... [PASSWORD_MIN_LETTERS {min-letters | DEFAULT | UNLIMITED}]
... [PASSWORD_MIN_UPPERCASE_LETTERS {min-cap-letters | DEFAULT | UNLIMITED}]
... [PASSWORD_MIN_LOWERCASE_LETTERS {min-lower-letters | DEFAULT | UNLIMITED}]
... [PASSWORD_MIN_DIGITS {min-digits | DEFAULT | UNLIMITED}]
... [PASSWORD_MIN_SYMBOLS {min-symbols | DEFAULT | UNLIMITED}]
```

Note: For all parameters, the special value DEFAULT means the parameter is inherited from the DEFAULT profile.

Parameters

Parameter Name	Description	Meaning of UNLIMITED value
name	The name of the profile to create	N/A
PASSWORD_LIFE_TIME *life-limit*	Integer number of days a password remains valid. After the time elapses, the user must change the password (or will be warned that their password has expired if	Passwords never expire.

	PASSWORD_GRACE_TIME is set to a value other than zero or UNLIMITED).	
PASSWORD_GRACE_TIME *grace-period*	Integer number of days the users are allowed to login (while being issued a warning message) after their passwords are older than the PASSWORD_LIFE_TIME. After this period expires, users are forced to change their passwords on login if they have not done so after their password expired.	No grace period (the same as zero)
FAILED_LOGIN_ATTEMPTS *login-limit*	The number of consecutive failed login attempts that result in a user's account being locked.	Accounts are never locked, no matter how many failed login attempts are made.
PASSWORD_LOCK_TIME *lock-period*	Integer value setting the number of days an account is locked after the user's account was locked by having too many failed login attempts. After the PASSWORD_LOCK_TIME has expired, the account is automatically unlocked.	Accounts locked because of too many failed login attempts are never automatically unlocked. They must be manually unlocked by the database superuser.
PASSWORD_REUSE_MAX *reuse-limit*	The number of password changes that need to occur before the current password can be reused.	Users are not required to change passwords a certain number of times before reusing an old password.
PASSWORD_REUSE_TIME *reuse-period*	The integer number of days that must pass after a password has been set before the before it can be reused.	Password reuse is not limited by time.
PASSWORD_MAX_LENGTH *max-length*	The maximum number of characters allowed in a password. Value must be in the range of 8 to 100.	Passwords are limited to 100 characters.
PASSWORD_MIN_LENGTH *min-length*	The minimum number of characters required in a password. Valid range is 0 to *max-length*.	Equal to *max-length*.
PASSWORD_MIN_LETTERS *min-of-letters*	Minimum number of letters (a-z and A-Z) that must be in a password. Valid ranged is 0 to *max-length*.	0 (no minimum).
PASSWORD_MIN_UPPERCASE_LETTERS *min-cap-letters*	Minimum number of capital letters (A-Z) that must be in a password. Valid range is is 0 to	0 (no minimum).

	max-length.	
PASSWORD_MIN_LOWERCASE_LETTERS *min-lower-letters*	Minimum number of lowercase letters (a-z) that must be in a password. Valid range is is 0 to *max-length*.	0 (no minimum).
PASSWORD_MIN_DIGITS *min-digits*	Minimum number of digits (0-9) that must be in a password. Valid range is is 0 to *max-length*.	0 (no minimum).
PASSWORD_MIN_SYMBOLS *min-symbols*	Minimum number of symbols (any printable non-letter and non-digit character, such as $, #, @, and so on) that must be in a password. Valid range is is 0 to *max-length*.	0 (no minimum).

Note: Only the profile settings for how many failed login attempts trigger account locking and how long accounts are locked have an effect on external password authentication methods such as LDAP or Kerberos. All password complexity, reuse, and lifetime settings only have an effect on passwords managed by Vertica.

ALTER PROFILE RENAME

Rename an existing profile.

Syntax

```
ALTER PROFILE name RENAME TO newname;
```

Parameters

name	The current name of the profile.
newname	The new name for the profile.

ALTER RESOURCE POOL

Modifies a resource pool.

Syntax

```
ALTER RESOURCE POOL pool-name MEMORYSIZE 'sizeUnits'
... [ MAXMEMORYSIZE 'sizeUnits' | NONE ]
... [ PRIORITY integer ]
... [ QUEUETIMEOUT integer | NONE ]
... [ PLANNEDCONCURRENCY integer ]
... [ SINGLEINITIATOR bool ]
... [ MAXCONCURRENCY integer | NONE ]
```

Parameters

pool-name	Specifies the name of the resource pool to alter.
MEMORYSIZE *'sizeUnits'*	[Default 0%] Amount of memory allocated to the resource pool. See also MAXMEMORYSIZE parameter. Units can be one of the following: ▪ % percentage of total memory available to the Resource Manager. (In this case size must be 0-100). ▪ K Kilobytes ▪ M Megabytes ▪ G Gigabytes ▪ T Terabytes **Note:** The MEMORYSIZE parameter refers to memory allocated to this pool per node and not across the whole cluster. The default of 0% means that the pool has no memory allocated to it and must exclusively borrow from the GENERAL ***pool*** (page 534).
MAXMEMORYSIZE *'sizeUnits'* | NONE	[Default unlimited] Maximum size the resource pool could grow by borrowing memory from the GENERAL pool. See ***Built-in Pools*** (page 534) for a discussion on how resource pools interact with the GENERAL pool. Units can be one of the following: ▪ % percentage of total memory available to the Resource Manager. (In this case, size must be 0-100). This notation has special meaning for the GENERAL pool, described in Notes below. ▪ K Kilobytes ▪ M Megabytes ▪ G Gigabytes ▪ T Terabytes If MAXMEMORYSIZE NONE is specified, there is no upper limit. **Notes:** The MAXMEMORYSIZE parameter refers to the maximum memory borrowed by this pool per node and not across the whole cluster. The default of unlimited means that the pool can borrow as much memory from GENERAL pool as is available. When set as a percentage (%) value, GENERAL.MAXMEMORYSIZE governs the total amount of RAM that the Resource Manager can use for queries, regardless of whether the parameter is set to a percent or to a specific value (for example, '10G'). The default setting is 95%. The MAXMEMORYSIZE of the WOSDATA and SYSDATA pools cannot be changed as long as any of their memory is in use. For example, in order to change the MAXMEMORYSIZE of the WOSDATA pool, you need to disable any trickle loading jobs and wait until the WOS is empty before you can change the MAXMEMORYSIZE.

PRIORITY	[Default 0] An integer that represents priority of queries in this pool, when they compete for resources in the GENERAL pool. Higher numbers denote higher priority.
QUEUETIMEOUT	[Default 300 seconds] An integer, in seconds, that represents the maximum amount of time the request is allowed to wait for resources to become available before being rejected. If set to NONE, the request can be queued for an unlimited amount of time. .
PLANNEDCONCURRENCY	[Default: Max(4,Min(total available memory/2GB,#cores))] An integer that represents number of concurrent queries that are normally expected to be running against the resource pool. This is not a hard limit and is used when apportioning memory in the pool to various requests. **Note:** This is a cluster wide maximum and NOT a per-node limit.
SINGLEINITIATOR	[Default false] A boolean that indicates whether all requests using this pool are issued against the same initiator node or whether multiple initiator nodes can be used; for instance in a round robin configuration. **Note:** Vertica recommends distributing requests evenly across all nodes and leaving this parameter unchanged.
MAXCONCURRENCY	[Default unlimited] An integer that represents the maximum number of concurrent execution slots available to the resource pool. If MAXCONCURRENCY NONE is specified, there is no limit. **Note:** This is a cluster wide maximum and NOT a per-node limit.

Notes

- The resource pool must exist before you can issue the ALTER RESOURCE POOL (page 481) command.
- Resource pool names are subject to the same rules as Vertica ***identifiers*** (page 15). ***Built-in pool*** (page 534) names cannot be used for user-defined pools.
- New resource pools can be created or altered without shutting down the system. The only exception is that changes to GENERAL.MAXMEMORYSIZE take effect only on a node restart. When a new pool is created (or its size altered), MEMORYSIZE amount of memory is taken out of the GENERAL pool. If the GENERAL pool does not currently have sufficient memory to create the pool due to existing queries being processed, a request is made to the system to create a pool as soon as resources become available. The pool is in operation as soon as the specified amount of memory becomes available. You can monitor whether the ALTER has been completed in the V_MONITOR.RESOURCE_POOL_STATUS (page 676) system table.
- If the GENERAL.MAXMEMORYSIZE parameter is modified while a node is down, and that node is restarted, the restarted node sees the new setting whereas other nodes continue to see the old setting until they are restarted. Vertica recommends that you do not change this parameter unless absolutely necessary.

- Under normal operation, MEMORYSIZE is required to be less than MAXMEMORYSIZE and an error is returned during CREATE/ALTER operations if this size limit is violated. However, under some circumstances where the node specification changes by addition/removal of memory, or if the database is moved to a different cluster, this invariant could be violated. In this case, MAXMEMORYSIZE is reduced to MEMORYSIZE.
- If two pools have the same PRIORITY, their requests are allowed to borrow from the GENERAL pool in order of arrival.

See Guidelines for Setting Pool Parameters in the Administrator's Guide for details about setting these parameters.

See Also

CREATE RESOURCE POOL (page 531)

CREATE USER (page 576)

DROP RESOURCE POOL (page 586)

RESOURCE_POOL_STATUS (page 730)

SET SESSION RESOURCE POOL (page 643)

SET SESSION MEMORYCAP (page 642)

Managing Workloads in the Administrator's Guide

ALTER SCHEMA

Renames one or more existing schemas.

Syntax

```
ALTER SCHEMA schema-name [ , ... ] {
... RENAME TO new-schema-name [ , ... ] }
```

Parameters

schema-name	Specifies the name of one or more schemas to rename.
RENAME TO	Specifies one or more new schema names. The lists of schemas to rename and the new schema names are parsed from left to right and matched accordingly using one-to-one correspondence. When renaming schemas, be sure to follow these standards: ▪ The number of schemas to rename must match the number of new schema names supplied. ▪ The new schema names must not already exist. The RENAME TO parameter is applied atomically. Either all the schemas are renamed or none of the schemas are renamed. If, for example, the number of schemas to rename does not match the number of new names supplied, none of the schemas are renamed. **Note:** Renaming a schema that is referenced by a view will cause the view to fail unless another schema is created to replace it.

Notes

- Only the superuser or schema owner can use the ALTER SCHEMA command.
- Renaming schemas does not affect existing prejoin projections because prejoin projections refer to schemas by the schemas' unique numeric IDs (OIDs), and the OIDs for schemas are not changed by ALTER SCHEMA.

Tip

Renaming schemas is useful for swapping schemas without actually moving data. To facilitate the swap, enter a non-existent, temporary placeholder schema. The following example uses the temporary schema *temps* to facilitate swapping schema S1 with schema S2. In this example, *S1* is renamed to *temps*. Then *S2* is renamed to *S1*. Finally, *temps* is renamed to *S2*.

```
ALTER SCHEMA S1, S2, temps
    RENAME TO temps, S1, S2;
```

Examples

The following example renames schema S1 to S3 and schema S2 to S4:

```
ALTER SCHEMA S1, S2
    RENAME TO S3, S4;
```

See Also

CREATE SCHEMA (page 539) and ***DROP SCHEMA*** (page 586)

ALTER SEQUENCE

Changes the sequence attributes.

Syntax1

```
ALTER SEQUENCE [schema-name.]sequence-name
... [ INCREMENT [ BY ] increment ]
... [ MINVALUE minvalue | NO MINVALUE ]
... [ MAXVALUE maxvalue | NO MAXVALUE ]
... [ START [ WITH ] start ]
... [ RESTART [ [ WITH ] restart ] ]
... [ CACHE cache ]
... [ CYCLE | NO CYCLE ]
```

Syntax 2

```
ALTER SEQUENCE [schema-name.]name RENAME TO new-name
```

Syntax 3

```
ALTER SEQUENCE [schema-name.]name SET SCHEMA new-schema-name
```

Parameters

sequence-name	The name (optionally schema-qualified) of the sequence to be altered. The name must be unique among sequences, tables,

	projections, and views.
increment	Modifies the value, which is added to the current sequence value to create a new value. A positive value makes an ascending sequence, a negative one a descending sequence.
MINVALUE | NO MINVALUE	Modifies the minimum value a sequence can generate. If you change this value and the current value falls outside of the range, the current value is changed to the minimum value if increment is greater than zero or the maximum value if increment is smaller than 0.
MAXVALUE | NO MAXVALUE	Modifies the maximum value for the sequence. If you change this value and the current value falls outside of the range, the current value is changed to the minimum value if increment is greater than zero or the maximum value if increment is smaller than 0.
start	Allows the sequence to begin anywhere.
restart	Changes the current value of the sequence. The specified value is returned by the next call of NEXTVAL.
cache	Modifies how many sequence numbers are preallocated and stored in memory for faster access. The default is 250,000 with a minimum value of 1 (only one value can be generated at a time, for example, no cache).
CYCLE | NO CYCLE	Allows you you to switch between CYCLE and NO CYCLE. The CYCLE option allows the sequence to wrap around when the maxvalue or minvalue is reached by an ascending or descending sequence respectively. If the limit is reached, the next number generated is the minvalue or maxvalue, respectively. If NO CYCLE is specified, any calls to NEXTVAL after the sequence has reached its maximum/minimum value, return an error. The default is NO CYCLE.
RENAME TO *new-name*	Renames a sequence within the same schema. To move a sequence, see SET SCHEMA below.
SET SCHEMA *new-schema-name*	Moves a sequence between schemas.

Notes

- You must own the sequence or be the superuser to use ALTER SEQUENCE.
- To change a sequence's schema, you must also have CREATE privilege on the new schema.
- Any parameters not specifically set in the ALTER SEQUENCE command retain their prior settings.

Examples

The following example modifies an ascending sequence called sequential to start at 105:

```
ALTER SEQUENCE sequential RESTART WITH 105;
```

The following example moves a sequence from one schema to another:

```
ALTER SEQUENCE [public.]sequence SET SCHEMA vmart;
```

The following example renames a sequence in the Vmart schema:

```
ALTER SEQUENCE [vmart.]sequence RENAME TO serial;
```

See Also

CREATE SEQUENCE (page 540)

CURRVAL (page 255)

DROP SEQUENCE (page 587)

GRANT (Sequence) (page 599)

NEXTVAL (page 254)

Using Sequences and Sequence Privileges in the Administrator's Guide

ALTER TABLE

Modifies an existing table.

Syntax1

```
ALTER TABLE [schema-name.]table-name {
... ADD COLUMN column-definition
... | ADD table-constraint (on page 492)
... | ALTER COLUMN column-name [ SET DEFAULT default-expression ]
... | [ DROP DEFAULT ]
... | DROP CONSTRAINT constraint-name [ RESTRICT | CASCADE ]
... | RENAME [ COLUMN ] column TO new-column
... | SET SCHEMA new-schema-name [ CASCADE | RESTRICT ] }
```

Syntax2

```
ALTER TABLE [schema-name.]table-name [ , ... ]
... RENAME [TO] new-table-name [ , ... ]
```

Parameters

[schema-name.]table-name	Specifies the name of the table to be altered. When using more than one schema, specify the schema that contains the table. ALTER TABLE can be used in conjunction with SET SCHEMA to move only one table between schemas at a time. When using ALTER TABLE to rename one or more tables, you can specify a comma-delimited list of table names to rename.
ADD COLUMN *column-definition*	Adds a new column defined by *column-definition* to a table and to all superprojections of the table. The column definition cannot contain restraints. Columns cannot be added to tables that have out-of-date superprojections with up-to-date buddies. When a new column is added: ▪ A unique projection column name is generated in each superprojection. ▪ The default value is inserted for existing rows. For example, if CURRENT_TIMESTAMP is the default expression, all rows have the current timestamp. **Tip:** When adding a column, only expressions that can be folded into a constant can be specified as a default column expression. This means that all system information functions (except CURRENT_DATABASE()) cannot be specified. Other functions that cannot be used are CURRENT_USER, SESSION_USER, and certain formatting functions such as TO_DATE and TO_TIMESTAMP. Volatile functions cannot be specified through ADD COLUMN. Use ALTER COLUMN to specify volatile functions. (Volatile functions change with every invocation.) **Notes:** ▪ Columns added to a table that is referenced by a view do not

	appear in the result set of the view even if the view uses the wild card (*) to represent all columns in the table. Recreate the view to incorporate the column.
ADD	Adds a ***table-constraint*** (on page 492) to a table that does not have any associated projections. **Note:** Adding a table constraint has no effect on views that reference the table.

ALTER COLUMN	Alters an existing column within the specified table to change or drop a default expression.
	Tip: You cannot specify a volatile function in its default column expression. To work around this, add the column and fill it with NULLS. Then, alter the column to specify the volatile function. For example:
	`ALTER TABLE tbl ADD COLUMN newcol float;`
	`ALTER TABLE tbl ALTER COLUMN newcol SET DEFAULT random();`

DROP CONSTRAINT	Drops the specified table-constraint from the table. **Note:** Dropping a table constraint has no effect on views that reference the table.
[RESTRICT | CASCADE]	Use the `CASCADE` keyword to drop a constraint upon which something else depends. For example, a FOREIGN KEY constraint depends on a UNIQUE or PRIMARY KEY constraint on the referenced columns.

RENAME [TO]	RENAME can be used to rename one or more tables. In either case, the key word changes the name of the table or tables to the specified name or names.
	To rename two or more tables simultaneously, use a comma-delimited list. The lists of tables to rename and the new table names are parsed from left to right and matched accordingly using one-to-one correspondence.
	When renaming tables, be sure to follow these standards:
	▪ Do not specify the schema-name as part of the table specification after the RENAME TO clause. The schema-name is specified only after the ALTER TABLE clause because this statement applies to only one schema.
	▪ The following example renames tables T1 and T2 in the S1 schema to U1 and U2 respectively.
	`=> ALTER TABLE S1.T1, S1.T2 RENAME TO U1, U2;`
	▪ The following example generates a syntax error:
	`=> ALTER TABLE S1.T1, S1.T2 RENAME TO S1.U1, S1.U2;`
	▪ The number of tables to rename must match the number of new table names supplied.
	▪ The new table names must not already exist.
	The `RENAME TO` parameter is applied atomically. Either all the tables are renamed or none of the tables are renamed. If, for example, the number of tables to rename does not match the number of new names supplied, none of the tables are renamed.
	Note: Renaming a table that is referenced by a view causes the view to fail unless another table is created to replace it.

RENAME [COLUMN]	Renames the specified column within the table. **Note:** If a column that is referenced by a view is renamed, the column does not appear in the result set of the view even if the view uses the wild card (*) to represent all columns in the table. Recreate the view to incorporate the column's new name.
SET SCHEMA	Moves the table to the specified schema. By default, `SET SCHEMA` is set to `CASCADE`. This means that all the projections that are anchored on this table are automatically moved to the new schema regardless of the schema in which they reside. To move only projections that are anchored on this table and that reside in the same schema, use the `RESTRICT` key word. If the name of the table or any of the projections that you want to move already exists in the new schema, the statement rolls back and the tables and projections are not moved. In the new schema, rename the table or projections that conflict with the ones that you want to move and then rerun the statement. **Notes:** Although this is likely to occur infrequently, Vertica supports moving system tables to system schemas if necessary. This might occur to support designs created through Database Designer. Temporary tables cannot be moved between schemas.

	SET SCHEMA supports moving only one table between schemas at a time.

Notes

- To use the ALTER TABLE statement, the user must either be a superuser or be the table owner and have CREATE privilege on the affected schema. If you use SET SCHEMA, you must also have CREATE privilege on the schema to which you want to move the table.
- With the exception of performing a table rename, one operation can be performed at a time in an ALTER TABLE command; for example, to add multiple columns, issue consecutive ALTER TABLE ADD COLUMN commands.
- You cannot add a column constraint using the ALTER TABLE command:

```
=> ALTER TABLE t1 ADD COLUMN c INT NOT NULL;
   ROLLBACK:  ALTER TABLE does not support ADD COLUMN with other clauses
```

- The following clauses cannot be used with any other clauses. They are exclusive:
  - RENAME [TO]
  - RENAME COLUMN
  - SET SCHEMA
  - ADD COLUMN
- The ADD constraints and DROP constraints clauses can be used together.
- Adding a column to a table does not affect the K-safety of the physical schema design.
- You cannot use ALTER TABLE ... ADD COLUMN on a temporary table.
- Vertica allows adding 1600 columns to a table.
- Renaming tables does not affect existing prejoin projections because prejoin projections refer to tables by the tables' unique numeric IDs (OIDs), and the OIDs for tables are not changed by ALTER TABLE.

Tip

Renaming tables is useful for swapping tables within the same schema without actually moving data. It cannot be used to swap tables across schemas. To enable the swap, use a non-existent, temporary placeholder table. The following example uses the temporary table *temps* to facilitate swapping table T1 with table T2. In this example, *T1* is renamed to *temps*. Then *T2* is renamed to *T1*. Finally, *temps* is renamed to *T2*.

```
=> ALTER TABLE T1, T2, temps RENAME TO temps, T1, T2;
```

Examples

The following example drops the default expression specified for the Discontinued_flag column.

```
=> ALTER TABLE Retail.Product_Dimension
   ALTER COLUMN Discontinued_flag DROP DEFAULT;
```

The following example renames a column in the Retail.Product_Dimension table from Product_description to Item_description:

```
=> ALTER TABLE Retail.Product_Dimension
   RENAME COLUMN Product_description TO Item_description;
```

The following example moves table T1 from schema S1 to schema S2. SET SCHEMA defaults to CASCADE so all the projections that are anchored on table T1 are automatically moved to schema S2 regardless of the schema in which they reside

```
=> ALTER TABLE S1.T1 SET SCHEMA S2;
```

table-constraint

Adds a join constraint to the metadata of a table. See Adding Constraints in the Administrator's Guide.

Syntax

```
[ CONSTRAINT constraint_name ]
... { PRIMARY KEY ( column [ , ... ] )
... | FOREIGN KEY ( column [ , ... ] )
... REFERENCES table
... | UNIQUE ( column [ , ... ] )
```

Parameters

`CONSTRAINT` *constraint-name*	Optionally assigns a name to the constraint. Vertica recommends that you name all constraints.
`PRIMARY KEY (` *column* `[ , ... ] )`	Adds a referential integrity constraint defining one or more NOT NULL numeric columns as the primary key.
`FOREIGN KEY (` *column* `[ , ... ] )`	Adds a referential integrity constraint defining one or more NOT NULL numeric columns as a foreign key.
`REFERENCES` *table*	Specifies the table to which the `FOREIGN KEY` constraint applies. If *column* is omitted, the default is the primary key of *table*.
`UNIQUE (` *column* `[ , ... ] )`	Ensures that the data contained in a column or a group of columns is unique with respect to all the rows in the table.

Notes

- A foreign key constraint can be specified solely by a reference to the table that contains the primary key. The columns in the referenced table do not need to be explicitly specified; for example:

```
CREATE TABLE fact(c1 INTEGER PRIMARY KEY);
CREATE TABLE dim (c1 INTEGER REFERENCES fact);
```

- Define PRIMARY KEY and FOREIGN KEY constraints in all tables that participate in inner joins. See Adding Constraints.
- Adding constraint to a table that is referenced in a view does not affect the view.

Examples

```
CORRELATION (Product_Description) DETERMINES (Category_Description)
```

The Retail Sales Example Database described in the Getting Started Guide contains a table Product_Dimension in which products have descriptions and categories. For example, the description "Seafood Product 1" exists only in the "Seafood" category. You can define several similar correlations between columns in the Product Dimension table.

ALTER USER

Changes a database user account.

Syntax

```
ALTER USER name
... [ ACCOUNT { LOCK | UNLOCK } ]
... [ IDENTIFIED BY 'password' [ REPLACE 'old-password' ] ]
... [ MEMORYCAP { 'memory-limit' | NONE } ]
... [ PASSWORD EXPIRE ]
... [ PROFILE { profile-name | DEFAULT } ]
... [ RESOURCE POOL pool-name ]
... [ RUNTIMECAP { 'time-limit' | NONE } ]
... [ TEMPSPACECAP { 'space-limit' | NONE } ]
```

Parameters

name	Specifies the name of the user to alter; names that contain special characters must be double-quoted.
ACCOUNT LOCK | UNLOCK	Locks or unlocks the user's account. Users cannot log in if their account is locked. Accounts can be locked either explicitly by the superuser, or if the user has more failed login attempts than is allowed by their profile.
IDENTIFIED BY 'password' [REPLACE 'old_password']	Sets the user's password to *password*. Non-superusers can only their own passwords and must supply the REPLACE parameter along with their old password. The superuser can change any user's password without supplying the REPLACE parameter.
PASSWORD EXPIRE	Expires the user's password. Vertica will force the user to change passwords during his or her next login. **Note:** PASSWORD EXPIRE has no effect when using external password authentication methods such as LDAP or Kerberos.
PROFILE *profile-name* | DEFAULT	Sets the user's profile to *profile-name*. Using the value DEFAULT sets the user's profile to the default profile.
MEMORYCAP '*memory-limit*' | NONE	Limits the amount of memory that the user's requests can use. This value is a number representing the amount of space, followed by a unit (for example, '10G'). The unit can be one of the following: ▪ % percentage of total memory available to the Resource Manager. (In this case value of the size size must be 0-100) ▪ K Kilobytes ▪ M Megabytes ▪ G Gigabytes ▪ T Terabytes

	Setting this value to NONE means the user has no limits on memory use.
RESOURCE POOL *pool-name*	Sets the name of the default resource pool for the user.
RUNTIMECAP '*time-limit*' | NONE	Sets the maximum amount of time any of the user's queries can execute. time-limit is an interval, such as '1 minute' or '100 seconds' (see ***Interval Values*** (page 29) for details). This value cannot exceed one year. Setting this value to NONE means there is no time limit on the user's queries.
TEMPSPACECAP '*space-limit*' | NONE	Limits the amount of temporary file storage the user's requests can use. This parameter's value has the same format as the MEMORYCAP value.

Notes

- Users can alter some of their own settings. They can set their default RESOURCE POOL to any pool on which they have been granted usage privileges. They can also change their password. They must supply their old password to do so.
- Only a superuser can alter another user.
- Attempting to switch users to using a resource pool on which they have not been granted access results in an error (even for the superuser).
- ALTER USER does not affect current sessions.

See Also

CREATE USER (page 576)

Managing Workloads in the Administrator's Guide

COMMIT

Ends the current transaction and makes all changes that occurred during the transaction permanent and visible to other users.

Syntax

```
COMMIT [ WORK | TRANSACTION ]
```

Parameters

WORK | TRANSACTION	Have no effect; they are optional keywords for readability.

COPY

Bulk loads data from one or more files or pipes on a cluster host into a Vertica database. (See ***LCOPY*** (page 604) to load from a data file on a client system using ODBC.)

`COPY` can load data in one of three formats:

- Text with delimiters (the default format)
- Native binary using the `NATIVE` keyword
- Native varchar using the `NATIVE VARCHAR` keyword

See Advanced Formats for Loading Data in the Administrator's Guide for details of using native binary or varchar.

COPY has many options that give you flexibility when importing your data. For example it can:

- Read data compressed using GZIP or BZIP as well as uncompressed data.
- Insert data into the WOS (memory) or directly into the ROS (disk).
- Set certain parameters (such as the delimiters and quote characters) for the entire copy operation, or for specific columns.
- Transform data before inserting it into the database.

Note: You must connect as the database superuser to copy from a file. Any user with `INSERT` privileges can copy data from the `STDIN` pipe.

Syntax

```
COPY [schema-name.]table
[ ( [ column-as-expression ] / column
...[ FILLER datatype ]
...[ FORMAT 'format' ]
...[ ENCLOSED BY 'char' ]
...[ ESCAPE AS 'char' ]
...[ NULL [ AS ] 'string' ]
...[ DELIMITER [ AS ] 'char' ]
...[ COLUMN OPTION ( column ... FORMAT 'format' ... [ ,... ] ) ]
...[ ,... ] ) ]
FROM { STDIN
...[ BZIP | GZIP | UNCOMPRESSED ] | 'pathToData' [ ON nodename ]
...[ BZIP | GZIP | UNCOMPRESSED ] [, ...] }
...[ NATIVE | NATIVE VARCHAR ]
...[ WITH ]
...[ DELIMITER [ AS ] 'char' ]
...[ TRAILING NULLCOLS ]
...[ NULL [ AS ] 'string' ]
...[ ESCAPE AS 'char' ]
...[ ENCLOSED BY 'char' [ AND 'char' ] ]
...[ RECORD TERMINATOR 'string' ]
...[ SKIP integer ]
...[ REJECTMAX integer ]
...[ EXCEPTIONS 'path' [ ON nodename ] [, ...] ]
...[ REJECTED DATA 'path' [ ON nodename ] [, ...] ]
```

```
...[ ENFORCELENGTH ]
...[ ABORT ON ERROR ]
...[ AUTO | DIRECT | TRICKLE ]
...[ STREAM NAME  'streamName']
...[ NO COMMIT ]
```

Parameters

[*schema-name.*]*table*	Specifies the name of a schema table (not a projection). Vertica loads the data into all projections that include columns from the schema table. When using more than one schema, specify the schema that contains the table.
column-as-expression	Specifies the target column, for which you want to compute values, as an expression. This is used to transform data when it is loaded into the target database. Transforming data is useful for computing values to be inserted into a column in the target database from other columns in the source. (See Transforming Data During Loads in the Administrator's Guide.) Transformation requirements: ▪ The COPY statement must contain at least one parsed column, which can be a filler column. (See Ignoring Columns and Fields in the Load File in the Administrator's Guide for more information about using fillers.) ▪ For parsed columns, specify only raw data in the source. ▪ The return data type of the expression must be coercible to that of the target column. Parameter (parsed columns) are also coerced to match the expression. ▪ When there are computed columns, all parsed columns in the expression must be listed in the COPY statement. Transformation restrictions: ▪ Computed columns cannot be used in COPY expressions. ▪ Raw data cannot be specified in the source for computed columns. ▪ COPY expressions may contain only constants. ▪ FORMAT cannot be specified for a computed column. Transformation usage: ▪ If nulls are specified in the raw data for parsed columns in the source, evaluation follows the same rules as for expressions within SQL statements. ▪ Parsed and computed columns can be interspersed in the COPY statement. ▪ Multiple columns can be specified in a COPY expression. ▪ Multiple COPY expressions can refer to the same parsed column. ▪ A COPY expression can be as simple as a single column and can be as complex as a case expression with multiple columns. ▪ COPY expressions can be specified for columns of all supported data types. ▪ COPY expressions can use most Vertica-supported SQL functions,

	operators, constants, NULLs, and comments, as follows: ***date/time*** (page 176) functions, ***formatting*** (page 212) functions, ***numeric*** (page 229) functions, ***string*** (page 259) functions, ***null-handling*** (page 248) functions, and ***system information*** (page 310) functions. ▪ `COPY` expressions cannot use SQL meta functions (***Vertica-specific*** (page 318)), ***analytic*** (page 120) functions, and ***aggregate*** (page 107) functions.
column	Restricts the load to one or more specified columns in the table. If no columns are specified, all columns are loaded by default. Table columns that are not in the column list are given their default values. If no default value is defined for a column, `COPY` inserts `NULL`. There is no implicit casting during parsing, so mismatched data types cause the `COPY` operation to roll back and the row to be rejected. For parsed columns, specify only raw data in the source. **Tip:** If you leave this parameter blank to load all the columns in the table, you can use the optional parameter `COLUMN OPTION` to specify parsing options for specific columns. **Note:** The data file must contain the same number of columns as the `COPY` command's column list. For example, in a table `T1` with nine columns (`C1` through `C9`), the following command would load the three columns of data in each record to columns `C1`, `C6`, and `C9`, respectively: `=> COPY T1 (C1, C6, C9);`
`FILLER`	Instructs Vertica not to load a column and the fields it contains into the destination table. This is useful for omitting columns that you do not want to transfer into a table. Transforms data from a source column and then loads the transformed data to a destination table without loading the original, untransformed source column (parsed column). (See Transforming Data During Loads in the Administrator's Guide.) Filler requirements: ▪ The data type of the filler column must be specified. ▪ The name of the filler column must be unique across the source file and target table. ▪ The filler column must be a parsed column, not a computed column. Filler restrictions: ▪ The source columns in a `COPY` statement cannot consist of only filler columns. ▪ Target table columns cannot be specified as filler whether they appear in the column list or not. Filler usage: ▪ Expressions can contain filler columns. ▪ There is no restriction on the number of filler columns that can be used in a `COPY` statement — other than at least one column must not be a filler column. ▪ A data file can consist of only filler columns. This means that all data in a data file can be loaded into filler columns and then transformed

	and loaded into table columns. ▪ All parser parameters can be specified for filler columns. ▪ All statement level parser parameters apply to filler columns.
FORMAT	Is specified for ***date/time*** (page 68), and ***binary*** (page 61) data types. Supported date/time formats are the same as those accepted by the ***TO_DATE*** (page 215) function. For example: `=> TO_DATE('05 Dec 2000', 'DD Mon YYYY')` If you specify invalid format strings, the `COPY` operation returns an error. See the following links for supported formats: ▪ ***Template Patterns for Date/Time Formatting*** (page 219) ▪ ***Template Pattern Modifiers for Date/Time Formatting*** (page 220) ▪ Loading Data into Binary Data Types See Loading Data into Binary Data Types to learn more about using the date/time and binary data types.. **Note:** the FORMAT keyword significantly improves performance for loading DATE data types.
pathToData	Specifies the absolute path of the file containing the data, which can be from multiple input sources. Path can optionally contain wildcards to match more than one file. The file or files must be accessible to the host on which the COPY statement runs. You can use variables to construct the pathname as described in Using Load Scripts. The supported patterns for wildcards are specified in the ***Linux Manual Page GLOB(7), Globbing pathnames http://man-wiki.net/index.php/7:glob***.
nodename	Is optional. If omitted, operations default to the query's initiator node. **Note:** Nodename cannot be specified with `STDIN` because `STDIN` is read

	on the initiator node only.
STDIN	Reads from the client a standard input instead of a file. STDIN takes one input source only and is read on the initiator node. To load multiple input sources, use *pathToData*.
BZIP|GZIP|UNCOMPRESSED	Input files can be of any format. If wildcards are used, then all qualifying input files must be of the same format. UNCOMPRESSED is the default. **Notes**: ▪ When using concatenated BZIP or GZIP files, be sure that each source file is terminated with a record terminator before you concatenate them. ▪ Concatenated BZIP and GZIP files are not supported for NATIVE (binary) and NATIVE VARCHAR formats.
WITH, AS	For readability and have no effect.
NATIVE	Specifies that the data is in a binary-format file. Loading data through a binary-format file is often faster than normal text mode, because it does not require the use and processing of delimiters. This saves the database the extra work of converting integers, dates, and timestamps from text to their native storage format. Binary format data files can be bigger than their text equivalents, however, you can reduce the space usage by compressing binary data using GZIP or BZIP. **Notes:** ▪ Native binary format loading can be used when developing plug-ins to ETL applications, as well as by batch inserts issued from ODBC and JDBC. ▪ Binary-format files must meet exacting specifications, as per Creating Native-Format Files to Load Data in the Administrator's Guide. ▪ You cannot mix Binary and ASCII source files in the same COPY statement. ▪ Concatenated BZIP and GZIP files are not supported for NATIVE (binary). See Advanced Formats For Loading Data in the Administrator's Guide.
NATIVE VARCHAR	Uses a similar file format to NATIVE (binary), but all fields are represented as strings in CHAR or VARCHAR. Conversion to the actual table data type is done on the database server; thus, NATIVE VARCHAR does not provide the same efficiency as NATIVE; however, NATIVE VARCHAR provides the convenience of not having to use delimiters or escape special characters, such as quotes, which can make working with client applications easier. **Note:** Concatenated BZIP and GZIP files are not supported for NATIVE VARCHAR formats. See Advanced Formats For Loading Data in the Administrator's Guide.
COLUMN OPTION	A parsing option that allows a subset of columns to be specified through the table column list. For example, you can specify that a particular column has its own delimiter, enclosed by, null as 'NULL' expression, and so on. You don't have to specify all the column names in the COPY column list, which can be especially useful for large tables with lots of columns.

	Note: You cannot specify the format of a column not accounted for in the table column list.
DELIMITER	Is the single ASCII character that separates columns within each record of a file. You can choose any ASCII value in the range E'\001' to E'\177' inclusive (any ASCII character except NULL: E'\000'). The default in Vertica is a vertical bar (|). **Note:** A comma (,) is the delimiter commonly used in CSV data files. If the delimiter character appears in string of data values, use the ESCAPE AS character (\ by default) to indicate that it is a literal. See Loading Data into Character Data Types. To specify a non-printing character, use either the extended string syntax (E'...') or, if StandardConformingStrings is enabled, a Unicode string literal (U&'...'). For example, to specify tab as the delimiter, you could use either E'\t' or U&'\0009'.
TRAILING NULLCOLS	Specifies that if Vertica encounters a short record , the missing columns are inserted with NULLs. **Note:** Vertica verifies that there is no NOT NULL constraint on a column before inserting a NULL. If a NOT NULL constraint exists on the column, Vertica returns an error and rolls back the statement.
ESCAPE AS	Sets the escape character that prevents the following character from being interpreted as one of the special characters defined by the COPY command (the record terminator, delimiter, enclosed by, and the escape characters). When any of these special characters are preceded by the escape character, the COPY command ignores their special meaning and copies them into the database literally. Whether or not the character following the escape character is one of these special characters, the escape character is always removed from the input. If you want the escape character value to be inserting into your database, you must escape it. For example, if you leave the escape character as the default backslash (\) character, you need to use two backslashes (\\) anyplace in your input where you want a backslash to appear in the loaded data. The alternative (and perhaps easier) method is use ESCAPE AS to change the escape character to a value that does not appear in your input data. The default value for the escape character is backslash (\). You can set the escape character to be any ASCII value in the range E'\001' to E'\177' inclusive (any ASCII character except NULL: E'\000'). **Note:** The data read in by the COPY command is not interpreted as ***string literals*** (page 19), and therefore does not follow the same escape rules as SQL statements (including the arguments to the COPY command). Only the characters defined by ESCAPE AS, DELIMITER, ENCLOSED BY, and RECORD TERMINATOR are treated as special values in the data read by the COPY command.
ENCLOSED BY	Sets the quote character and allows delimiter characters to be embedded in string values. You can choose any ASCII value in the range E'\001' to E'\177' inclusive (any ASCII character except NULL: E'\000'). By default, ENCLOSED BY has no value, meaning data is not enclosed by any

	sort of quote character.
	Given the following input (with the default | `DELIMITER`) :
	`"vertica | value"`
	The default is:
	▪ Column 1 contains `"vertica`
	▪ Column 1 contains `value"`
	Notice the double quotes (`"`) before `vertica` and after `value`.
	When you enable `ENCLOSED BY`, you can specify an ASCII character to enclose data. All ASCII characters are allowed except for a space. Double quote is the most commonly used quotation character.
	The following indicates that data in the input to `COPY` is within double quotes:
	`ENCLOSED BY '"'`
	Using the following sample input, columns are distributed as follows:
	`"1", "vertica,value", ",", "'"`
	▪ Column 1 contains `1`
	▪ Column 2 contains `vertica,value`
	▪ Column 3 contains `,`
	▪ Column 4 contains `'`
	You could also write the above example using any ASCII character of your choosing:
	`~1~, ~vertica,value~, ~,~, ~'~`
	You can use single quote as the quote character, but you must escape it by using either the extended string syntax, a Unicode literal string if `StandardConformingStrings` is enabled, or by using four single quotes:
	`ENCLOSED BY E'\''`
	`ENCLOSED BY U&'\0027'`
	`ENCLOSED BY ''''`
	Using any of the above means the following input is properly parsed:
	`'1', 'vertica,value', ',', '\''`
	See ***String Literals (Character)*** (page 23) for an explanation of the string literal formats you can use to specify the `ENCLOSED BY` parameter.
	Use the `ESCAPE AS` character to embed the `ENCLOSED BY` delimiter within character string values. For example, using the default `ESCAPE AS` character (`\`) and double quote as the `ENCLOSED BY` character, the following input returns `"vertica"`
	`"\"vertica\""`

`NULL`	The string that represents a null value. It can contain any ASCII values in the range `E'\001'` to `E'\177'` inclusive (any ASCII character except `NULL`: `E'\000'`). The default is an empty string (`''`). When NULL is an empty string (`''`), use quotes to insert an empty string instead of a NULL. For example, using `NULL " ENCLOSED BY '"',` ▪ `1||3` — Inserts a NULL in the second columns. ▪ `1|""|3` — Inserts an empty string instead of a NULL in the second columns.

<table>
<tr><td></td><td>To input an empty or literal string, use quotes (ENCLOSED BY); for example:
NULL ''
NULL 'literal'
The null string is case-insensitive and must be the only value between the delimiters. For example, if the null string is NULL and the delimiter is the vertical bar (|):
|NULL| indicates a null value.
| NULL | does not indicate a null value.
When you use the COPY command in a script, you must substitute a double-backslash for each null string that includes a backslash. For example, the scripts used to load the example databases contain:
COPY ... NULL E'\\n' ...</td></tr>
<tr><td>RECORD TERMINATOR</td><td>Specifies the literal character string that indicates the end of a data file record. If you do not specify a value, then Vertica attempts to determine the correct line ending, accepting either just a linefeed (E'\n') common on UNIX systems, or a carriage return and linefeed (E'\r\n') common on Windows platforms. If you specify a RECORD TERMINATOR, you must be sure the input file matches, otherwise you may get inconsistent data loads.
To specify non-printing characters as the RECORD TERMINATOR, use either the extended string syntax or Unicode string literals. The following table lists some common record terminator characters. See String Literals (page 23) for an explanation of the literal string formats.
<table>
<tr><th>Extended String Syntax</th><th>Unicode Literal String</th><th>Description</th><th>ASCII Decimal</th></tr>
<tr><td>E'\a'</td><td>U&'\0007'</td><td>Bell</td><td>7</td></tr>
<tr><td>E'\b'</td><td>U&'\0008'</td><td>Backspace</td><td>8</td></tr>
<tr><td>E'\t'</td><td>U&'\0009'</td><td>Horizontal tab</td><td>9</td></tr>
<tr><td>E'\n'</td><td>U&'\000a'</td><td>Linefeed</td><td>10</td></tr>
<tr><td>E'\v'</td><td>U&'\000b'</td><td>Vertical tab</td><td>11</td></tr>
<tr><td>E'\f'</td><td>U&'\000c'</td><td>Formfeed</td><td>12</td></tr>
<tr><td>E'\r'</td><td>U&'\000d'</td><td>Carriage return</td><td>13</td></tr>
<tr><td>E'\\'</td><td>U&'\005c'</td><td>Backslash</td><td>92</td></tr>
</table>
Note: The record terminator cannot be the same as DELIMITER, NULL, ESCAPE or ENCLOSED BY.</td></tr>
<tr><td>SKIP</td><td>Skips the first 'n' records in each file in a load, which is useful if you want to omit table header information.</td></tr>
</table>

REJECTMAX	Sets an upper limit on the number of logical records to be rejected before a load fails. A rejection is data that could not be parsed into the corresponding data type during a bulk load. (It does not refer to referential constraints.) The limit on the number of logical records to be rejected is one less than the value specified for REJECTMAX. When the number of rejected records becomes equal to the value specified for REJECTMAX, the load fails and the failed records are placed into the reject file. If not specified or if value is 0, REJECTMAX allows an unlimited number of rejections. **Note:** Vertica does not accumulate rejected records across files or nodes while the data is loading. If one file exceeds the maximum reject number, the entire load fails.
EXCEPTIONS	Specifies the filename or absolute path in which to write messages indicating the input line number and the reason for each rejected data record. The default path is: <Catalog dir>/CopyErrorLogs/<tablename>-<filename of source>-copy-from-exceptions <Catalog dir> represents the directory in which the database catalog files are stored, and <tablename>-<filename of source> are the names of the table and data file. If copying from STDIN, the <filename of source> is STDIN. **Note:** Filename is required because of multiple input files. Also, long table names combined with long data file names can exceed the operating system's maximum length (typically 255 characters). To work around this limitation, specify a path for the exceptions file that is different from the default path; for example, \tmp\<shorter-file-name>. If exceptions files are not specified: ▪ If there is one data source file (*pathToData* or STDIN), all information is stored as one file in the default directory. ▪ If there are multiple data files, all information is stored as separate files, one for each data file in default directory. If exception files are specified: ▪ If there is one data file, path is treated as a file with all information stored in this file. If path is not a file, then the system returns an error. ▪ If there are multiple data files, path is treated as a directory with all information stored in separate files, one for each data file in *this* directory. If path is not a directory, then the system returns an error. ▪ Exceptions files are not shipped to the initiator node. ▪ Only one path per node is accepted. If more than one is provided, Vertica returns an error. ▪ The format for the EXCEPTIONS file is: ▪ COPY: Input record <num> in <pathofinputfile> has been rejected (<reason>). Please see <pathtorejectfile>, record <recordnum> for the rejected record.
REJECTED DATA	Specifies the filename or absolute path in which to write rejected rows. This file can then be edited to resolve problems and reloaded. The default path is: <Catalog dir>/CopyErrorLogs/<tablename>-<filename of source>-copy-from-data

	<Catalog dir> represents the directory in which the database catalog files are stored, and <tablename>-<filename of source> are the names of the table and data file. If copying from STDIN, the <filename of source> is STDIN. **Notes:** Filename is required because of multiple input files. Also, long table names combined with long data file names can exceed the operating system's maximum length (typically 255 characters). To work around this limitation, specify a path for the rejected data file that is different from the default path; for example, \tmp\<shorter-file-name>. If rejected data files are not specified: ▪ If there is one data source file (*pathToData* or STDIN), all information is stored as one file in the default directory. ▪ If there are multiple data files, all information is stored as separate files, one for each data file in default directory. If rejected data files are specified: ▪ If there is one data file, path is treated as a file with all information stored in this file. If path is not a file, then the system returns an error. ▪ If there are multiple data files, path is treated as a directory, with all information stored in separate files, one for each data file in *this* directory. If path is not a directory, then the system returns an error. ▪ Rejected data files are not shipped to the initiator node. ▪ Only one path per node is accepted. If more than one is provided, Vertica returns an error.
ENFORCELENGTH	Rejects rows that do not fit into the target table instead of truncating them. This can occur with column types of char, varchar, binary, and varbinary. For example, if 'abc' is loaded into VARCHAR(2) it is automatically truncated to 'ab' and loaded. Using ENFORCELENGTH causes the 'abc' to be rejected. **Note:** COPY has a hard 65K character limit on the length of NATIVE and NATIVE VARCHAR data. If it encounters a value that is longer than this length, it always rejects the row, even if ENFORCELENGTH is disabled.
ABORT ON ERROR	Stops the COPY command if a row is rejected and rolls back the command. No data is loaded.
AUTO | DIRECT | TRICKLE	Specifies how data is loaded into the database. ▪ AUTO (the default) loads data into the WOS (Write Optimized Store) until it is full, then it loads directly into ROS (Read Optimized Store) containers. ▪ DIRECT bypasses the WOS and loads data into ROS containers. This option is best suited when you are loading large amounts of data (100MB or more) at a time. Using DIRECT for many loads of smaller data sets results in many ROS containers, which have to be combined later. ▪ TRICKLE loads data only into the WOS. If the WOS becomes full, an error occurs and the entire data load is rolled back. This option is more efficient than AUTO when loading data into partitioned tables. Use this option only when you have a finely-tuned load and moveout process so you can be sure there is room in the WOS for the data

	you are loading.
STREAM NAME	Is the optional identifier that names a stream, which could be useful for quickly identifying a particular load. STREAM NAME appears in the stream column of the LOAD_STREAMS (page 710) table. By default, Vertica names streams by table and file name. For example, if you have two files (f1, f2) in Table A, stream names would appear as A-f1, A-f2, etc. Use the following statement to name a stream: => COPY <mytable> FROM <myfile> DELIMITER '|' DIRECT STREAM NAME 'My stream name';
NO COMMIT	Use COPY with the NO COMMIT key words to prevent the current transaction from committing automatically (default behavior for all but temporary tables). This option is useful for executing multiple COPY commands in a single transaction. For example, all the rows in the following sequence commit in the same transaction. => COPY... NO COMMIT; => COPY... NO COMMIT; => COPY... NO COMMIT; => COMMIT; NO COMMIT can be combined with any other existing COPY option, and all the usual transaction semantics apply. If there is a transaction in progress initiated by a statement other than COPY (for example, INSERT), COPY... NO COMMIT adds rows to the same transaction as the earlier statements. The previous statements are NOT committed. **Tip:** Use the NO COMMIT keywords to incorporate detection of constraint violations into the load process. Vertica checks for violations when queries are run, not when data is loaded. To avoid constraint violations, load data without committing it and then perform a post-load check of your data using the ***ANALYZE_CONSTRAINTS*** (page 321) function. If the function finds constraint violations, you can easily roll back the load because you have not committed it.

COPY Formats

The following COPY options are available when loading all data formats (delimited text, NATIVE (binary) and NATIVE VARCHAR):

- COLUMN OPTION
- DIRECT
- ENFORCELENGTH
- EXCEPTIONS
- FILLER

- REJECTED DATA
- ABORT ON ERROR
- STREAM NAME
- SKIP
- REJECTMAX
- STORAGE
- STDIN
- BZIP|GZIP|UNCOMPRESSED

NO COMMIT The following option is available when loading data in delimited text or NATIVE VARCHAR format:

FORMAT The following options are only available when loading delimited text:

- NULL
- DELIMITER
- ENCLOSED BY
- ESCAPE AS
- TRAILING NULLCOLS
- RECORD TERMINATOR

Notes

- The data read in by the COPY command is not interpreted as ***string literals*** (page 19), and therefore does not follow the same escape rules as SQL statements (including the arguments to the COPY command). Only the characters defined by ESCAPE AS, DELIMITER, ENCLOSED BY, and RECORD TERMINATOR are treated as special values in the data read by the COPY command.
- To prevent excessive resource usage, COPY is limited to loading 50 files per node at a time.
- The COPY command automatically commits itself and any current transaction unless NO COMMIT is specified and unless the tables are temp tables. Vertica recommends that you COMMIT (page 496) or ROLLBACK (page 614) the current transaction before you use COPY.
- You cannot use the same character in both the DELIMITER and NULL strings.
- NULL values are not allowed for columns with primary key or foreign key referential integrity constraints.
- String data in load files is considered to be all characters between the specified delimiters. Do not enclose character strings in quotes. In other words, quote characters are treated as ordinary data.
- Invalid input is defined as:
  - Missing columns (too few columns in an input line).
  - Extra columns (too many columns in an input line).
  - Empty columns for INTEGER or DATE/TIME data types. COPY does not use the default data values defined by the ***CREATE TABLE*** (page 546) command.

  - Incorrect representation of data type. For example, non-numeric data in an INTEGER column is invalid.
- Empty values (two consecutive delimiters) are accepted as valid input data for CHAR and VARCHAR data types. Empty columns are stored as an empty string (`''`), which is not equivalent to a null string.
- When an empty line is encountered during load, it is neither inserted nor rejected. However, the record number is incremented. Bear this in mind when you evaluate lists of rejected records. If you return a list of rejected records and one empty row was encountered during load, the position of rejected records is bumped up one position.
- Canceling a COPY statement rolls back all rows loaded by that statement.
- If you are using JDBC, Vertica recommends that you use use the following value for the RECORD TERMINATOR:
  `System.getProperty("line.separator")`
- Named pipes are supported. Naming conventions have the same rules as file names on the given file system. Permissions are open, write, and close.
- The following parameters can be specified on either a statement or on a per-column basis: DELIMITER, ENCLOSED BY, ESCAPE AS, and NULL. The same rules apply whether the parameter is specified at the statement or column level. Column-level parameters override statement-level parameters. If no column-level parameter is specified, the statement-level parameter is used. If neither a column-level nor statement-level parameter is specified, the default is used.

Examples

Basic Examples

The following examples specify `FORMAT`, `DELIMITER`, `NULL` and `ENCLOSED BY` strings.

```
=> COPY public.customer_dimension (customer_since FORMAT 'YYYY')
   DELIMITER ','
   NULL AS 'null'
   ENCLOSED BY '"'
=> COPY store.store_dimension
   FROM :input_file
   DELIMITER '|'
   NULL ''
   RECORD TERMINATOR E'\f'
=> COPY a
   FROM stdin
   DELIMITER ','
   NULL E'\\N'
   DIRECT;
```

Changing the Escape Character

If you input contains backslash characters (\) that you want to be read as data rather than as escape sequences, you can change the escape character to some other character that does not appear in your input (such as a control character):

```
=> COPY mytable FROM '/data/input.txt' ESCAPE AS E('\001');
```

Loading Comma Separated Values

If you have a file containing comma-separated values that are terminated by line feeds, you can use the following command:

```
=>  COPY mytable FROM STDIN DELIMITER ',' RECORD TERMINATOR E'\n';
```

Specifying Quote Characters for a Single Column

The following example sets a single column to be enclosed by double quotes, rather than the entire row.

```
=> COPY Retail.Dim (Dno, Dname ENCLOSED BY '"', Dstore)
   FROM '/home/dbadmin/dim3.txt'
   EXCEPTIONS '/home/dbadmin/exp.txt'
   DELIMITER ',';
```

This example properly reads data such as:

```
123,"Smith, John",9832
```

Loading Binary Data Through Delimiters

In the following example create a table that loads a different binary format for each column and insert the same value, the byte sequence `{0x61,0x62,0x63,0x64,0x65}`.

```
=> CREATE TABLE t(
     oct VARBINARY(5),
     hex VARBINARY(5),
     bitstring VARBINARY(5) );
```

Create the projection:

```
=> CREATE PROJECTION t_p(oct, hex, bitstring) AS SELECT * FROM t;
```

Issue the COPY command. Note that the copy is from STDIN, not a file.

```
=> COPY t (oct FORMAT 'octal',
           hex FORMAT 'hex',
           bitstring FORMAT 'bitstring')
   FROM STDIN DELIMITER ',';
```

Enter the data to be copied, and end it with a backslash and a period on a line by itself:

```
>> 141142143144145,0x6162636465,0110000101100010011000110110010001100101
>> \.
```

Now query table `t` to see the inputs:

```
=> SELECT * FROM t;
oct    | hex   | bitstring
-------+-------+-----------
abcde  | abcde | abcde
(1 row)
```

For more information, see Loading Data into Binary Data Types.

Using Compressed Data and Named Pipes

The following command creates the named pipe, *pipe1*:

```
\! mkfifo  pipe1
\set dir `pwd`/
\set file '''':dir'pipe1'''
```

The following sequence copies an uncompressed file from the named pipe:

```
\! cat pf1.dat > pipe1 &
COPY fact FROM :file delimiter '|';
SELECT * FROM fact;
COMMIT;
```

The following statement copies a GZIP file from named pipe and uncompresses it:

```
\! gzip pf1.dat
\! cat pf1.dat.gz > pipe1 &
COPY fact FROM :file ON site01 GZIP delimiter '|';
SELECT * FROM fact;
COMMIT;
\!gunzip pf1.dat.gz
```

The following COPY command copies a BZIP file from named pipe and then uncompresses it:

```
\!bzip2 pf1.dat
\! cat pf1.dat.bz2 > pipe1 &
COPY fact FROM :file ON site01 BZIP delimiter '|';
SELECT * FROM fact;
COMMIT;
bunzip2 pf1.dat.bz2
```

User-specified Exceptions and Rejected Data

```
\set dir `pwd`/data/
\set remote_dir /scratch_b/qa/tmp_ms/
```

Reject/Exception files NOT specified. The inputs are multiple files, and exceptions and rejection files go to the default directory on each node:

```
\set file1 '''':dir'C1_fact.dat'''
\set file2 '''':dir'C2_fact.dat'''
\set file3 '''':remote_dir'C3_fact.dat'''
\set file4 '''':remote_dir'C4_fact.dat'''
COPY fact FROM :file1 ON site01,
               :file2 ON site01,
               :file3 ON site02,
               :file4 ON site02
DELIMITER '|';
```

Reject/Exception files SPECIFIED. Input is a single file on the initiator, and the exceptions and rejected data are file names instead of directories:

```
\set except_s1 '''':dir'exceptions'''
\set reject_s1 '''':dir'rejections'''

COPY fact FROM :file1 ON site01
DELIMITER '|'
REJECTED DATA :reject_s1 ON site01
EXCEPTIONS :except_s1 ON site01;
```

Reject/Exception files SPECIFIED. A single file is on remote node:

```
\set except_s2 '''':remote_dir'exceptions'''
\set reject_s2 '''':remote_dir'rejections'''

COPY fact FROM :file1 ON site02
DELIMITER '|'
REJECTED DATA :reject_s2 ON site02
EXCEPTIONS :except_s2 ON site02;
```

Reject/Exception files SPECIFIED. Multiple data files on multiple nodes, with rejected data and exceptions referring to the directory on which the files reside:

```
\set except_s1 '''':dir''''
\set reject_s1 '''':dir''''
\set except_s2 '''':remote_dir''''
\set reject_s2 '''':remote_dir''''
COPY fact FROM :file1 ON site01,
               :file2 ON site01,
               :file3 ON site02,
               :file4 ON site02
DELIMITER '|'
REJECTED DATA :reject_s1 ON site01, :reject_s2 ON site02
EXCEPTIONS :except_s1 ON site01, :except_s2 ON site02;
```

Loading NULL values

You can specify NULL values by entering fields in a data file without content. For example, given the default delimiter (`|`) and default NULL (empty string), the following inputs:

```
|  |  1
|  2  | 3
4  |  | 5
6  |  |
```

are inserted into the table as follows:

```
(null, null, 1)
(null, 2, 3)
(4, null, 5)
(6, null, null)
```

If NULL is set as a literal (`'null'`), the following inputs:

```
null | null |    1
null |    2 |    3
   4 | null |    5
   6 | null | null
```

are inserted into the table as follows:

```
(null, null, 1)
(null, 2, 3)
(4, null, 5)
(6, null, null)
```

Using Trailing NULL Columns

The following illustrates how trailing null columns handles a short record:

```
=> CREATE TABLE z (
     a INT,
     b INT,
     c INT );
```

Insert some values:

```
=> INSERT INTO z VALUES (1, 2, 3);
```

Query table `z` to see the inputs:

```
=> SELECT * FROM z;
 a | b | c
---+---+---
 1 | 2 | 3
(1 row)
```

Now insert data using the STDIN keyword:

```
=> COPY z FROM STDIN TRAILING NULLCOLS;
>> 4 | 5 | 6
>> 7 | 8
>> \.

=> SELECT * FROM z;
 a | b | c
---+---+---
 1 | 2 | 3
 4 | 5 | 6
 7 | 8 |
(3 rows)
```

The following example shows what happens when you try to use a trailing null column on a column that contains a NOT NULL constraint:

```
=> CREATE TABLE n (
          a INT,
          b INT NOT NULL,
          c INT );
=> INSERT INTO n VALUES (1, 2, 3);
=> SELECT * FROM n;
 a | b | c
---+---+---
 1 | 2 | 3
(1 row)
=> COPY n FROM STDIN trailing nullcols abort on error;
>> 4 | 5 | 6
>> 7 | 8
>> 9
>> \.
  ERROR:  COPY: Input record 3 has been rejected (Cannot set trailing column to
  NULL as column 2 (b) is NOT NULL)
=> SELECT * FROM n;
 a | b | c
---+---+---
 1 | 2 | 3
(1 row)
```

Transforming Data

The following example derives and loads values for the year, month, and day columns in the target database based on the timestamp column in the source database. It also loads the parsed column, timestamp, from the source database to the target database.

```
=> CREATE TABLE t (
     year VARCHAR(10),
     month VARCHAR(10),
     day VARCHAR(10),
     k TIMESTAMP );
=> CREATE PROJECTION tp (
     year,
     month,
     day,
     k )
   AS SELECT * FROM t;
=> COPY t (year AS TO_CHAR(k, 'YYYY'),
           month AS TO_CHAR(k, 'Month'),
           day AS TO_CHAR(k, 'DD'),
           k FORMAT 'YYYY-MM-DD') FROM STDIN NO COMMIT;
>> 2009-06-17
>> 1979-06-30
>> 2007-11-26
>> \.
=> SELECT * FROM t;

 year |   month   | day |         k
------+-----------+-----+---------------------
 2009 | June      | 17  | 2009-06-17 00:00:00
 1979 | June      | 30  | 1979-06-30 00:00:00
 2007 | November  | 26  | 2007-11-26 00:00:00
(3 rows)
```

Ignoring Columns and Fields in the Load File

The following example derives and loads the value for the `TIMESTAMP` column in the target database from the year, month, and day columns in the source input. The year, month, and day columns are not loaded because the `FILLER` keyword skips them.

```
=> CREATE TABLE t (k TIMESTAMP);
=> CREATE PROJECTION tp (k) AS SELECT * FROM t;
=> COPY t(year FILLER VARCHAR(10),
          month FILLER VARCHAR(10),
          day FILLER VARCHAR(10),
          k AS TO_DATE(YEAR || MONTH || DAY, 'YYYYMMDD') )
   FROM STDIN NO COMMIT;
>> 2009|06|17
>> 1979|06|30
>> 2007|11|26
>> \.
=> SELECT * FROM t;
          k
---------------------
```

```
 2009-06-17 00:00:00
 1979-06-30 00:00:00
 2007-11-26 00:00:00
(3 rows)
```

Specifying Parsing Options for a Column

First create a simple table.

```
=> CREATE TABLE t(
     pk INT,
     col1 VARCHAR(10),
     col2 VARCHAR(10),
     col3 VARCHAR(10),
     col4 TIMESTAMP);
```

Now use the `COLUMN OPTION` parameter to change the `col1` default delimiter to a tilde (`~`).

```
=> COPY t COLUMN OPTION(col1 DELIMITER '~') FROM STDIN NO COMMIT;
>> 1|ee~gg|yy|1999-12-12
>> \.

=> SELECT * FROM t;
 pk | col1 | col2 | col3 |        col4
----+------+------+------+---------------------
  1 | ee   | gg   | yy   | 1999-12-12 00:00:00
(1 row)
```

See Also

LCOPY (page 604)

SQL Data Types (page 60)

ANALYZE_CONSTRAINTS (page 321)

Loading and Modifying Data in the Administrator's Guide

CREATE FUNCTION

Lets you store SQL expressions as functions in Vertica for use in queries. Called SQL Macros, these functions are useful for executing complex queries or combining Vertica built-in functions. You simply call the function name you assigned.

Syntax

```
CREATE [ OR REPLACE ] FUNCTION
... [ schema-name.]function-name ( [ argname argtype  [, ...] ] )
... RETURN rettype
... AS
... BEGIN
...... RETURN expression;
... END;
```

Parameters

[*schema-name*.]	[Optional] Specifies the name of a schema.
function-name	Specifies a name for the function (SQL Macro) to create. If the function name is schema-qualified, the function is created in the specified schema.
argname	Specifies the name of the argument.
argtype	Specifies the data type for argument that is passed to the function. Argument types must match Vertica type names. See ***SQL Data Types*** (page 60).
rettype	Specifies the data type to be returned by the function.
RETURN *expression*;	Specifies the SQL Macro (function body), which must be in the form of 'RETURN expression.' expression can contain built-in functions, operators, and argument names specified in the CREATE FUNCTION statement. A semicolon at the end of the expression is required. **Note:** Only one RETURN expression is allowed in the CREATE FUNCTION definition. FROM, WHERE, GROUP BY, ORDER BY, LIMIT, aggregation, analytics and meta function are not allowed.

Notes

- A SQL Macro can be used anywhere in a query where an ordinary SQL expression can be used, except in the table partition clause or the projection segmentation clause.
- SQL Macros are flattened in all cases, including DDL. See Flattening FROM Clause Subqueries and Views in the Programmer's Guide.
- You can ***create views*** (page 578) on the queries that use SQL Macros and then query the views. When you create a view, a SQL Macro replaces a call to the user-defined function with the function body in a view definition. Therefore, when the body of the user-defined function is replaced, the view should also be replaced.
- If you want to change the body of a SQL Macro, use the CREATE OR REPLACE syntax. The command replaces the function with the new definition. If you change only the argument name or argument type, the system maintains both versions under the same function name. See **Examples** section below.
- If multiple SQL Macros with same name and argument type are in the search path, the first match is used when the function is called.
- The strictness and volatility (stable, immutable, or volatile) of a SQL Macro are automatically inferred from the function's definition. Vertica then performs constant folding optimization, when possible, and determines the correctness of usage, such as where an immutable function is expected but a volatile function is provided.
- You can return a list of all SQL Macro functions by querying the system table V_CATALOG.USER_FUNCTIONS (page 683) and executing the vsql meta-command \df. Users see only the functions on which they have EXECUTE privileges.

Permissions

- To create a SQL Macro, a user must have `CREATE` privileges on the schema.
- To use a SQL Macro the user must have USAGE privileges on the schema and EXECUTE privileges on the defined function. See ***GRANT (Function)*** (page 596) and ***REVOKE (Function)*** (page 607).
- Only the superuser or the SQL Macro owner can ***drop*** (page 582) or ***alter*** (page 477) a SQL Macro.

Example

This example creates a SQL Macro called `zeroifnull` that accepts an `INTEGER` argument and returns an `INTEGER` result.

```
=> CREATE FUNCTION zeroifnull(x INT) RETURN INT
   AS BEGIN
     RETURN (CASE WHEN (x IS NOT NULL) THEN x ELSE 0 END);
   END;
```

You can use the new SQL Macro (`zeroifnull`) any place where you can use an ordinary SQL expression. For example, create a simple table:

```
=> CREATE TABLE tabwnulls(col1 INT);
=> INSERT INTO tabwnulls VALUES(1);
=> INSERT INTO tabwnulls VALUES(NULL);
=> INSERT INTO tabwnulls VALUES(0);
=> SELECT * FROM tabwnulls;
 a
---
 1
 0
(3 rows)
```

Use the `zeroifnull` function in a `SELECT` statement, where the function calls column a from table tabwnulls:

```
=> SELECT zeroifnull(col1) FROM tabwnulls;
 zeroifnull
------------
          1
          0
          0
(3 rows)
```

Use the `zeroifnull` function in the `GROUP BY` clause:

```
=> SELECT COUNT(*) FROM tabwnulls GROUP BY zeroifnull(col1); count
-------
     2
     1
(2 rows)
```

If you want to change a SQL Macro's body, use the `CREATE OR REPLACE` syntax. The following command modifies the `CASE` expression:

```
=> CREATE OR REPLACE FUNCTION zeroifnull(x INT) RETURN INT
```

```
AS BEGIN
  RETURN (CASE WHEN (x IS NULL) THEN 0 ELSE x END);
END;
```

To see how this information is stored in the Vertica catalog, see Viewing Information About SQL Macros in the <SQL_PROGRAMMERS_GUIDE>.

See Also

ALTER FUNCTION (page 477)

DROP FUNCTION (page 582)

GRANT (Function) (page 596)

REVOKE (Function) (page 607)

V_CATALOG.USER_FUNCTIONS (page 683)

Using SQL Macros in the Programmer's Guide

CREATE PROCEDURE

Adds an external procedure to Vertica.

Syntax

```
CREATE PROCEDURE [schema-name.]procedure-name (
... [ argname ] argtype [,...] ] )
... AS 'exec-name'
... LANGUAGE language-name
... USER 'OS-user'
```

Parameters

[*schema-name.*]	[Optional] Specifies the name of a schema.
procedure-name	Specifies a name for the external procedure. If the procedure-name is schema-qualified, the procedure is created in the specified schema.
argname	Provides a cue to procedure callers.
argtype	Specifies the data type for argument(s) that are passed to the procedure. Argument types must match Vertica type names. See ***SQL Data Types*** (page 60).
AS	Specifies the executable program in the procedures directory.
LANGUAGE	Specifies the language used, This parameter must be set to EXTERNAL.
USER	Specifies the user executed as. The user is the owner of the file. The user cannot be root. **Note:** The external program must allow execute privileges for this user.

Notes

- A procedure file must be owned by the database administrator (OS account) or by a user in the same group as the administrator. (The procedure file owner cannot be root.) The procedure file must also have the set UID attribute enabled, and allow read and execute permission for the group.
- Only the database superuser can create procedures.
- By default, only the database superuser can execute procedures. However, the superuser can grant the right to execute procedures to other users. See ***GRANT (Procedure)*** (page 597).

Example

This example illustrates how to create a procedure named *helloplanet* for the *helloplanet.sh* external procedure file. This file accepts one varchar argument.

Sample file:

```
#!/bin/bash
echo "hello planet argument: $1" >> /tmp/myprocedure.log
exit 0
```

Issue the following SQL to create the procedure:

```
CREATE PROCEDURE helloplanet(arg1 varchar) as 'helloplanet.sh' language
'external' USER 'release';
```

See Also

DROP PROCEDURE (page 583)

CREATE PROFILE

Creates a profile that controls password requirements for users. Only the database superuser can create or alter a profile.

Syntax

```
CREATE PROFILE name LIMIT
... [PASSWORD_LIFE_TIME {life-limit | DEFAULT | UNLIMITED}]
... [PASSWORD_GRACE_TIME {grace_period | DEFAULT | UNLIMITED}]
... [FAILED_LOGIN_ATTEMPTS {login-limit | DEFAULT | UNLIMITED}]
... [PASSWORD_LOCK_TIME {lock-period | DEFAULT | UNLIMITED}]
... [PASSWORD_REUSE_MAX {reuse-limit | DEFAULT | UNLIMITED}]
... [PASSWORD_REUSE_TIME {reuse-period | DEFAULT | UNLIMITED}]
... [PASSWORD_MAX_LENGTH {max-length | DEFAULT | UNLIMITED}]
... [PASSWORD_MIN_LENGTH {min-length | DEFAULT | UNLIMITED}]
... [PASSWORD_MIN_LETTERS {min-letters | DEFAULT | UNLIMITED}]
... [PASSWORD_MIN_UPPERCASE_LETTERS {min-cap-letters | DEFAULT | UNLIMITED}]
... [PASSWORD_MIN_LOWERCASE_LETTERS {min-lower-letters | DEFAULT | UNLIMITED}]
... [PASSWORD_MIN_DIGITS {min-digits | DEFAULT | UNLIMITED}]
```

Note: For all parameters, the special DEFAULT value means that the parameter's value is inherited from the DEFAULT profile. Any changes to the parameter in the DEFAULT profile is reflected by all of the profiles that inherit that parameter. Any parameter not specified in the CREATE PROFILE command is set to DEFAULT.

ParametersParameter Name	Description	Meaning of UNLIMITED value
name	The name of the profile to create	N/A
PASSWORD_LIFE_TIME *life-limit*	Integer number of days a password remains valid. After the time elapses, the user must change the password (or will be warned that their password has expired if PASSWORD_GRACE_TIME is set to a value other than zero or UNLIMITED).	Passwords never expire.
PASSWORD_GRACE_TIME *grace-period*	Integer number of days the users are allowed to login (while being issued a warning message) after their passwords are older than the PASSWORD_LIFE_TIME. After this period expires, users are forced to change their passwords on login if they have not done so after their password expired.	No grace period (the same as zero)
FAILED_LOGIN_ATTEMPTS *login-limit*	The number of consecutive failed login attempts that result in a user's account being locked.	Accounts are never locked, no matter how many failed login attempts are made.
PASSWORD_LOCK_TIME *lock-period*	Integer value setting the number of days an account is locked after the user's account was locked by having too many failed login attempts. After the PASSWORD_LOCK_TIME has expired, the account is automatically unlocked.	Accounts locked because of too many failed login attempts are never automatically unlocked. They must be manually unlocked by the database superuser.
PASSWORD_REUSE_MAX *reuse-limit*	The number of password changes that need to occur before the current password can be reused.	Users are not required to change passwords a certain number of times before reusing an old password.
PASSWORD_REUSE_TIME *reuse-period*	The integer number of days that must pass after a password has been set before the before it can be reused.	Password reuse is not limited by time.
PASSWORD_MAX_LENGTH *max-length*	The maximum number of	Passwords are limited to 100

	characters allowed in a password. Value must be in the range of 8 to 100.	characters.
PASSWORD_MIN_LENGTH *min-length*	The minimum number of characters required in a password. Valid range is 0 to *max-length*.	Equal to *max-length*.
PASSWORD_MIN_LETTERS *min-of-letters*	Minimum number of letters (a-z and A-Z) that must be in a password. Valid ranged is 0 to *max-length*.	0 (no minimum).
PASSWORD_MIN_UPPERCASE_LETTERS *min-cap-letters*	Minimum number of capital letters (A-Z) that must be in a password. Valid range is is 0 to *max-length*.	0 (no minimum).
PASSWORD_MIN_LOWERCASE_LETTERS *min-lower-letters*	Minimum number of lowercase letters (a-z) that must be in a password. Valid range is is 0 to *max-length*.	0 (no minimum).
PASSWORD_MIN_DIGITS *min-digits*	Minimum number of digits (0-9) that must be in a password. Valid range is is 0 to *max-length*.	0 (no minimum).
PASSWORD_MIN_SYMBOLS *min-symbols*	Minimum number of symbols (any printable non-letter and non-digit character, such as $, #, @, and so on) that must be in a password. Valid range is is 0 to *max-length*.	0 (no minimum).

Note: Only the profile settings for how many failed login attempts trigger account locking and how long accounts are locked have an effect on external password authentication methods such as LDAP or Kerberos. All password complexity, reuse, and lifetime settings only have an effect on passwords managed by Vertica.

CREATE PROJECTION

Creates metadata for a projection in the Vertica catalog.

Syntax

```
CREATE PROJECTION [schema-name.]projection-name (
... projection-column [ ENCODING encoding-type (on page 526) ]
... [ ACCESSRANK integer ] [ , ... ]
... [ GROUPED( projection-column-reference [,...] ) ] )
AS SELECT table-column [ , ... ] FROM table-reference [ , ... ]
... [ WHERE join-predicate (on page 54) [ AND join-predicate ] ...
... [ ORDER BY table-column [ , ... ] ]
... [ hash-segmentation-clause (on page 528) | range-segmentation-clause (on page
529)
... | UNSEGMENTED { NODE node | ALL NODES } ]
... [ KSAFE [ k-num ] ]
```

Parameters

[*schema-name.*]	[Optional] Specifies the name of a schema.
projection-name	Specifies the name of the projection to be created. If the projection-name is schema-qualified, the projection is created in the specified schema. Otherwise, the projection is created in the same schema as the anchor table.

projection-column	Specifies the name of a column in the projection. The data type is inferred from the corresponding column in the schema table (based on ordinal position).
	If projection columns are not explicitly named, they are inferred from the column names for the table specified in the SELECT statement. The following example automatically uses store and transaction as the projection column names for sales_p:
	`=> CREATE TABLE sales(store INTEGER, transaction INTEGER);`
	`=> CREATE PROJECTION sales_p AS SELECT * FROM sales KSAFE 1;`
	Note that you cannot specify specific encodings on projection columns using this method.
	Different *projection-column* names can be used to distinguish multiple columns of the same name from different tables so that no aliases are needed.

ENCODING *encoding-type*	[Optional] Specifies the ***type of encoding*** (see "***encoding-type***" on page 526) to use on the column. By default, the encoding-type is auto. **Caution:** Using the NONE keyword for strings could negatively affect the behavior of string columns.
ACCESSRANK *integer*	[Optional] Overrides the default access rank for a column. This is useful if you want to increase or decrease the speed at which a column is accessed. See Creating and Configuring Storage Locations and Prioritizing Column Access Speed in the Administrator's Guide.

GROUPED	Groups two or more columns into a single disk file. This minimizes file I/O for work loads that: ▪ Read a large percentage of the columns in a table. ▪ Perform single row look-ups. ▪ Query against many small columns. ▪ Frequently update data in these columns. If you have data that is always accessed together and it is not used in predicates, you can increase query performance by grouping these columns. Once grouped, queries can no longer independently retrieve from disk all records for an individual column independent of the other columns within the group. **Note:** RLE compression is reduced when a RLE column is grouped with one or more non-RLE columns. When grouping columns you can: ▪ Group some of the columns: ▪ (a, GROUPED(b, c), d) ▪ Group all of the columns: ▪ (GROUPED(a, b, c, d)) ▪ Create multiple groupings in the same projection: ▪ (GROUPED(a, b), GROUPED(c, d)) **Note:** Vertica performs dynamic column-grouping. For example, to provide better read and write efficiency for small loads, Vertica ignores any projection-defined column grouping (or lack thereof) and groups all columns together by default.
SELECT *table-column*	Specifies a list of schema table columns corresponding (in ordinal position) to the projection columns.
table-reference	Specifies a list of schema tables containing the columns to include in the projection in the form: *table-name* [AS] *alias* [(*column-alias* [, ...])] [, ...]]
WHERE *join-predicate*	Specifies foreign-key = primary-key equijoins between the fact table and dimension tables. Foreign key columns must be NOT NULL. No other predicates are allowed.
ORDER BY *table-column*	[Optional] Specifies which columns to sort. Because all projection columns are sorted in ascending order in physical storage, CREATE PROJECTION does not allow you to specify ascending or descending. **Note:** If you do not specify the sort order, Vertica uses the order in which columns are specified in the column list as the sort order for the projection.
hash-segmentation-clause	[Optional] Allows you to segment a projection based on a built-in hash function that provides even distribution of data across nodes, resulting in optimal query execution. See ***hash-segmentation-clause*** (on page 528).
range-segmentation-clause	[Optional] Allows you to segment a projection based on a known range of values stored in a specific column chosen to provide even

	distribution of data across a set of nodes, resulting in optimal query execution. See ***range-segmentation-clause*** (on page 529).
UNSEGMENTED { NODE *node* | ALL NODES }	[Optional] Allows you to specify that the projection be unsegmented, as follows: ▪ NODE *node*—Creates the unsegmented projection on the specified node only. Dimension table projections must be UNSEGMENTED. ▪ ALL NODES—Creates a separate unsegmented projection on each node (automatic replication). To perform distributed query execution, Vertica requires an exact, unsegmented copy of each dimension table superprojection on each node.
KSAFE [*k-num*]	Specifies the K-Safety level of the projection. This integer determines how many replicated or segmented buddy projections are created. The value must be greater than or equal to the current K-Safety level of the database and less than the total number of nodes. If KSAFE or its value are not specified, the projection might not be K-Safe. This example creates a superprojection for a database with a K-Safety of one (1): K-SAFE 1 **Note:** KSAFE cannot be used with range segmentation.

Unsegmented Projection Naming

CREATE PROJECTION ... UNSEGMENTED takes a snapshot of the nodes defined at execution time to generate a node list in a predictable order. Thus, replicated projections have the name:

projection-name_node-name

For example, if the nodes are named NODE01, NODE02, and NODE03 then the following command creates projections named ABC_NODE01, ABC_NODE02, and ABC_NODE03:

```
=> CREATE PROJECTION ABC ... UNSEGMENTED ALL NODES;
```

This naming convention could affect functions that provide information about projections, for example, ***GET_PROJECTIONS*** (page 358) or ***GET_PROJECTION_STATUS*** (page 357), where you must provide the name ABC_NODE01 instead of just ABC. To view a list of the nodes in a database, use the View Database command in the Administration Tools.

Notes

- If there is a naming conflict with existing catalog objects (projections), the CREATE PROJECTION statement fails.
- Vertica recommends that you use multiple projection syntax for K-safe clusters.
- CREATE PROJECTION does not load data into physical storage. If the tables over which the projection is defined already contain data you must issue ***START_REFRESH*** (page 394) to bring the projection up-to-date. This process could take a long time, depending on how much data is in the tables. Once a projection is up-to-date, it is updated as part of INSERT, UPDATE, DELETE or COPY statements.
- If no segmentation is specified, the default is UNSEGMENTED on the node where the CREATE PROJECTION was run.

- A projection is not refreshed until after a buddy projection is created. After the CREATE PROJECTION is run, if you run `SELECT START_REFRESH()` the following message displays:

  ```
  Starting refresh background process
  ```

  However, the refresh does not begin until after a buddy projection is created. You can monitor the refresh operation by examining the `vertica.log` file or view the final status of the projection refresh by using `SELECT get_projections('table-name;)`. For example:

  ```
  => SELECT get_projections('customer_dimension'); get_projections
  ---------------------------------------------------------------
  Current system K is 1.
  # of Nodes: 4.
  Table public.customer_dimension has 4 projections.

  Projection Name: [Segmented] [Seg Cols] [# of Buddies] [Buddy
     Projections] [Safe] [UptoDate]
  -------------------------------------------------------------
  public.customer_dimension_node0004 [Segmented: No] [Seg Cols: ] [K: 3]
     [public.customer_dimension_node0003,
     public.customer_dimension_node0002,
     public.customer_dimension_node0001] [Safe: Yes] [UptoDate:
     Yes][Stats: Yes]
  public.customer_dimension_node0003 [Segmented: No] [Seg Cols: ] [K: 3]
     [public.customer_dimension_node0004,
     public.customer_dimension_node0002,
     public.customer_dimension_node0001] [Safe: Yes] [UptoDate:
     Yes][Stats: Yes]
  public.customer_dimension_node0002 [Segmented: No] [Seg Cols: ] [K: 3]
     [public.customer_dimension_node0004,
     public.customer_dimension_node0003,
     public.customer_dimension_node0001] [Safe: Yes] [UptoDate:
     Yes][Stats: Yes]
  public.customer_dimension_node0001 [Segmented: No] [Seg Cols: ] [K: 3]
     [public.customer_dimension_node0004,
     public.customer_dimension_node0003,
     public.customer_dimension_node0002] [Safe: Yes] [UptoDate:
     Yes][Stats: Yes]
  (1 row)
  ```

Vertica internal operations (mergeout, refresh, and recovery) maintain partition separation except in certain cases:

- Recovery of a projection when the buddy projection from which the partition is recovering is identically sorted. If the projection is undergoing a full rebuild, it is recovered one ROS container at a time. The projection ends up with a storage layout identical to its buddy and is, therefore, properly segmented.

  Note: In the case of a partial rebuild, all recovered data goes into a single ROS container and must be partitioned manually.

- Manual tuple mover operations often output a single storage container, combining any existing partitions; for example, after executing any of the `PURGE()` operations.

Example

The following example groups the highly correlated columns bid and ask. However, the stock column is stored separately.

```
=> CREATE TABLE trades (stock CHAR(5), bid INT, ask INT);
=> CREATE PROJECTION tradeproj (stock ENCODING RLE, GROUPED(bid ENCODING DELTAVAL,
ask))
      AS (SELECT * FROM trades) KSAFE 1;
```

encoding-type

Vertica supports the following encoding and compression types:

ENCODING AUTO (default)

For CHAR/VARCHAR, BOOLEAN, BINARY/VARBINARY, and FLOAT columns, Lempel-Ziv-Oberhumer-based (LZO) compression is used. For INTEGER, DATE/TIME/TIMESTAMP, and INTERVAL types, the compression scheme is based on the delta between consecutive column values.

Encoding Auto is ideal for sorted, many-valued columns such as primary keys. It is also suitable for general purpose applications for which no other encoding or compression scheme is applicable. Therefore, it serves as the default if no encoding/compression is specified.

The CPU requirements for this type are relatively small. In the worst case, data might expand by eight percent (8%) for LZO and twenty percent (20%) for integer data.

ENCODING DELTAVAL

For INTEGER and DATE/TIME/TIMESTAMP/INTERVAL columns, data is recorded as a difference from the smallest value in the data block. This encoding has no effect on other data types.

Encoding Deltaval is best used for many-valued, unsorted integer or integer-based columns. The CPU requirements for this type are small, and the data never expands.

ENCODING RLE

Run Length Encoding (RLE) replaces sequences (runs) of identical values with a single pair that contains the value and number of occurrences. Therefore, it is best used for low cardinality columns that are present in the ORDER BY clause of a projection.

The Vertica execution engine processes RLE encoding run-by-run and the Vertica optimizer gives it preference. Use it only when the run length is large, such as when low-cardinality columns are sorted.

The storage for RLE and AUTO encoding of CHAR/VARCHAR and BINARY/VARBINARY is always the same.

ENCODING BLOCK_DICT

For each block of storage, Vertica compiles distinct column values into a dictionary and then stores the dictionary and a list of indexes to represent the data block.

BLOCK_DICT is ideal for few-valued, unsorted columns in which saving space is more important than encoding speed. Certain kinds of data, such as stock prices, are typically few-valued within a localized area once the data is sorted, such as by stock symbol and timestamp, and are good candidates for BLOCK_DICT. Long CHAR/VARCHAR columns are not good candidates for BLOCK_DICT encoding.

CHAR and VARCHAR columns that contain 0x00 or 0xFF characters should not be encoded with BLOCK_DICT. Also, BINARY/VARBINARY columns do not support BLOCK_DICT encoding.

The encoding CPU for BLOCK_DICT is significantly higher than for default encoding schemes. The maximum data expansion is eight percent (8%).

ENCODING BLOCKDICT_COMP

This encoding type is similar to BLOCK_DICT except that dictionary indexes are entropy coded. This encoding type requires significantly more CPU time to encode and decode and has a poorer worst-case performance. However, use of this type can lead to space savings if the distribution of values is extremely skewed.

ENCODING DELTARANGE_COMP

This compression scheme is primarily used for floating point data, and it stores each value as a delta from the previous one.

This scheme is ideal for many-valued FLOAT columns that are either sorted or confined to a range. Do not use this scheme for unsorted columns that contain NULL values, as the storage cost for representing a NULL value is high. This scheme has a high cost for both compression and decompression.

To determine if DELTARANGE_COMP is suitable for a particular set of data, compare it to other schemes. Be sure to use the same sort order as the projection, and select sample data that will be stored consecutively in the database.

ENCODING COMMONDELTA_COMP

This compression scheme builds a dictionary of all the deltas in the block and then stores indexes into the delta dictionary using entropy coding.

This scheme is ideal for sorted FLOAT and INTEGER-based (DATE/TIME/TIMESTAMP/INTERVAL) data columns with predictable sequences and only the occasional sequence breaks, such as timestamps recorded at periodic intervals or primary keys. For example, the following sequence compresses well: 300, 600, 900, 1200, 1500, 600, 1200, 1800, 2400. The following sequence does not compress well: 1, 3, 6, 10, 15, 21, 28, 36, 45, 55.

If the delta distribution is excellent, columns can be sorted in less than one bit per row. However, this scheme is very CPU intensive. If you use this scheme on data with arbitrary deltas, it can lead to significant data expansion.

ENCODING NONE

Do not specify this value. It is obsolete and exists only for backwards compatibility. The result of ENCODING NONE is the same as ENCODING AUTO except when applied to CHAR and VARCHAR columns. Using ENCODING NONE on these columns increases space usage, increases processing time, and leads to problems if 0x00 or 0xFF characters are present in the data.

hash-segmentation-clause

Allows you to segment a projection based on a built-in hash function that provides even distribution of data across some or all of the nodes in a cluster, resulting in optimal query execution.

Note: Hash segmentation is the preferred method of segmentation. The Database Designer uses hash segmentation by default.

Syntax

```
SEGMENTED BY expression
  [ ALL NODES [ OFFSET offset ] | NODES node [ ,... ] ]
```

Parameters

`SEGMENTED BY` *expression*	Can be a general SQL expression, but there is no reason to use anything other than the built-in ***HASH*** (page 236) or ***MODULARHASH*** (page 239) functions with table columns as arguments. Choose columns that have a large number of unique data values and acceptable skew in their data distribution. Primary key columns that meet the criteria could be an excellent choice for hash segmentation.
`ALL NODES`	Automatically distributes the data evenly across all nodes at the time the `CREATE PROJECTION` statement is run. The ordering of the nodes is fixed.
`OFFSET` *offset*	Is an integer that specifies the node within the ordered sequence on which to start the segmentation distribution, relative to 0. See example below.
`NODES` *node* `[ ,... ]`	Specifies a subset of the nodes in the cluster over which to distribute the data. You can use a specific node only once in any projection. For a list of the nodes in a database, use the View Database command in the Administration Tools.

Notes

- Omitting an OFFSET clause is equivalent to OFFSET 0.
- CREATE PROJECTION accepts the deprecated syntax `SITES` *node* for compatibility with previous releases.
- Table column names must be used in the expression, not the new projection column names
- If you want to use a different `SEGMENTED BY` expression, the following restrictions apply:
  - All leaf expressions must be either constants or ***column-references*** (see "***Column References***" on page 45) to a column in the SELECT list of the CREATE PROJECTION command.

- Aggregate functions are not allowed.
- The expression must return the same value over the life of the database.
- The expression must return non-negative INTEGER values in the range 0 <= x < 2^{63} (two to the sixty-third power or 2^63), and values are generally distributed uniformly over that range.
- If *expression* produces a value outside the expected range (a negative value for example), no error occurs, and the row is added to the first segment of the projection.

Examples

```
=> CREATE PROJECTION ... SEGMENTED BY HASH(C1,C2) ALL NODES;
=> CREATE PROJECTION ... SEGMENTED BY HASH(C1,C2) ALL NODES OFFSET 1;
```

The example produces two hash-segmented buddy projections that form part of a K-Safe design. The projections can use different sort orders.

```
=> CREATE PROJECTION fact_ts_2 (
      f_price,
      f_cid,
      f_tid,
      f_cost,
      f_date) AS (
   SELECT price, cid, tid, cost, dwdate FROM fact)
SEGMENTED BY ModularHash(dwdate) ALL NODES OFFSET 2;
```

See Also

HASH (page 236) and ***MODULARHASH*** (page 239)

range-segmentation-clause

Allows you to segment a projection based on a known range of values stored in a specific column chosen to provide even distribution of data across a set of nodes, resulting in optimal query execution.

Note: Vertica Systems, Inc. recommends that you use hash segmentation, instead of range segmentation.

Syntax

```
SEGMENTED BY expression
  NODE node VALUES LESS THAN value
  ...
  NODE node VALUES LESS THAN MAXVALUE
```

Parameters (Range Segmentation)

`SEGMENTED BY` *expression*	Is a single ***column reference*** (see "***Column References***" on page 45) to a column in the SELECT list of the CREATE PROJECTION statement. Choose a column that has: ▪ INTEGER or FLOAT data type ▪ A known range of data values ▪ An even distribution of data values ▪ A large number of unique data values

	Avoid columns that: ▪ Are foreign keys ▪ Are used in query predicates ▪ Have a date/time data type ▪ Have correlations with other columns due to functional dependencies. **Note:** Segmenting on DATE/TIME data types is valid but guaranteed to produce temporal skew in the data distribution and is not recommended. If you choose this option, do not use TIME or TIMETZ because their range is only 24 hours.
NODE *node*	Is a symbolic name for a node. You can use a specific node only once in any projection. For a list of the nodes in a database, use SELECT * FROM NODE_RESOURCES.
VALUES LESS THAN *value*	Specifies that this segment can contain a range of data values *less than* the specified *value*, except that segments cannot overlap. In other words, the minimum value of the range is determined by the *value* of the previous segment (if any).
MAXVALUE	Specifies a sub-range with no upper limit. In other words, it represents a value greater than the maximum value that can exist in the data. The maximum value depends on the data type of the segmentation column.

Notes

- The SEGMENTED BY *expression* syntax allows a general SQL expression but there is no reason to use anything other than a single ***column reference*** (see "***Column References***" on page 45) for range segmentation. If you want to use a different expression, the following restrictions apply:
  - All leaf expressions must be either constants or ***column-references*** (see "***Column References***" on page 45) to a column in the SELECT list of the CREATE PROJECTION command
  - Aggregate functions are not allowed
  - The expression must return the same value over the life of the database.
- During INSERT or COPY to a segmented projection, if *expression* produces a value outside the expected range (a negative value for example), no error occurs, and the row is added to a segment of the projection.
- CREATE PROJECTION with range segmentation accepts the deprecated syntax SITE *node* for compatibility with previous releases.
- CREATE PROJECTION with range segmentation allows the SEGMENTED BY expression to be a single column-reference to a column in the *projection-column* list for compatibility with previous releases. This syntax is considered to be a deprecated feature and causes a warning message. See DEPRECATED syntax in the Troubleshooting Guide.

See Also

NODE_RESOURCES (page 714)

CREATE RESOURCE POOL

Creates a resource pool.

Syntax

```
CREATE RESOURCE POOL pool-name MEMORYSIZE 'sizeUnits'
... [ MAXMEMORYSIZE 'sizeUnits' | NONE ]
... [ PRIORITY n ]
... [ QUEUETIMEOUT n | NONE ]
... [ PLANNEDCONCURRENCY n ]
... [ SINGLEINITIATOR bool ]
... [ MAXCONCURRENCY n | NONE ]
```

Parameters

pool-name	Specifies the name of the resource pool to create.
MEMORYSIZE '*sizeUnits*'	[Default 0%] Amount of memory allocated to the resource pool. See also MAXMEMORYSIZE parameter. Units can be one of the following: ▪ % percentage of total memory available to the Resource Manager. (In this case, size must be 0-100.). ▪ K Kilobytes ▪ M Megabytes ▪ G Gigabytes ▪ T Terabytes **Note:** This parameter refers to memory allocated to this pool per node and not across the whole cluster. The default of 0% means that the pool has no memory allocated to it and must exclusively borrow from the GENERAL pool.
MAXMEMORYSIZE '*sizeUnits*' | NONE	[Default unlimited] Maximum size the resource pool could grow by borrowing memory from the GENERAL pool. See ***Built-in Pools*** (page 534) for a discussion on how resource pools interact with the GENERAL pool. Units can be one of the following: ▪ % percentage of total memory available to the Resource Manager. (In this case, size must be 0-100). This notation has special meaning for the GENERAL pool, described in Notes below. ▪ K Kilobytes ▪ M Megabytes ▪ G Gigabytes ▪ T Terabytes If MAXMEMORYSIZE NONE is specified, there is no upper limit. **Notes:** The MAXMEMORYSIZE parameter refers to the maximum

	memory borrowed by this pool per node and not across the whole cluster. The default of unlimited means that the pool can borrow as much memory from GENERAL pool as is available. When set as a percentage (%) value, GENERAL.MAXMEMORYSIZE governs the total amount of RAM that the Resource Manager can use for queries, regardless of whether the parameter is set to a percent or to a specific value (for example, '10G'). The default setting is 95%.
PRIORITY	[Default 0] An integer that represents priority of queries in this pool, when they compete for resources in the GENERAL pool. Higher numbers denote higher priority.
QUEUETIMEOUT	[Default 300 seconds] An integer, in seconds, that represents the maximum amount of time the request is allowed to wait for resources to become available before being rejected. If set to NONE, the request can be queued for an unlimited amount of time.
PLANNEDCONCURRENCY	[Default: Max (4, Min (total available memory / 2GB, #cores))] An integer that represents number of concurrent queries that are normally expected to be running against the resource pool. This is not a hard limit and is used when apportioning memory in the pool to various requests. **Notes:** ▪ This is a cluster-wide maximum and not a per-node limit. ▪ If you created or upgraded your database in 4.0 or 4.1, the PLANNEDCONCURRENCY setting on the GENERAL pool defaults to a too-small value for machines with large numbers of cores. To adjust to a more appropriate value: ▪ => ALTER RESOURCE POOL general PLANNEDCONCURRENCY ▪ <#cores>; ▪ You only need to set this parameter if you created a database before 4.1, patchset 1.
SINGLEINITIATOR	[Default false] A boolean that indicates whether all requests using this pool are issued against the same initiator node or whether multiple initiator nodes can be used; for instance in a round-robin configuration. **Note:** Vertica recommends that you distribute requests evenly across all nodes and leave this parameter unchanged.
MAXCONCURRENCY	[Default unlimited] An integer that represents the maximum number of concurrent execution slots available to the resource pool. If MAXCONCURRENCY NONE is specified, there is no limit. **Note:** This is a cluster-wide maximum and not a per-node limit.

Notes

- Resource pool names are subject to the same rules as Vertica ***identifiers*** (page 15). ***Built-in pool*** (page 534) names cannot be used for user-defined pools.
- New resource pools can be created or altered without shutting down the system.
- When a new pool is created (or its size altered), MEMORYSIZE amount of memory is taken out of the GENERAL ***pool*** (page 534). If the GENERAL pool does not currently have sufficient memory to create the pool due to existing queries being processed, a request is made to the system to create a pool as soon as resources become available. The pool is created immediately and memory is moved to the pool as it becomes available. Such memory movement has higher priority than any query.

  The pool is in operation as soon as the specified amount of memory becomes available. You can monitor whether the ALTER has been completed in the V_MONITOR.RESOURCE_POOL_STATUS (page 676) system table.
- Under normal operation, MEMORYSIZE is required to be less than MAXMEMORYSIZE and an error is returned during CREATE/ALTER operations if this size limit is violated. However, under some circumstances where the node specification changes by addition/removal of memory, or if the database is moved to a different cluster, this invariant could be violated. In this case, MAXMEMORYSIZE is increased to MEMORYSIZE.
- If two pools have the same PRIORITY, their requests are allowed to borrow from the GENERAL pool in order of arrival.

See Guidelines for Setting Pool Parameters in the Administrator's Guide for details about setting these parameters.

Example

The following command creates a resource pool with MEMORYSIZE of 110MB to ensure that the CEO query has adequate memory reserved for it:

```
=> CREATE RESOURCE POOL ceo_pool MEMORYSIZE '110M' PRIORITY 10;
\pset expanded
Expanded display is on.
SELECT * FROM resource_pools WHERE name = 'ceo_pool';
-[ RECORD 1 ]-------+------------
name                | ceo_pool
is_internal         | f
memorysize          | 110M
maxmemorysize       |
priority            | 10
queuetimeout        | 300
plannedconcurrency  | 4
maxconcurrency      |
singleinitiator     | f
```

Assuming the CEO report user already exists, associate this user with the above resource pool using ALTER USER statement.

```
=> ALTER USER ceo_user RESOURCE POOL ceo_pool;
```

Issue the following command to confirm that the ceo_user is associated with the ceo_pool:

```
=> SELECT * FROM users WHERE user_name ='ceo_user';
-[ RECORD 1 ]-+------------------
user_id       | 45035996273713548
user_name     | ceo_user
is_super_user | f
resource_pool | ceo_pool
memory_cap_kb | unlimited
```

See Also

ALTER RESOURCE POOL (page 481)

CREATE USER (page 576)

DROP RESOURCE POOL (page 586)

SET SESSION RESOURCE POOL (page 643)

SET SESSION MEMORYCAP (page 642)

Managing Workloads in the Administrator's Guide

Built-in Pools

Vertica is preconfigured to have several built-in pools for various system tasks. The built-in pools can be reconfigured to suit your usage. The following sections describe the purpose of built-in pools and the default settings.

Built-in Pool	Settings
GENERAL	A special, catch-all pool used to answer requests that have no specific resource pool associated with them. Any memory left over after memory has been allocated to all other pools is automatically allocated to the GENERAL pool. The MEMORYSIZE parameter of the GENERAL pool is undefined (variable), however, the GENERAL pool must be at least 1GB in size and cannot be smaller than 25% of the memory in the system. The MAXMEMORYSIZE parameter of the GENERAL pool has special meaning; when set as a % value it represents the percent of total physical RAM on the machine that the Resource Manager can use for queries. By default it is set to 95%. The GENERAL.MAXMEMORYSIZE governs the total amount of RAM that the Resource Manager can use for queries, regardless of whether it is set to a percent or to a specific value (for example, '10GB') Any user-defined pool can “borrow” memory from the GENERAL pool to satisfy requests that need extra memory until the MAXMEMORYSIZE parameter of that pool is reached. If the pool is configured to have MEMORYSIZE equal to MAXMEMORYSIZE it cannot borrow any memory from the GENERAL pool and is said to be a standalone resource pool. When multiple pools request memory from the GENERAL pool, they are granted access to general pool memory according to their priority setting. In this manner, the GENERAL pool provides some elasticity to account for point-in-time deviations from normal usage of individual resource pools.
SYSQUERY	Is used to answer queries against ***system monitoring and catalog tables*** (page 660).
SYSDATA	Is used to reserve memory for results of queries against ***system monitoring and***

	catalog tables (page 660).
WOSDATA	Is used by the Write Optimized Store (WOS). Loads to the WOS automatically spill to the ROS once they exceed a certain amount of WOS usage; the PLANNEDCONCURRENCY parameter of the WOS is used to determine this spill threshold. For instance, if PLANNEDCONCURRENCY of the WOSDATA pool is set to 4, then a load spills to the ROS once it has occupied one quarter of the WOS. See Scenario: Tuning for Continuous Load and Query in the Administrator's Guide.
TM	Is memory used by the Tuple Mover(TM). The MAXCONCURRENCY parameter can be used to allow more than one concurrent TM operation to occur at the same time. See Scenario: Tuning Tuple Mover Pool Settings in the Administrator's Guide.
RECOVERY	Is used by queries issued when recovering another node of the database. The MAXCONCURRENCY parameter is used to determine how many concurrent recovery threads to use. The PLANNEDCONCURRENCY parameter (by default set to twice the MAXCONCURRENCY) can be used to tune how to apportion memory to the recovery queries. See Scenario: Tuning for Recovery in the Administrator's Guide.
REFRESH	Is used by queries issued by the ***PROJECTION_REFRESHES*** (page 717) operations. Refresh currently does not use multiple concurrent threads; thus, changes to the MAXCONCURRENCY values have no effect. See Scenario: Tuning for Refresh in the Administrator's Guide.
DBD	Is used by the Database Designer to control resource usage by its internal processing. This pool is configured to have a QUEUETIMEOUT of 0 seconds. This is done because the Database Designer is a resource intensive process, and in a system under severe memory pressure, the Database Designer excuses itself from running (instead of being queued and adding to the existing contention) and notifies the user to run it when the system is quieter. Vertica recommends that you do not reconfigure this pool.

Upgrade from Vertica 3.5

For a database being upgraded from 3.5, Vertica automatically translates most existing parameter values into the new resource pool settings.

Note: The following 3.5 parameters are not automatically translated to new settings in 4.0: QueriesPerNode, TotalQueries, InitiationTokensPerQuery, InitiationTokensPerLoad, LocalInitiationTokens, and LocalSysInitiationTokens.

The PLANNEDCONCURRENCY and MAXCONCURRENCY parameters of the resource pools must be manually tuned per Guidelines for Setting Pool Parameters in the Administrator's Guide. On first database startup after an upgrade to 4.0, if Vertica detects that any of the above parameters have been changed from their defaults in 3.5, it returns the following notifications, indicating that these parameters must be tuned manually:

- Due to significant changes in resource management and query execution, the configuration settings QueriesPerNode, TotalQueries, LoadsPerNode, and TotalLoads have been deprecated. See Workload Management in the Administrator's Guide for advice on resource tuning.

- Due to significant changes in resource management, the configuration settings `InitiationTokensPerQuery`, `InitiationTokensPerLoad`, `LocalInitiationTokens`, `LocalSysInitiationTokens` have been deprecated. See Workload Management in the Administrator's Guide for advice on limiting the number of concurrent queries.

Built-in Pool Configuration

The following tables show the default values of the configuration settings for the built-in pools for a new database and for a database upgraded from 3.5.

Note: Some of the parameter values of built-in pools have special restrictions, which are noted in the tables.

GENERAL

Setting	Value
`MEMORYSIZE`	N/A (cannot be set)
`MAXMEMORYSIZE`	Default: 95% of Total RAM on the node. 3.5 upgrade: Set as a % value based on `MaxResourceUsagePct` parameter. Restrictions: ▪ Cannot be less than 1GB. ▪ Cannot be less than 25% of RAM. ▪ Setting to 100% generates warnings that swapping could result.
`PRIORITY`	0
`QUEUETIMEOUT`	300 3.5 Upgrade: Resource Timeout parameter
`PLANNEDCONCURRENCY`	Min(2*#cores,TotalLoads) if TotalLoads is set, otherwise Min(2*#cores, #nodes * LoadsPerNode) 3.5 Upgrade: Max (default above, LPN+2) where LPN is the `LoadsPerNode` parameter if set or TotalLoads/# nodes if set. **Notes:** ▪ `QueriesPerNode` or `TotalQueries` are not used in the default calculation. See Best Practices For Workload Management in the Administrator's Guide for guidance on how to tune. ▪ The `PLANNEDCONCURRENCY` setting on the `GENERAL` pool defaults to a too-small value for machines with large numbers of cores. To adjust to a more appropriate value: ▪ `=> ALTER RESOURCE POOL general PLANNEDCONCURRENCY <#cores>;` See Guidelines for Setting Pool Parameters in the Administrator's Guide
`MAXCONCURRENCY`	Unlimited

	Restrictions: Setting to 0 generates warnings that no system queries may be able to run in the system.
SINGLEINITIATOR	False

SYSQUERY

Setting	Value
MEMORYSIZE	64M 3.5 Upgrade: SysWOSSizeMB Restrictions: Setting to <20M generates warnings because it could prevent system queries from running and make problem diagnosis difficult.
MAXMEMORYSIZE	Unlimited
PRIORITY	20
QUEUETIMEOUT	300 3.5 Upgrade: Resource Timeout parameter
PLANNEDCONCURRENCY	See GENERAL
MAXCONCURRENCY	Unlimited Restrictions: Setting to 0 generates warnings that no system queries may be able to run in the system.
SINGLEINITIATOR	False

SYSDATA

Setting	Value
MEMORYSIZE	100m 3.5 Upgrade: Sysmemsizemb
MAXMEMORYSIZE	10% Restriction: Setting To <4m generates warnings that no system queries may be able to run in the system.
PRIORITY	N/A (cannot be set)
QUEUETIMEOUT	N/A (cannot be set)
PLANNEDCONCURRENCY	N/A (cannot be set)
MAXCONCURRENCY	N/A (cannot be set)
SINGLEINITIATOR	N/A (cannot be set)

WOSDATA

Setting	Value
MEMORYSIZE	0%

	3.5 Upgrade: If `ReserveWOSMemory` is set, then `MaxWOSMemPct`, else 0%
`MAXMEMORYSIZE`	25% or 2GB, whichever is less. (25% for databases created before 4.1 Patchset 1.) 3.5 Upgrade: `MaxWOSMemPct`
`PRIORITY`	N/A (cannot be set)
`QUEUETIMEOUT`	N/A (cannot be set)
`PLANNEDCONCURRENCY`	2*#nodes 3.5 Upgrade: `TotalLoads`, if set or `LoadsPerNode`*#nodes
`MAXCONCURRENCY`	N/A (cannot be set)
`SINGLEINITIATOR`	N/A (cannot be set)

TM

Setting	Value
`MEMORYSIZE`	100M
`MAXMEMORYSIZE`	Unlimited
`PRIORITY`	10
`QUEUETIMEOUT`	300 3.5 Upgrade: Resource Timeout parameter
`PLANNEDCONCURRENCY`	1
`MAXCONCURRENCY`	2 Restrictions: Cannot set to 0 or NONE(unlimited)
`SINGLEINITIATOR`	True

REFRESH

Setting	Value
`MEMORYSIZE`	0%
`MAXMEMORYSIZE`	Unlimited
`PRIORITY`	-10
`QUEUETIMEOUT`	300 3.5 Upgrade: Resource Timeout parameter
`PLANNEDCONCURRENCY`	4
`MAXCONCURRENCY`	Unlimited Restrictions: cannot set to 0
`SINGLEINITIATOR`	True

RECOVERY

Setting	Value
MEMORYSIZE	0%
MAXMEMORYSIZE	Unlimited Restrictions: Cannot set to < 25%.
PRIORITY	15
QUEUETIMEOUT	300 3.5 Upgrade: Resource Timeout parameter
PLANNEDCONCURRENCY	Twice MAXCONCURRENCY
MAXCONCURRENCY	(# of cores / 2) + 1 3.5 Upgrade: RecoverThreadCount Restrictions: Cannot set to 0 or NONE (unlimited)
SINGLEINITIATOR	True

DBD

Setting	Value
MEMORYSIZE	0%
MAXMEMORYSIZE	Unlimited
PRIORITY	0
QUEUETIMEOUT	0
PLANNEDCONCURRENCY	See GENERAL
MAXCONCURRENCY	Unlimited
SINGLEINITIATOR	False

CREATE SCHEMA

Defines a new schema.

Syntax

```
CREATE SCHEMA schemaname [ AUTHORIZATION user-name ]
```

Parameters

schemaname	Specifies the name of the schema to create. The schema name must be distinct from all other schemas within the database. If the schema name is not provided, the user name is used as the schema name.
AUTHORIZATION *user-name*	Assigns ownership of the schema to a user. If a user name is not provided, the user who creates the schema is assigned ownership. Only a Superuser is allowed to create a schema that is owned by a different user.

Notes

- To create a schema, the user must either be a superuser or have CREATE privilege for the database. See ***GRANT (Database)*** (page 595).
- Optionally, CREATE SCHEMA could include the following sub-statements to create tables within the schema:
  - ***CREATE TABLE*** (page 546)
  - GRANT
- With the following exceptions, these sub-statements are treated as if they have been entered as individual commands after the CREATE SCHEMA statement has completed:
  - If the AUTHORIZATION statement is used, all tables are owned by the specified user.
  - The CREATE SCHEMA statement and all its associated sub-statements are completed as one transaction. If any of the statements fail, the entire CREATE SCHEMA statement is rolled back.

Examples

The following example creates a schema named `s1` with no objects.

```
=> CREATE SCHEMA s1;
```

The following series of commands create a schema named `s1` with a table named `t1` and grants Fred and Aniket access to all existing tables and ALL privileges on table `t1`:

```
=> CREATE SCHEMA s1;
=> CREATE TABLE t1 (c INT);
=> GRANT USAGE ON SCHEMA s1 TO Fred, Aniket;
=> GRANT ALL ON TABLE t1 TO Fred, Aniket;
```

See Also

ALTER SCHEMA (page 484)

SET SEARCH_PATH (page 639)

DROP SCHEMA (page 586)

CREATE SEQUENCE

Defines a new sequence number generator.

Syntax

```
CREATE SEQUENCE [schema-name.]sequence_name
... [ INCREMENT [ BY ] increment ]
... [ MINVALUE minvalue | NO MINVALUE ]
... [ MAXVALUE maxvalue | NO MAXVALUE ]
... [ START [ WITH ] start ]
... [ CACHE cache ]
... [ CYCLE | NO CYCLE ]
```

Parameters

sequence_name	The name (optionally schema-qualified) of the sequence to be created. The name must be unique among sequences, tables, projections, and views.
increment	Specifies which value is added to the current sequence value to create a new value. A positive value makes an ascending sequence; a negative value makes a descending sequence. The default value is 1.
minvalue | NO MINVALUE	Determines the minimum value a sequence can generate. If this clause is not supplied or NO MINVALUE is specified, then defaults are used. The defaults are 1 and $-2^{63}-1$ for ascending and descending sequences, respectively.
maxvalue | NO MAXVALUE	Determines the maximum value for the sequence. If this clause is not supplied or NO MAXVALUE is specified, then default values are used. The defaults are $2^{63}-1$ and -1 for ascending and descending sequences, respectively.
start	Allows the sequence to begin anywhere. The default starting value is *minvalue* for ascending sequences and *maxvalue* for descending sequences.
cache	Specifies how many sequence numbers are pre-allocated and stored in memory for faster access. The default is 250,000 with a minimum value is 1 (only one value can be generated at a time, for example, no cache). **Notes:** ▪ When the CACHE clause is specified, each session has its own cache on each Vertica node. ▪ Sequences that specify a small cache size could cause a performance degradation.
CYCLE | NO CYCLE	Allows the sequence to wrap around when the *maxvalue* or *minvalue* is reached by an ascending or descending sequence, respectively. If the limit is reached, the next number generated is the *minvalue* or *maxvalue*, respectively. If NO CYCLE is specified, any calls to NEXTVAL (page 254) after the sequence has reached its maximum/minimum value return an error. NO CYCLE is the default.

Notes

- Consider using sequences or auto-incrementing columns for primary key columns, which guarantees uniqueness and avoids the constraint enforcement problem and associated overhead. For more information see Using Sequences in the Administrator's Guide.

- If a schema name is given, the sequence is created in the specified schema. Otherwise it is created in the current schema. The sequence name must be distinct from the name of any other sequence, table, index, or view in the same schema.
- You must have CREATE privileges on the schema in which you want to create a sequence.
- After a sequence is created, use the functions ***NEXTVAL*** (page 254) and ***CURRVAL*** (page 255) to operate on the sequence. A cache is created when NEXTVAL is called.
- You cannot use NEXTVAL or CURRVAL to act on a sequence in a SELECT statement:
  - in a WHERE clause
  - in a GROUP BY or ORDER BY clause
  - in a DISTINCT clause
  - along with a UNION, INTERSECT or MINUS
  - in a subquery
- Additionally, you cannot use NEXTVAL or CURRVAL to act on a sequence in:
  - a subquery of UPDATE or DELETE
  - a view
- You can work around some of these restrictions by using subqueries. For example, to use sequences with a DISTINCT clause:

```
SELECT t.col1, shift_allocation_seq.nextval
FROM (
  SELECT DISTINCT col1 FROM av_temp1) t;
```

- If you want to generate, for example, only even numbers, specify INCREMENT BY 2 and use a *start* value of 2.
- Use ***DROP SEQUENCE*** (page 587) to remove a sequence; however, you cannot drop a sequence upon which other objects depends.
- DROP SEQUENCE ... CASCADE is not supported. Sequences used in a default expression of a column cannot be dropped until all references to the sequence are removed from the default expression.

Cache Operation

- In each session, every node maintains its own cache of the sequence state, so you need a Global Catalog Lock(X) to obtain a cache of values from a sequence.
- Regardless of the number of calls to NEXTVAL and CURRVAL, sequences are incremented one time per row. This means multiple calls to NEXTVAL within the same row return the same value. If joins are used, a sequence is incremented one time for the final composite row.
- It is possible for one session to allocate a cache and use it slowly while another statement requests and loads many values. Therefore, the values returned from NEXTVAL in one statement could be distant from the values returned in another statement.
- If a disconnect occurs, any remaining values that have not been returned through NEXTVAL are lost.
- If a statement fails after NEXTVAL is called and the cache is incremented, the new cache value is not rolled back.
- When the cache runs out of sequence numbers, it automatically obtains more from the Global Catalog.

- Because large cache sizes can create gaps in the sequence, you might decide to specify a smaller cache. Note that smaller cache sizes can result in a performance degradation.

Examples

The following example creates an ascending sequence called `sequential`, starting at 101:

```
=> CREATE SEQUENCE my_seq START 101;
```

After a sequence is created, use the sequence functions ***NEXTVAL*** (page 254) and ***CURRVAL*** (page 255) to operate on the sequence. These functions provide simple, multiuser-safe methods for obtaining successive sequence values from sequence objects.

Note:

CURRVAL returns a sequence's most recent value, so if you run CURRVAL before NEXTVAL, the system returns an error:

```
ERROR:  Sequence my_seq has not been accessed in the session
```

NEXTVAL must be called at least one time in a session to provide a value for CURRVAL. A cache is created when NEXTVAL is called.

The following command generates the first number for this sequence:

```
=> SELECT NEXTVAL('my_seq');
 nextval
---------
     101
(1 row)
```

The following command returns the current value of this sequence. Since no other operations have been performed on the newly-created sequence, the function returns the expected value of 101:

```
=> SELECT CURRVAL('my_seq');
 currval
---------
     101
(1 row)
```

The following command increments the value for this sequence by one (1):

```
=> SELECT NEXTVAL('my_seq');
 nextval
---------
     102
(1 row)
```

Calling the CURRVAL again function returns only the current value:

```
=> SELECT CURRVAL('my_seq');
 currval
---------
     102
(1 row)
```

The following example shows how to use the `my_sequence` sequence in an INSERT statement.

```
=> CREATE TABLE customer (
      lname VARCHAR(25),
      fname VARCHAR(25),
      membership_card INTEGER,
      ID INTEGER
);
=> INSERT INTO customer VALUES ('Hawkins' ,'John', 072753, NEXTVAL('my_seq'));
```

Now query the table you just created. Notice that the ID column has been incremented 1 value to 103:

```
=> SELECT * FROM customer;
  lname  | fname | membership_card | ID
---------+-------+-----------------+-----
 Hawkins | John  |           72753 | 103
(1 row)
```

The following example shows how to use a sequence as the default value for an INSERT command:

```
=> CREATE TABLE customer2(
      ID INTEGER DEFAULT NEXTVAL('my_seq'),
      lname VARCHAR(25),
      fname VARCHAR(25),
      membership_card INTEGER
);
=> INSERT INTO customer2 VALUES (default,'Carr', 'Mary', 87432);
```

Now query the table you just created. The ID column has been incremented by (1) again to 104:

```
=> SELECT * FROM customer2;
 ID  | lname | fname | membership_card
-----+-------+-------+-----------------
 104 | Carr  | Mary  |           87432
(1 row)
```

The following example shows how to use NEXTVAL in a SELECT statement:

```
=> SELECT NEXTVAL('my_seq'), lname FROM customer2;
 NEXTVAL | lname
---------+-------
     105 | Carr
(1 row)
```

As you can see, each time NEXTVAL is called, the value increments by 1.

The following example shows how to use CURRVAL in a SELECT statement:

```
=> SELECT CURRVAL('my_seq'), lname FROM customer2;
 CURRVAL | lname
---------+-------
     105 | Carr
(1 row)
```

The value doesn't change above because the CURRVAL function returns only the current value.

See Also

ALTER SEQUENCE (page 485)

CREATE TABLE ***column-constraint*** (page 556)

CURRVAL (page 255)

DROP SEQUENCE (page 587)

GRANT (Sequence) (page 599)

NEXTVAL (page 254)

Using Sequences and Sequence Privileges in the Administrator's Guide

CREATE TABLE

Creates a table in the logical schema.

Note: A default superprojection is automatically created for the table. See "Superprojection Creation" within this topic for details about how it is implemented.

Syntax

```
CREATE TABLE [schema-name.]table-name
... { ( column-definition (see "column-definition (table)" on page 552) [ , ... ] )
... | [ column-name-list (see "column-name-list (table)" on page 553) ] AS [ [ AT EPOCH LATEST ]
... | [ AT TIME 'timestamp' ] ] query }
... [ ORDER BY table-column [ , ... ] ]
... [ ENCODED BY column-definition [ , ... ]
... [ hash-segmentation-clause (see "hash-segmentation-clause (table)" on page 561)
... | range-segmentation-clause (see "range-segmentation-clause (table)" on page 562)
... | UNSEGMENTED { NODE node | ALL NODES } ]
... [ KSAFE [k_num] ]
... [ PARTITION BY partition-clause ]
```

Parameters

[*schema-name.*]*table-name*	Table-name specifies the name of the table to be created. Schema-name specifies the schema where the table is created. If schema-name is omitted, the table is created in the first schema listed in the current ***search_path.*** (page 639)
column-definition	Defines one or more columns. See ***column-definition*** (see "***column-definition (table)***" on page 552).
ORDER BY *table-column*	[Optional] Specifies the sort order for the superprojection that is automatically created for the table. If you do not specify the sort order, Vertica uses the order in which columns are specified in the column definition as the sort order for the projection. For example: `ORDER BY col2, col1, col5` Note: Data is in ascending order only.
column-name-list	Renames columns when creating a table from a query (CREATE TABLE AS SELECT). See ***column-name-list*** (page 553).

AS query	Creates a new table from the results of a query and fills it with data from the query. For example:
	`CREATE TABLE promo AS SELECT ... ;`
	Column renaming is supported as part of the process:
	`CREATE TABLE promo (name, address, ...) AS SELECT customer_name, customer_address ... ;`
	The query table-column must be followed by the FROM clause to identify the table from which to copy the columns. See the example at the bottom of this topic as well as the ***SELECT*** (page 617) statement.
	If the query output has expressions other than simple columns (for example, constants, functions, etc) then either an alias must be specified for that expression, or all columns must be listed in the column name list.

`AT EPOCH LATEST | AT TIME 'timestamp'`	Used with AS query to query historical data. You can specify AT EPOCH LATEST to include data from the latest committed DML transaction or specify a specific epoch based on its time stamp.
`ENCODED BY` *column-definition*	[CREATE TABLE AS query Only] This parameter is useful to specify the column encoding and/ or the access rank for specific columns in the query when a column-definition is not used to rename columns for the table to be created. See ***column-definition*** (see "***column-definition (temp table)***" on page 569) for examples. If you rename table columns when creating a table from a query, you can supply the encoding type and access rank in the column name list instead.
hash-segmentation-clause	[Optional] Allows you to segment the superprojection based on a built-in hash function that provides even distribution of data across nodes, resulting in optimal query execution. See ***hash-segmentation-clause*** (see "***hash-segmentation-clause (table)***" on page 561).
range-segmentation-clause	[Optional] Allows you to segment the superprojection based on a known range of values stored in a specific column chosen to provide even distribution of data across a set of nodes, resulting in optimal query execution. See ***range-segmentation-clause*** (see "***range-segmentation-clause (table)***" on page 562).
`UNSEGMENTED { NODE` *node* `| ALL NODES }`	[Optional] Allows you to specify that the projection be unsegmented, as follows: ▪ NODE *node*—Creates the unsegmented projection on the specified node only. Dimension table projections must be UNSEGMENTED. ▪ ALL NODES—Creates a separate unsegmented projection on each node (automatic replication). To perform distributed query execution, Vertica requires an exact, unsegmented copy of each dimension table superprojection on each node.
`KSAFE [` *k* `]`	[Optional] Specifies the K-Safety level of the automatic

	projection created for the table. The integer K determines how many unsegmented or segmented buddy projections are created. The value must be greater than or equal to the current K-Safety level of the database and less than the total number of nodes. If KSAFE or its value are not specified, the superprojection is created at the current system K-Safety level. For example: `K-SAFE 1` Note: When a hash-segmentation-clause is used with KSAFE, Vertica automatically creates k_num+1 buddy projections to meet the K-safety requirement.
`PARTITION BY` *`partition-clause`*	[Not supported for queries (`CREATE TABLE AS SELECT`)] ▪ All leaf expressions must be either constants or columns of the table. ▪ All other expressions must be functions and operators; aggregate functions and queries are not permitted in the expression. ▪ The partition-clause must calculate an idempotent value from its arguments and must be not null. ▪ SQL functions used in the partitioning expression must be immutable.

Automatic Projection Creation

To get your database up and running quickly, Vertica automatically creates a default projection for each table created through the ***CREATE TABLE*** (page 546) and ***CREATE TEMPORARY TABLE*** (page 564) statements. The timing of when the projection is created depends on how you use the CREATE TABLE statement:

- If you create a table without providing the projection-related clauses, a superprojection is automatically created for the table when an INSERT, COPY, or LCOPY command is issued to load data into the table for the first time. The projection is created in the same schema as the table. Once Vertica has created the projection, it loads the data.
- If you use CREATE TABLE AS SELECT to create a table from the results of a query, the table is created first and a projection is created immediately after, using some of the properties of the underlying SELECT query.
- (Advanced users only) If you use any of the following parameters, the default projection is created immediately upon table creation using the specified properties:
  - ***column-definition*** (page 552) (ENCODING encoding-type and ACCESSRANK integer)
  - ORDER BY table-column
  - ***hash-segmentation-clause*** (page 561)
  - ***range-segmentation-clause*** (page 562)
  - UNSEGMENTED { NODE *node* | ALL NODES }
  - KSAFE

  Note: Before you define a superprojection in the above manner, read Creating Custom Designs in the Administrator's Guide.

Characteristics of Default Automatic Projections

A default projection has the following characteristics:

- It is a superprojection.
- It uses the default ***encoding-type*** (page 526) AUTO.
- If the table has one or more primary keys defined, the projection is sorted by these columns. Otherwise, the projection is sorted in the same order as defined in the table column-definition list.
- If the K-safety for the database is zero (K-Safety=0), the projection is unsegmented on the initiator node. If K-Safety is greater than zero (K-Safety>0), the superprojection is replicated (unsegmented) on all nodes. See Segmentation in the Concepts Guide.
- If the projection was created through the CREATE TABLE AS SELECT statement, the projection uses the sort order, segmentation, and encoding specified for the columns in the query table.

Default automatic projections let you get your database up and running quickly; however, they might not necessarily provide the best performance. Vertica recommends that you start with these projections and then use the Database Designer to optimize your database. The Database Designer creates projections that optimize your database based on the characteristics of the data and, optionally, the queries you use.

Partition Clauses

Creating a table with the partition clause causes all projections anchored on that table to be partitioned according to the partitioning clause. For each partitioned projection, logically, there are as many partitions as the number of unique values returned by the partitioned expression applied over the rows of the projection.

Note: Due to the impact on the number of ROS containers, explicit and implicit upper limits are imposed on the number of partitions a projection can have; these limits, however, are detected during the course of operation, such as during COPY.

Creating a partitioned table does not necessarily force all data feeding into a table's projection to be segregated immediately. Logically, the partition clause is applied after the segmented by clause.

Partitioning specifies how data is organized at individual nodes in a cluster and after projection data is segmented; only then is the data partitioned at each node based on the criteria in the partitioning clause.

SQL functions used in the partitioning expression must be immutable, which means they return the exact same value regardless of when it is invoked and independently of session or environment settings, such as LOCALE. For example, the TO_CHAR function is dependent on locale settings and cannot be used. RANDOM produces different values on each invocation and cannot be used.

Data loaded with the COPY command is automatically partitioned according to the table's PARTITION BY clause.

For more information, see "Restrictions on Partitioning Expressions" in Defining Partitions in the Administrator's Guide

Notes

- If a database has had automatic recovery enabled, you must temporarily disable automatic recovery in order to create a new table. In other words, you must:
  ```
  SELECT MARK_DESIGN_KSAFE(0)
  CREATE TABLE ...
  CREATE PROJECTION ...
  SELECT MARK_DESIGN_KSAFE(1)
  ```
- Canceling a CREATE TABLE statement can cause unpredictable results. Vertica Systems, Inc. recommends that you allow the statement to finish, then use ***DROP TABLE*** (page 589).

Examples

The following example creates a table named Product_Dimension in the Retail schema. It also creates a default superprojection when data is loaded:

```
=> CREATE TABLE Retail.Product_Dimension (
       Product_Key                    integer NOT NULL,
       Product_Description            varchar(128),
       SKU_Number                     char(32) NOT NULL,
       Category_Description           char(32),
       Department_Description         char(32) NOT NULL,
       Package_Type_Description       char(32),
       Package_Size                   char(32),
       Fat_Content                    integer,
       Diet_Type                      char(32),
       Weight                         integer,
       Weight_Units_of_Measure        char(32),
       Shelf_Width                    integer,
       Shelf_Height                   integer,
       Shelf_Depth                    integer
);
```

The following example creates a table named Employee_Dimension and its associated superprojection in the Public schema. Instead of using the sort order from the column definition, the superprojection uses the sort order specified by the ORDER BY clause. The superprojection is created at the same time as the table because the superprojection is actively defined as part of the CREATE TABLE statement.

```
=> CREATE TABLE Public.Employee_Dimension (
       Employee_key                   integer PRIMARY KEY NOT NULL,
       Employee_gender                varchar(8) ENCODING RLE,
       Employee_title                 varchar(8),
       Employee_first_name            varchar(64),
       Employee_middle_initial        varchar(8),
       Employee_last_name             varchar(64), )
ORDER BY Employee_gender, Employee_last_name, Employee_first_name;
```

The following example creates a table called time and partitions the data by year. It also creates a default superprojection when data is loaded:

```
=> CREATE TABLE time( ..., date_col date NOT NULL, ...)
=> PARTITION BY extract('year' FROM date_col);
```

The following example creates a table named location and partitions the data by state. It also creates a default superprojection when data is loaded:

```
=> CREATE TABLE location(..., state VARCHAR NOT NULL, ...)
=> PARTITION BY state;
```

The following table uses SELECT AS to create a table called promo and load data from columns in the customer_dimension table in which the customer's annual_income is greater than 1,000,000. The data is ordered by state and annual income.

```
=> CREATE TABLE promo
   AS SELECT
      customer_name,
      customer_address,
      customer_city,
      customer_state,
      annual_income
   FROM customer_dimension
   WHERE annual_income>1000000
   ORDER BY customer_state, annual_income;
```

The following table uses SELECT AS to create a table called promo and load data from the latest committed DML transaction (AT EPOCH LATEST).

```
=> CREATE TABLE promo
   AS AT EPOCH LATEST SELECT
      customer_name,
      customer_address,
      customer_city,
      customer_state,
      annual_income
FROM customer_dimension;
```

See Also

Physical Schema in the Concepts Guide

COPY (page 497)

CREATE TEMPORARY TABLE (page 564)

DROP_PARTITION (page 341)

DROP PROJECTION (page 585)

DUMP_PARTITION_KEYS (page 346)

DUMP_PROJECTION_PARTITION_KEYS (page 347)

DUMP_TABLE_PARTITION_KEYS (page 348)

PARTITION_PROJECTION (page 368)

PARTITION_TABLE (page 369)

SELECT (page 617)

Partitioning Tables and Auto Partitioning in the Administrator's Guide

column-definition (table)

A column definition specifies the name, data type, and constraints to be applied to a column.

Syntax

```
column-name data-type {
... [ column-constraint (on page 556) [ ... ] | [ table-constraint (on page 560)
] [ ,... ]
... [ ENCODING encoding-type ]
... [ ACCESSRANK integer ] ]
```

Parameters

column-name	Specifies the name of a column to be created or added.
data-type	Specifies one of the following data types: ***BINARY*** (page 61) ***BOOLEAN*** (page 65) ***CHARACTER*** (page 66) ***DATE/TIME*** (page 68) ***NUMERIC*** (page 92)
column-constraint	Specifies a ***column constraint*** (see "***column-constraint***" on page 556) to apply to the column.
ENCODING *encoding -type*	[Optional] Specifies the ***type of encoding*** (see "***encoding-type***" on page 526) to use on the column. By default, the encoding-type is auto. **Caution:** Using the NONE keyword for strings could negatively affect the behavior of string columns.
ACCESSRANK *integer*	[Optional] Overrides the default access rank for a column. This is useful if you want to increase or decrease the speed at which a column is accessed. See Creating and Configuring Storage Locations and Prioritizing Column Access Speed in the Administrator's Guide.

Example

The following example creates a table named Employee_Dimension and its associated superprojection in the Public schema. Note that encoding-type RLE is specified for the Employee_gender column definition:

```
=> CREATE TABLE Public.Employee_Dimension (
    Employee_key                  integer PRIMARY KEY NOT NULL,
    Employee_gender               varchar(8) ENCODING RLE,
    Employee_title                varchar(8),
    Employee_first_name           varchar(64),
    Employee_middle_initial       varchar(8),
    Employee_last_name            varchar(64),
);
```

column-name-list (table)

Is used to rename columns when creating a table from a query (`CREATE TABLE AS SELECT`). It can also be used to specify the ***encoding type*** (see "***encoding-type***" on page 526) and access rank of the column.

Syntax

```
column-name-list
... [ ENCODING encoding-type ]
... [ ACCESSRANK integer ] [ , ... ]
... [ GROUPED ( projection-column-reference [,...] ) ]
```

Parameters

column-name	Specifies the new name for the column.
ENCODING *encoding-type*	Specifies the type of encoding to use on the column. By default, the encoding-type is auto. See ***encoding type*** (see "***encoding-type***" on page 526) for a complete list. **Caution:** Using the NONE keyword for strings could negatively affect the behavior of string columns.
ACCESSRANK *integer*	Overrides the default access rank for a column. This is useful if you want to increase or decrease the speed at which a column is accessed. See Creating and Configuring Storage Locations and Prioritizing Column Access Speed in the Administrator's Guide.

GROUPED	Groups two or more columns into a single disk file. This minimizes file I/O for work loads that: ▪ Read a large percentage of the columns in a table. ▪ Perform single row look-ups. ▪ Query against many small columns. ▪ Frequently update data in these columns. If you have data that is always accessed together and it is not used in predicates, you can increase query performance by grouping these columns. Once grouped, queries can no longer independently retrieve from disk all records for an individual column independent of the other columns within the group. **Note:** RLE compression is reduced when a RLE column is grouped with one or more non-RLE columns. When grouping columns you can: ▪ Group some of the columns: ▪ `(a, GROUPED(b, c), d)` ▪ Group all of the columns: ▪ `(GROUPED(a, b, c, d))` ▪ Create multiple groupings in the same projection: ▪ `(GROUPED(a, b), GROUPED(c, d))` **Note:** Vertica performs dynamic column grouping. For example, to provide better read and write efficiency for small loads, Vertica ignores any projection-defined column grouping (or lack thereof) and groups all columns together by default.

Notes if you are using a query:

Neither the data type nor column constraint can be specified for a column in the column-name-list. These are derived by the columns in the query table identified in the FROM clause. If the query output has expressions other than simple columns (for example, constants, functions, etc) then either an alias must be specified for that expression, or all columns must be listed in the column name list.

You can supply the encoding type and access rank in either the column-name-list or the column list in the query, but not both.

The following statements are both allowed:

```
=> CREATE TABLE promo (state ENCODING RLE ACCESSRANK 1, zip ENCODING RLE, ...)
   AS SELECT * FROM customer_dimension
   ORDER BY customer_state, ... ;

=> CREATE TABLE promo
   AS SELECT * FROM customer_dimension
   ORDER BY customer_state
```

```
   ENCODED BY customer_state ENCODING RLE ACCESSRANK 1, customer_zip ENCODING RLE
...;
```

The following statement is not allowed because encoding is specified in both column-name-list and ENCODED BY clause:

```
=> CREATE TABLE promo (state ENCODING RLE ACCESSRANK 1, zip ENCODING RLE, ...)
   AS SELECT * FROM customer_dimension
   ORDER BY customer_state
   ENCODED BY customer_state ENCODING RLE ACCESSRANK 1, customer_zip ENCODING RLE
...;
```

Example

The following example creates a table named `employee_dimension` and its associated superprojection in the public schema. Note that encoding-type RLE is specified for the `employee_gender` column definition:

```
=> CREATE TABLE public.employee_dimension (
    employee_key             INTEGER PRIMARY KEY NOT NULL,
    employee_gender          VARCHAR(8) ENCODING RLE,
    employee_title           VARCHAR(8),
    employee_first_name      VARCHAR(64),
    employee_middle_initial  VARCHAR(8),
    employee_last_name       VARCHAR(64)
);
```

Using the Vmart schema, the following example creates a table named `promo` from a query that selects data from columns in the `customer_dimension` table. RLE encoding is specified for the state column in the column name list.

```
=> CREATE TABLE promo (
     name,
     address,
     city,
     state ENCODING RLE, income )
   AS SELECT customer_name,
     customer_address,
     customer_city,
     customer_state,
     annual_income
FROM customer_dimension
WHERE annual_income > 1000000
ORDER BY customer_state, annual_income;
```

column-constraint

Adds a referential integrity constraint to the metadata of a column. See Adding Constraints in the Administrator's Guide.

Syntax

```
[ CONSTRAINT constraint-name ] {
...[ NOT ] NULL
...| PRIMARY KEY
...| REFERENCES table-name
...| UNIQUE
...[ DEFAULT default ]
...[ AUTO_INCREMENT ]
...[ IDENTITY [ ( seed , increment, cache ) ] ] }
```

Parameters

CONSTRAINT *constraint-name*	Optionally assigns a name to the constraint. Vertica recommends that you name all constraints.
NULL	[Default] Specifies that the column is allowed to contain null values.
NOT NULL	Specifies that the column must receive a value during INSERT and UPDATE operations. If no DEFAULT value is specified and no value is provided, the INSERT or UPDATE statement returns an error because no default value exists.
PRIMARY KEY	Adds a referential integrity constraint defining the column as the primary key.
REFERENCES	Adds a referential integrity constraint defining the column as a foreign key. If column is omitted, the default is the primary key of table.
table-name	Specifies the table to which the REFERENCES constraint applies.
column-name	Specifies the column to which the REFERENCES constraint applies. If column is omitted, the default is the primary key of table-name.
UNIQUE	Ensures that the data contained in a column or a group of columns is unique with respect to all the rows in the table.
DEFAULT *default*	Specifies a default data value for a column if the column is used in an INSERT operation and no value is specified for the column. If there is no value specified for the column and no default, the default is NULL. Default value usage: ▪ A default value can be set for a column of any data type. ▪ The default value can be any variable-free expression, as long as it matches the data type of the column. ▪ Variable-free expressions can contain constants, SQL functions, null-handling functions, system information functions, string functions, numeric functions, formatting functions, nested functions, and all Vertica-supported operators Default value restrictions:

	▪ Expressions can contain only constant arguments. ▪ Subqueries and cross-references to other columns in the table are not permitted in the expression. ▪ The return value of a default expression cannot be NULL. ▪ The return data type of the default expression after evaluation either matches that of the column for which it is defined, or an implicit cast between the two data types is possible. For example, a character value cannot be cast to a numeric data type implicitly, but a number data type can be cast to character data type implicitly. ▪ Default expressions, when evaluated, conform to the bounds for the column. ▪ Volatile functions are not supported when adding columns to existing tables. (A volatile function changes with every invocation.) For example, RANDOM(), CURRVAL(), TIMEOFDAY(), and SYSDATE() are not supported. See ***ALTER TABLE*** (page 488). **Note:** Vertica attempts to check the validity of default expressions, but some errors might not be caught until run time.
AUTO_INCREMENT	Creates a column within the specified table that consists of values generated by the database. These values cannot be modified. The initial value of this column is 1 and it is incremented by 1 each time a row is added. **Note:** Vertica supports only one AUTO_INCREMENT or IDENTITY column per table.
IDENTITY	Creates an identity column within the specified table that consists of values generated by the database. These values cannot be modified. Identify columns can also be used as primary keys. **Notes** ▪ AUTO_INCREMENT and IDENTITY are identical except that IDENTITY takes extra arguments. ▪ IDENTITY arguments are optional. ▪ Vertica supports only one IDENTITY or one AUTO_INCREMENT column per table.
seed	When used with IDENTITY, specifies the value for the first row loaded into the table. Default is 1.
increment	When used with IDENTITY, specifies the value that is added to identity value of the previous row. Default is 1.
cache	When used with IDENTITY, specifies the number of unique numbers to be preallocated and stored in memory for faster access. Default is 250,000 with a minimum value of 1. **Note:** The cache value can contain positive integers only.

Notes

- IDENTITY arguments are optional; however you cannot specify increment without a seed. Thus, if you supply only one argument, the system assigns a seed value. Two values are seed and increment, and three values are seed, increment, and cache. The following are all valid examples:

```
=> CREATE TABLE t1(x IDENTITY(1,1,9), y INT);
=> CREATE TABLE t1(x IDENTITY(1,1), y INT);
=> CREATE TABLE t1(x IDENTITY(1), y INT);
```

- A FOREIGN KEY constraint can be specified solely by a REFERENCE to the table that contains the PRIMARY KEY. The columns in the referenced table do not need to be explicitly specified; for example:

```
CREATE TABLE fact(c1 INTEGER PRIMARY KEY NOT NULL);
CREATE TABLE dim (c1 INTEGER REFERENCES fact NOT NULL);
```

- Columns that are given PRIMARY and FOREIGN constraints must also be set NOT NULL. Vertica automatically sets these columns to be NOT NULL if you do not do so explicitly.
- Vertica supports variable-free expressions in the column DEFAULT clause. See ***COPY*** (page 497) [*Column as Expression*].
- If you are using a CREATE TABLE AS SELECT statement, the column-constraint parameter does not apply. Column constraints are set by the columns in the query table identified in the FROM clause.
- An auto-increment or identity value is never rolled back even if a transaction that tries to insert a value into a table is not committed.

Example

The following command creates the `store_dimension` table and sets the default column value for Store_state to MA:

```
=> CREATE TABLE store_dimension (store_state CHAR (2) DEFAULT MA);
```

The following command creates the `public.employee_dimension` table and sets the default column value for `hire_date` to `current_date()`:

```
=> CREATE TABLE public.employee_dimension (hire_date DATE DEFAULT
current_date());
```

The following example uses the IDENTITY column-constraint to create a table with an ID column that has an initial value of 1. It is incremented by 1 every time a row is inserted.

```
=> CREATE TABLE Premium_Customer(
     ID IDENTITY(1,1),
     lname VARCHAR(25),
     fname VARCHAR(25),
     store_membership_card INTEGER
);
=> INSERT INTO Premium_Customer (lname, fname, store_membership_card )
   VALUES ('Gupta', 'Saleem', 475987);
```

Confirm the row you added and see the ID value:

```
=> SELECT * FROM Premium_Customer;
```

```
 ID | lname | fname  | store_membership_card
----+-------+--------+----------------------
  1 | Gupta | Saleem |                475987
(1 row)
```

Now add another row:

```
=> INSERT INTO Premium_Customer (lname, fname, store_membership_card)
   VALUES ('Lee', 'Chen', 598742);
```

Calling the LAST_INSERT_ID function returns value 2 because you previously inserted a new customer (Chen Lee), and this value is incremented each time a row is inserted:

```
=> SELECT LAST_INSERT_ID();
last_insert_id
---------------
              2
(1 row)
```

View all the ID values in the `Premium_Customer` table:

```
=> SELECT * FROM Premium_Customer;
 ID | lname | fname  | store_membership_card
----+-------+--------+----------------------
  1 | Gupta | Saleem |                475987
  2 | Lee   | Chen   |                598742
(2 rows)
```

The following example uses the AUTO_INCREMENT column-constraint to create a table with an ID column that automatically increments every time a row is inserted.

```
=> CREATE TABLE Premium_Customer(
     ID AUTO_INCREMENT,
     lname VARCHAR(25),
     fname VARCHAR(25),
     store_membership_card INTEGER
);
=> INSERT INTO Premium_Customer (lname, fname, store_membership_card )
   VALUES ('Gupta', 'Saleem', 475987);
```

Confirm the row you added and see the ID value:

```
=> SELECT * FROM Premium_Customer;
 ID | lname | fname  | store_membership_card
----+-------+--------+----------------------
  1 | Gupta | Saleem |                475987
(1 row)
```

Now add two rows:

```
=> INSERT INTO Premium_Customer (lname, fname, store_membership_card)
   VALUES ('Lee', 'Chen', 598742);
=> INSERT INTO Premium_Customer (lname, fname, store_membership_card)
   VALUES ('Brown', 'John', 642159);
=> SELECT * FROM Premium_Customer;
 ID | lname | fname  | store_membership_card
----+-------+--------+----------------------
  1 | Gupta | Saleem |                475987
  2 | Lee   | Chen   |                598742
```

```
  3 | Brown | John   |                642159
(3 rows)
```

This time the LAST_INSERT_ID returns a value of 3:

```
=> SELECT LAST_INSERT_ID();
 LAST_INSERT_ID
----------------
              3
(1 row)
```

For additional examples, see ***CREATE SEQUENCE*** (page 540).

table-constraint

Adds a join constraint to the metadata of a table. See Adding Constraints in the Administrator's Guide.

Syntax

```
[ CONSTRAINT constraint_name ]
... [ NOT ] NULL
... { PRIMARY KEY ( column [ , ... ] )
... | FOREIGN KEY ( column [ , ... ] ) REFERENCES table
... | UNIQUE ( column [ , ... ] )
```

Parameters

CONSTRAINT	Optionally assigns a name to the constraint. Vertica recommends that you name all constraints.
NULL	[Default] Specifies that the column is allowed to contain null values.
NOT NULL	Specifies that the column must receive a value during INSERT and UPDATE operations. If no DEFAULT value is specified and no value is provided, the INSERT or UPDATE statement returns an error because no default value exists.
PRIMARY KEY	Adds a referential integrity constraint defining one or more NOT NULL numeric columns as the primary key.
FOREIGN KEY	Adds a referential integrity constraint defining one or more NOT NULL numeric columns as a foreign key.
REFERENCES	Specifies the table to which the FOREIGN KEY constraint applies. If *column* is omitted, the default is the primary key of *table*.
UNIQUE	Ensures that the data contained in a column or a group of columns is unique with respect to all the rows in the table.

Notes

- A foreign key constraint can be specified solely by a reference to the table that contains the primary key. The columns in the referenced table do not need to be explicitly specified; for example:

  ```
  CREATE TABLE fact(c1 INTEGER PRIMARY KEY);
  CREATE TABLE dim (c1 INTEGER REFERENCES fact);
  ```

- Define PRIMARY KEY and FOREIGN KEY constraints in all tables that participate in inner joins. See Adding Join Constraints.
- Adding constraints to a table that is referenced in a view does not affect the view.

Examples

```
CORRELATION (Product_Description) DETERMINES (Category_Description)
```

The Retail Sales Example Database described in the Getting Started Guide contains a table Product_Dimension in which products have descriptions and categories. For example, the description "Seafood Product 1" exists only in the "Seafood" category. You can define several similar correlations between columns in the Product Dimension table.

hash-segmentation-clause (table)

Hash segmentation allows you to segment a projection based on a built-in hash function that provides even distribution of data across some or all of the nodes in a cluster, resulting in optimal query execution.

Note: Hash segmentation is the preferred method of segmentation. The Database Designer uses hash segmentation by default.

Syntax

```
SEGMENTED BY expression
  [ ALL NODES | NODES node [ ,... ] ]
```

Parameters

`SEGMENTED BY` *expression*	Can be a general SQL expression, but there is no reason to use anything other than the built-in ***HASH*** (page 236) or ***MODULARHASH*** (page 239) functions with table columns as arguments. Choose columns that have a large number of unique data values and acceptable skew in their data distribution. Primary key columns that meet the criteria could be an excellent choice for hash segmentation.
`ALL NODES`	Automatically distributes the data evenly across all nodes at the time the projection is created. The ordering of the nodes is fixed.
`NODES` *node* `[ ,... ]`	Specifies a subset of the nodes in the cluster over which to distribute the data. You can use a specific node only once in any projection. For a list of the nodes in a database, use the View Database command in the Administration Tools.

Notes

- Table column names must be used in the expression, not the projection column names.
- If you want to use a different `SEGMENTED BY` expression, the following restrictions apply:
  - All leaf expressions must be either constants or ***column-references*** (see "***Column References***" on page 45) to a column in the SELECT list of the CREATE PROJECTION command
  - Aggregate functions are not allowed
  - The expression must return the same value over the life of the database.

  - The expression must return non-negative INTEGER values in the range 0 <= x < 2^{63} (two to the sixty-third power or 2^63), and values are generally distributed uniformly over that range.
  - If *expression* produces a value outside the expected range (a negative value for example), no error occurs, and the row is added to the first segment of the projection.
- When a hash-segmentation-clause is used with KSAFE [k_num], Vertica automatically creates k_num+1 buddy projections to meet the K-safety requirement.
- The hash-segmentation-clause within the CREATE TABLE statement does not support the OFFSET keyword, which is available in the CREATE PROJECTION command. The OFFSET is set to zero (0).

Example

This example segments the default superprojection and its buddies for the Public.Employee_Dimension table using HASH segmentation across all nodes based on the Employee_key column:

```
=> CREATE TABLE Public.Employee_Dimension (
       Employee_key                   integer PRIMARY KEY NOT NULL,
       Employee_gender                varchar(8) ENCODING RLE,
       Employee_title                 varchar(8),
       Employee_first_name            varchar(64),
       Employee_middle_initial        varchar(8),
       Employee_last_name             varchar(64),
)
SEGMENTED BY HASH(Employee_key) ALL NODES;
```

See Also

HASH (page 236) and ***MODULARHASH*** (page 239)

range-segmentation-clause (table)

Range segmentation allows you to segment a projection based on a known range of values stored in a specific column chosen to provide even distribution of data across a set of nodes, resulting in optimal query execution.

Note: Vertica Systems, Inc. recommends that you use hash segmentation, instead of range segmentation.

Syntax

```
SEGMENTED BY expression
  NODE node VALUES LESS THAN value
  ...
  NODE node VALUES LESS THAN MAXVALUE
```

Parameters (Range Segmentation)

`SEGMENTED BY` *expression*	Is a single ***column reference*** (see "***Column References***" on page 45) to a column in the column definition of the CREATE TABLE statement. Choose a column that has: ▪ INTEGER or FLOAT data type

	▪ A known range of data values ▪ An even distribution of data values ▪ A large number of unique data values Avoid columns that: ▪ Are foreign keys ▪ Are used in query predicates ▪ Have a date/time data type ▪ Have correlations with other columns due to functional dependencies. **Note:** Segmenting on DATE/TIME data types is valid but guaranteed to produce temporal skew in the data distribution and is not recommended. If you choose this option, do not use TIME or TIMETZ because their range is only 24 hours.
`NODE` *node*	Is a symbolic name for a node. You can use a specific node only once in any projection. For a list of the nodes in a database, use `SELECT * FROM NODE_RESOURCES`.
`VALUES LESS THAN` *value*	Specifies that this segment can contain a range of data values *less than* the specified *value*, except that segments cannot overlap. In other words, the minimum value of the range is determined by the *value* of the previous segment (if any).
`MAXVALUE`	Specifies a sub-range with no upper limit. In other words, it represents a value greater than the maximum value that can exist in the data. The maximum value depends on the data type of the segmentation column.

Notes

- The `SEGMENTED BY` *expression* syntax allows a general SQL expression but there is no reason to use anything other than a single ***column reference*** (see "***Column References***" on page 45) for range segmentation. If you want to use a different expression, the following restrictions apply:
  - All leaf expressions must be either constants or column-references to a column in the SELECT list of the CREATE PROJECTION command
  - Aggregate functions are not allowed
  - The expression must return the same value over the life of the database.
- During INSERT or COPY to a segmented projection, if *expression* produces a value outside the expected range (a negative value for example), no error occurs, and the row is added to a segment of the projection.

See Also

NODE_RESOURCES (page 714)

CREATE TEMPORARY TABLE

Creates a temporary table.

Note: A default superprojection is automatically created for the temporary table. See "Superprojection Creation" within this topic for details about how it is implemented.

Syntax

```
CREATE [ [ GLOBAL | LOCAL ] { TEMPORARY | TEMP } ]
... TABLE [schema-name].table-name {
... ( column-definition (see "column-definition (temp table)" on page 569) [ , ...
] )
... | [ column-name-list (see "column-name-list (temp table)" on page 570) ] }
... [ ON COMMIT { DELETE | PRESERVE } ROWS ]
... [ AS [ AT EPOCH LATEST ] | [ AT TIME 'timestamp' ] query ]
... [ [ ORDER BY table-column [ , ... ] ]
....[ ENCODED BY column-definition [ , ... ]
....[ hash-segmentation-clause (see "hash-segmentation-clause (temp table)" on
page 572) | range-segmentation-clause (see "range-segmentation-clause (temp
table)" on page 573)
....| UNSEGMENTED { NODE node | ALL NODES } ]
....[ KSAFE [ k-num ] ]
....| [ NO PROJECTION ] ]
```

Parameters

GLOBAL	[Optional] Specifies that the table definition is visible to all sessions. Temporary table data is visible only to the session that inserts the data into the table. Temporary tables in Vertica default to global.
LOCAL	[Optional] Specifies that the table definition is visible only to the session in which it is created. Temporary tables in Vertica default to global.
TEMPORARY | TEMP	Specifies that the table is a temporary table.
[schema-name].table-name	Specifies the name of the temporary table to be created. For a global temporary table, the user can specify the schema where the table is to be created. If schema-name is omitted, the table is created in the first schema listed in current ***search_path*** (page 639). Schema-name is not supported for local temporary tables because they are always created in a special schema.
column-definition	Defines one or more columns. See ***column-definition*** (see "***column-definition (temp table)***" on page 569).
column-name-list	Renames columns when creating a temporary table from a query (CREATE TEMPORARY TABLE AS SELECT). See ***column-name-list*** (see "***column-name-list (temp table)***" on page 570).
ON COMMIT { PRESERVE | DELETE } ROWS	[Optional] Specifies whether data is transaction- or session-scoped: ▪ DELETE marks the temporary table for transaction-scoped

	data. Vertica truncates the table (delete all its rows) after each commit. DELETE ROWS is the default. ▪ PRESERVE marks the temporary table for session-scoped data, which is preserved beyond the lifetime of a single transaction. Vertica truncates the table (delete all its rows) when you terminate a session.
`AT EPOCH LATEST | AT TIME 'timestamp'`	Used with AS query to query historical data. You can specify AT EPOCH LATEST to include data from the latest committed DML transaction or specify a specific epoch based on its time stamp.

AS query	[Optional.] Creates a new table from the results of a query and fills it with data from the query as long as ON COMMIT PRESERVE ROWS is specified:
	`CREATE GLOBAL TEMP TABLE temp_table1 ON COMMIT PRESERVE ROWS AS SELECT ...;`
	If ON COMMIT DELETE ROWS is specified, the temporary table is created, but data is not inserted from the query:
	`CREATE GLOBAL TEMP TABLE temp_table1 ON COMMIT DELETE ROWS AS SELECT ...;`
	Column renaming is supported as part of the process:
	`CREATE TEMP TABLE temp-table1 (name, address, ...) AS SELECT customer_name, customer_address ... ;`

`ORDER BY` *table-column*	[Optional] Specifies the sort order for the superprojection that is automatically created for the table. If you do not specify the sort order, Vertica uses the order in which columns are specified in the column definition as the sort order for the projection. For example: ORDER BY col2, col1, col5 Note: Data is in ascending order only.
`ENCODED BY column-definition`	[CREATE TEMPORARY TABLE AS query Only] This parameter is useful to specify the column encoding and/ or the access rank for specific columns in the query when a column-definition is not used to rename columns for the table to be created. See ***column-definition*** (see "***column-definition (temp table)***" on page 569) for examples. If you rename table columns when creating a table from a query, you can supply the encoding type and access rank in the column name list instead.
`hash-segmentation-clause`	[Optional] Allows you to segment the superprojection based on a built-in hash function that provides even distribution of data across nodes, resulting in optimal query execution. See ***hash-segmentation-clause*** (see "***hash-segmentation-clause (temp table)***" on page 572).
`range-segmentation-clause`	[Optional] Allows you to segment the superprojection based on a known range of values stored in a specific column chosen to provide even distribution of data across a set of nodes, resulting in optimal query execution. See ***range-segmentation-clause*** (see "***range-segmentation-clause (temp table)***" on page 573).
`UNSEGMENTED { NODE` *node* `| ALL NODES }`	[Optional] Allows you to specify that the projection be unsegmented, as follows:

	▪ NODE *node*—Creates the unsegmented projection on the specified node only. Dimension table projections must be UNSEGMENTED. ▪ ALL NODES—Creates a separate unsegmented projection on each node (automatic replication). To perform distributed query execution, Vertica requires an exact, unsegmented copy of each dimension table superprojection on each node.
KSAFE [*k-num*]	[Optional] Specifies the K-Safety level of the automatic projection created for the table. The integer K determines how many unsegmented or segmented buddy projections are created. The value must be greater than or equal to the current K-Safety level of the database and less than the total number of nodes. If KSAFE or its value are not specified, the superprojection is created at the current system K-Safety level. For example: K-SAFE 1 **Note:** When a hash-segmentation-clause is used with KSAFE, Vertica automatically creates k_num+1 buddy projections to meet the K-safety requirement.
NO PROJECTION	[Optional] Prevents the automatic creation of a default superprojection for the temporary table until data is loaded. NO PROJECTION cannot be used with queries (CREATE TEMPORARY TABLE AS SELECT), ORDER BY, ENCODED BY, KSAFE, ***hash-segmentation clause*** (page 572), or ***range-segmentation-clause*** (page 573).

A common use case for a temporary table is to divide complex query processing into multiple steps. Typically, a reporting tool holds intermediate results while reports are generated (for example, first get a result set, then query the result set, and so on). You can also write subqueries.

Note: The default is ON COMMIT DELETE ROWS, where data is discarded at the end of the transaction or session.

Global Temporary Tables

Global temporary tables are created in the public schema, and they are visible to all users and sessions. However, the contents (data) of a global table are private to the transaction or session in which the data was inserted. Data is automatically removed when the transaction commits, rolls back, or the session ends. This allows two users to use the same temporary table, concurrently, but see only data specific to his or her own transactions for the duration of those transactions or sessions.

The definition of a global temporary table persists in the database catalogs until explicitly removed by using the ***DROP TABLE*** (page 589) statement.

Local Temporary Tables

A local temporary table is created in the V_TEMP_SCHEMA namespace and is transparently inserted into the user's search path. It is visible only to the user who creates the table for the duration of the session in which it is created. When the session ends, the table definition is automatically dropped from the database catalogs.

Superprojection Creation

When you use the CREATE TEMPORARY TABLE command, the table is created first and the default superprojection is created immediately after unless you specify NO PROJECTION.

A default projection has the following characteristics:

- It uses the default encoding-type AUTO.
- It is automatically unsegmented on the initiator node and pinned if you do not specify a segmentation clause (***hash-segmentation-clause*** (page 572), ***range-segmentation-clause*** (page 573), or UNSEGMENTED).
- If the table has one or more primary keys defined, the projection is sorted by these columns. Otherwise, the the projection is sorted in the same order as defined in the table column-definition list.
- Temp tables are not recoverable, so the superprojection is not K-Safe (K-SAFE=0), and you cannot make the table K-safe.

Advanced users can modify the default projection created through the CREATE TEMPORARY TABLE statement by defining any or all of the following parameters:

- ***column-definition*** (page 569) (ENCODING encoding-type and ACCESSRANK integer)
- ORDER BY table-column
- ***hash-segmentation-clause*** (page 572)
- ***range-segmentation-clause*** (page 573)
- UNSEGMENTED { NODE node | ALL NODES }
- NO PROJECTION

Note: Before you define the superprojection in this manner, read Creating Custom Designs in the Administrator's Guide.

Notes

- You cannot add projections to non-empty, session-scoped temporary tables (ON COMMIT PRESERVE ROWS). Make sure that projections exist before you load data. See the "Automatic Projection Creation" in the ***CREATE TABLE*** (page 546) statement.
- Although adding projections is allowed for tables with ON COMMIT DELETE ROWS specified, be aware that you could lose all the data.
- The V_TEMP_SCHEMA namespace is automatically part of the search path. Thus, temporary table names do not need to be preceded with the schema.
- Queries that involve temporary tables have the same restrictions on SQL support as queries that do not use temporary tables.
- Prejoin projections that refer to both temporary and non-temporary tables are not supported.
- Single-node (pinned to the initiator node only) projections are supported.
- AT EPOCH LATEST queries that refer to session-scoped temporary tables work the same as those for transaction-scoped temporary tables. Both return all committed and uncommitted data regardless of epoch. For example, you can commit data from a temporary table in one epoch, advance the epoch, and then commit data in a new epoch.

- Moveout and mergeout operations cannot be used on session-scoped temporary data.
- If you issue the ***TRUNCATE TABLE*** (page 651) statement on a temporary table, only session-specific data is truncated with no affect on data in other sessions.
- The `DELETE ... FROM TEMP TABLE` syntax does not truncate data when the table was created with `PRESERVE`; it marks rows for deletion. See ***DELETE*** (page 580) for additional details.
- In general, session-scoped temporary table data is not visible using system (virtual) tables.
- Views are supported for temporary tables.
- `ANALYZE_STATISTICS (page 327)` is not supported for temporary tables.
- Table partitions are not supported for temporary tables.
- Temporary tables do not recover. If a node fails, queries that use the temporary table also fail. Restart the session and populate the temporary table.

Examples

Session-scoped rows in a GLOBAL temporary table can be preserved for the whole session or for the current transaction only. For example, in the first statement below, `ON COMMIT DELETE ROWS` indicates that data be deleted at the end of the transaction.

```
=> CREATE GLOBAL TEMP TABLE temp_table1 (
     x  NUMERIC,
     y  NUMERIC )
   ON COMMIT DELETE ROWS;
```

By contrast, ON COMMIT PRESERVE ROWS indicates that data be preserved until the end of the session.

```
=> CREATE GLOBAL TEMP TABLE temp_table2 (
     x  NUMERIC,
     y  NUMERIC )
   ON COMMIT PRESERVE ROWS;
```

The following example specifies that the superprojection created for the temp table use RLE encoding for the y column:

```
=> CREATE LOCAL TEMP TABLE temp_table1 (
       x  NUMERIC,
       y  NUMERIC ENCODING RLE )
   ON COMMIT DELETE ROWS;
```

The following example specifies that the superprojection created for the temp table use the sort order specified by the ORDER BY clause rather than the order of columns in the column list.

```
=> CREATE GLOBAL TEMP TABLE temp_table1 (
       x  NUMERIC,
       y  NUMERIC ENCODING RLE,
       b  VARCHAR(8),
       z  VARCHAR(8) )
   ORDER BY z, x;
```

See Also

ALTER TABLE (page 488), ***CREATE TABLE*** (page 546), ***DELETE*** (page 580), ***DROP TABLE*** (page 589)

Subqueries in the Programmer's Guide

Transactions in the Concepts Guide

column-definition (temp table)

A column definition specifies the name, data type, default, and other characteristics to be applied to a column.

Syntax

```
column-name data-type [ DEFAULT ] [ NULL | NOT NULL ]
  [ ENCODING encoding-type ] [ ACCESSRANK integer ] ]
```

Parameters

column-name	Specifies the name of the temporary table to be created.
data-type	Specifies one of the following data types: ▪ BINARY ▪ BOOLEAN ▪ CHARACTER ▪ DATE/TIME ▪ NUMERIC
DEFAULT *default*	Specifies a default data value for a column if the column is used in an INSERT operation and no value is specified for the column. If there is no value specified for the column and no default, the default is NULL. Default value usage: ▪ A default value can be set for a column of any data type. ▪ The default value can be any variable-free expression, as long as it matches the data type of the column. ▪ Variable-free expressions can contain constants, SQL functions, null-handling functions, system information functions, string functions, numeric functions, formatting functions, nested functions, and all Vertica-supported operators Default value restrictions: ▪ Expressions can contain only constant arguments. ▪ Subqueries and cross-references to other columns in the table are not permitted in the expression. ▪ The return value of a default expression cannot be NULL. ▪ The return data type of the default expression after evaluation either matches that of the column for which it is defined, or an implicit cast between the two data types is possible. For example, a character value cannot be cast to a numeric data type implicitly, but a number data type can be cast to character data type implicitly. ▪ Default expressions, when evaluated, conform to the bounds for the column. ▪ Volatile functions are not supported when adding columns to

	existing tables. (A volatile function changes with every invocation.) For example, RANDOM(), CURRVAL(), TIMEOFDAY(), and SYSDATE() are not supported. See ***ALTER TABLE*** (page 488). **Note:** Vertica attempts to check the validity of default expressions, but some errors might not be caught until run time.
NULL	[Default] Specifies that the column is allowed to contain null values.
NOT NULL	Specifies that the column must receive a value during INSERT and UPDATE operations. If no DEFAULT value is specified and no value is provided, the INSERT or UPDATE statement returns an error because no default value exists.
ENCODING *encoding-type*	[Optional] Specifies the ***type of encoding*** (see "***encoding-type***" on page 526) to use on the column. By default, the encoding-type is auto. **Caution:** Using the NONE keyword for strings could negatively affect the behavior of string columns.
ACCESSRANK *integer*	[Optional] Overrides the default access rank for a column. This is useful if you want to increase or decrease the speed at which a column is accessed. See Creating and Configuring Storage Locations and Prioritizing Column Access Speed in the Administrator's Guide.

column-name-list (temp table)

A column name list is used to rename columns when creating a temporary table from a query (CREATE TEMPORARY TABLE AS SELECT). It can also be used to specify the ***encoding type*** (see "***encoding-type***" on page 526) and access rank of the column.

Syntax

```
column-name-list [ ENCODING encoding-type ] [ ACCESSRANK integer ] [ , ... ]
    [ GROUPED( projection-column-reference [,...] ) ]
```

Parameters

column-name-list	Specifies the new name for the column.
ENCODING *encoding-type*	[Optional] Specifies the type of encoding to use on the column. By default, the encoding-type is auto. See ***encoding type*** (see "***encoding-type***" on page 526) for a complete list. Caution: Using the NONE keyword for strings could negatively affect the behavior of string columns.
ACCESSRANK *integer*	[Optional] Overrides the default access rank for a column. This is useful if you want to increase or decrease the speed at which a column is accessed. See Creating and Configuring Storage Locations and Prioritizing Column Access Speed in the Administrator's Guide.

GROUPED	Groups two or more columns into a single disk file. This minimizes file I/O for work loads that: ▪ Read a large percentage of the columns in a table. ▪ Perform single row look-ups. ▪ Query against many small columns. ▪ Frequently update data in these columns. If you have data that is always accessed together and it is not used in predicates, you can increase query performance by grouping these columns. Once grouped, queries can no longer independently retrieve from disk all records for an individual column independent of the other columns within the group. **Note:** RLE compression is reduced when a RLE column is grouped with one or more non-RLE columns. When grouping columns you can: ▪ Group some of the columns: ▪ (a, GROUPED(b, c), d) ▪ Group all of the columns: ▪ (GROUPED(a, b, c, d)) ▪ Create multiple groupings in the same projection: ▪ (GROUPED(a, b), GROUPED(c, d)) **Note:** Vertica performs dynamic column-grouping. For example, to provide better read and write efficiency for small loads, Vertica ignores any projection-defined column grouping (or lack thereof) and groups all columns together by default.

Notes:

If you are using a CREATE TEMPORARY TABLE AS SELECT statement:

- The data-type cannot be specified for a column in the column name list. It is derived by the column in the query table identified in the FROM clause
- You can supply the encoding type and access rank in either the column name list or the column list in the query, but not both.

  The following statements are both allowed:

```
=> CREATE TEMPORARY TABLE temp_table1 (state ENCODING RLE ACCESSRANK 1, zip
   ENCODING RLE, ...)
    AS SELECT * FROM customer_dimension
    ORDER BY customer_state, ... ;
=> CREATE TEMPORARY TABLE temp_table1 AS SELECT * FROM customer_dimension
   ORDER BY customer_state
   ENCODED BY customer_state ENCODING RLE ACCESSRANK 1, customer_zip ENCODING
   RLE ...;
```

  The following statement is not allowed:

```
=> CREATE TEMPORARY TABLE temp_table1 (state ENCODING RLE ACCESSRANK 1, zip
   ENCODING RLE, ...)
    AS SELECT * FROM customer_dimension
    ORDER BY customer_state
```

```
ENCODED BY customer_state ENCODING RLE ACCESSRANK 1, customer_zip ENCODING
RLE ...;
```

Example

The following example creates a temporary table named temp_table2 and its associated superprojection. Note that encoding-type RLE is specified for the y column definition:

```
=> CREATE GLOBAL TEMP TABLE temp_table2 (
       x  NUMERIC,
       y  NUMERIC ENCODING RLE,
       b  VARCHAR(8),
       z  VARCHAR(8) );
```

The following example creates a table named temp_table3 from a query that selects data from columns in the customer_dimension table. RLE encoding is specified for the state column in the column name list.

```
=> CREATE TABLE temp_table3 (name, address, city, state ENCODING RLE, income)
   AS SELECT
      customer_name,
      customer_address,
      customer_city,
      customer_state,
      annual_income
   FROM customer_dimension
   WHERE annual_income > 1000000
   ORDER BY customer_state, annual_income;
```

hash-segmentation-clause (temp table)

By default, the superprojection for the temp table is unsegmented on the initiator node (a pinned projection). If you prefer, you can choose either hash-segmentation (preferred) or range-segmentation if you have more than one node.

Hash segmentation allows you to segment a projection based on a built-in hash function that provides even distribution of data across some or all of the nodes in a cluster, resulting in optimal query execution. Projections created in this manner are not pinned.

Note: Hash segmentation is the preferred method of segmentation. The Database Designer uses hash segmentation by default.

Syntax

```
SEGMENTED BY expression
  [ ALL NODES | NODES node [ ,... ] ]
```

Parameters

`SEGMENTED BY` *expression*	Can be a general SQL expression, but there is no reason to use anything other than the built-in ***HASH*** (page 236) or ***MODULARHASH*** (page 239) functions with table columns as arguments. Choose columns that have a large number of unique data values and

	acceptable skew in their data distribution. Primary key columns that meet the criteria could be an excellent choice for hash segmentation.
`ALL NODES`	Automatically distributes the data evenly across all nodes at the time the projection is created. The ordering of the nodes is fixed.
`NODES` *`node`* `[ ,... ]`	Specifies a subset of the nodes in the cluster over which to distribute the data. You can use a specific node only once in any projection. For a list of the nodes in a database, use the View Database command in the Administration Tools.

Notes

- Table column names must be used in the expression, not the projection column names.
- If you want to use a different `SEGMENTED BY` expression, the following restrictions apply:
  - All leaf expressions must be either constants or ***column-references*** (see "***Column References***" on page 45) to a column in the SELECT list of the CREATE PROJECTION command
  - Aggregate functions are not allowed
  - The expression must return the same value over the life of the database.
  - The expression must return non-negative INTEGER values in the range $0 <= x < 2^{63}$ (two to the sixty-third power or 2^63), and values are generally distributed uniformly over that range.
  - If *expression* produces a value outside the expected range (a negative value for example), no error occurs, and the row is added to the first segment of the projection.
- The hash-segmentation-clause within the CREATE TEMP TABLE statement does not support the OFFSET keyword, which is available in the CREATE PROJECTION command. The OFFSET is set to zero (0).

Example

This example segments the default superprojection and its buddies using HASH segmentation based on column 1 (C1).

```
=> CREATE TEMPORARY TABLE ... SEGMENTED BY HASH(C1) ALL NODES;
```

See Also

HASH (page 236) and ***MODULARHASH*** (page 239)

range-segmentation-clause (temp table)

By default, the superprojection for the temp table is unsegmented on the initiator node (a pinned projection). If you prefer, you can choose either hash-segmentation (preferred) or range-segmentation if you have more than one node.

Range segmentation allows you to segment a projection based on a known range of values stored in a specific column chosen to provide even distribution of data across a set of nodes, resulting in optimal query execution. Projections created in this manner are not pinned.

Note: Vertica Systems, Inc. recommends that you use hash segmentation, instead of range segmentation.

Syntax

```
SEGMENTED BY expression
  NODE node VALUES LESS THAN value
    ⋮
  NODE node VALUES LESS THAN MAXVALUE
```

Parameters (Range Segmentation)

`SEGMENTED BY expression`	Is a single ***column reference*** (see "***Column References***" on page 45) to a column in the SELECT list of the CREATE PROJECTION statement. Choose a column that has: ▪ INTEGER or FLOAT data type ▪ A known range of data values ▪ An even distribution of data values ▪ A large number of unique data values Avoid columns that: ▪ Are foreign keys ▪ Are used in query predicates ▪ Have a date/time data type ▪ Have correlations with other columns due to functional dependencies. **Note:** Segmenting on DATE/TIME data types is valid but guaranteed to produce temporal skew in the data distribution and is not recommended. If you choose this option, do not use TIME or TIMETZ because their range is only 24 hours.
`NODE node`	Is a symbolic name for a node. You can use a specific node only once in any projection. For a list of the nodes in a database, use `SELECT * FROM NODE_RESOURCES`.
`VALUES LESS THAN value`	Specifies that this segment can contain a range of data values *less than* the specified *value*, except that segments cannot overlap. In other words, the minimum value of the range is determined by the *value* of the previous segment (if any).
`MAXVALUE`	Specifies a sub-range with no upper limit. In other words, it represents a value greater than the maximum value that can exist in the data. The maximum value depends on the data type of the segmentation column.

Notes

- The `SEGMENTED BY` *expression* syntax allows a general SQL expression but there is no reason to use anything other than a single ***column reference*** (see "***Column References***" on page 45) for range segmentation. If you want to use a different expression, the following restrictions apply:
  - All leaf expressions must be either constants or column-references to a column in the SELECT list of the CREATE PROJECTION command
  - Aggregate functions are not allowed
  - The expression must return the same value over the life of the database.

- During INSERT or COPY to a segmented projection, if *expression* produces a value outside the expected range (a negative value for example), no error occurs, and the row is added to a segment of the projection.

See Also

NODE_RESOURCES (page 714)

CREATE USER

Adds a name to the list of authorized database users.

Syntax

```
CREATE USER name
... [ ACCOUNT {LOCK | UNLOCK} ]
... [ IDENTIFIED BY 'password' ]
... [ PASSWORD EXPIRE ]
... [ MEMORYCAP {'memory-limit' | NONE} ]
... [ PROFILE {profile | DEFAULT} ]
... [ RESOURCE POOL pool-name ]
... [ RUNTIMECAP {'time-limit' | NONE} ]
... [ TEMPSPACECAP {'space-limit' | NONE} ]
```

Parameters

name	Specifies the name of the user to create; names that contain special characters must be double-quoted. **Tip:** Vertica database user names are logically separate from user names of the operating system in which the server runs. If all the users of a particular server also have accounts on the server's machine, it makes sense to assign database user names that match their operating system user names. However, a server that accepts remote connections could have many database users who have no local operating system account, and in such cases there need be no connection between database user names and OS user names.
ACCOUNT LOCK | UNLOCK	Locks or unlocks the account. Specifying LOCK prevents the user from logging in. Specifying UNLOCK unlocks the account, allowing the user to log in. In addition to manually locking an account, an account can be locked when a user has more failed login attempts that is allowed.
IDENTIFIED BY *'password'*	Sets the password for the user. If this parameter is omitted, then the user does not have a password and is not prompted for one when connecting. If a password is supplied, it must conform to the password complexity policy set by the user's profile (either the one specified in the PROFILE parameter, or the default profile if the PROFILE parameter is omitted).
PASSWORD EXPIRE	Expires the user's password immediately. The user will be forced to change the password when he or she next logs in. The grace period setting (if any) in the user's profile is overridden. **Note:** PASSWORD EXPIRE has no effect when using external password authentication methods such as LDAP or Kerberos.
MEMORYCAP '*memory-limit*' | NONE	Limits the amount of memory that the user's requests can use. This value is a number representing the amount of space, followed by a unit (for example, '10G'). The unit can be one of the following:

	▪ % percentage of total memory available to the Resource Manager. (In this case value for the size must be 0-100) ▪ K Kilobytes ▪ M Megabytes ▪ G Gigabytes ▪ T Terabytes Setting this value to NONE means the user's sessions have no limits on memory use. This is the default value.
PROFILE *profile* | DEFAULT	Assigns the user to the profile named *profile*. Profiles set the user's password policy. See Profiles in the Administrator's Guide for details. Using the value DEFAULT here assigns the user to the default profile. If this parameter is omitted, the user is assigned to the default profile.
RESOURCE POOL *pool-name*	Sets the name of the resource pool from which to request the user's resources. This command creates a usage grant for the user on the resource pool unless the resource pool is publicly usable.
RUNTIMECAP '*time-limit*' | NONE	Sets the maximum amount of time any of the user's queries can execute. time-limit is an interval, such as '1 minute' or '100 seconds' (see ***Interval Values*** (page 29) for details). The maximum duration allowed is one year. Setting this value to NONE means there is no time limit on the user's queries.
TEMPSPACECAP '*space-limit*' | NONE	Limits the amount of temporary file storage the user's requests can use. This parameter's value has the same format as the MEMORYCAP value.

Notes

- Only a superuser can create a user.
- User names created with double-quotes are case sensitive. For example:
  ```
  => CREATE USER "FrEd1";
  ```
  In the above example, the login name must be an exact match. If the user name was created without double-quotes (for example, FRED1), then the user can log in as FRED1, FrEd1, fred1, and so on.

  Note: *ALTER USER* (page 494) and ***DROP USER*** (page 591) are case-*in*sensitive.
- Newly-created users do not have access to schema PUBLIC by default. Make sure to GRANT USAGE ON SCHEMA PUBLIC to all users you create.
- You can change a user password by using the ALTER USER statement. If you want to configure a user to not have any password authentication, you can set the empty password '' in CREATE or ALTER USER statements, or omit the IDENTIFIED BY parameter in CREATE USER.
- By default, users have the right to create temporary tables in the database.

Examples

```
=> CREATE USER Fred;
=> GRANT USAGE ON SCHEMA PUBLIC to Fred;
```

See Also

ALTER USER (page 494) and ***DROP USER*** (page 591)

Managing Workloads in the Administrator's Guide

CREATE VIEW

Defines a new view.

Syntax

```
CREATE VIEW viewname [ ( column-name [, ...] ) ] AS query ]
```

Parameters

viewname	Specifies the name of the view to create. The view name must be unique. Do not use the same name as any table, view, or projection within the database. If the view name is not provided, the user name is used as the view name.
column-name	[Optional] Specifies the list of names to be used as column names for the view. Columns are presented from left to right in the order given. If not specified, Vertica automatically deduces the column names from the query.
query	Specifies the query that the view executes. Vertica also uses the query to deduce the list of names to be used as columns names for the view if they are not specified. Use a ***SELECT*** (page 617) statement to specify the query.The SELECT statement can refer to tables, temp tables, and other views.

Notes

Views are read only. You cannot perform insert, update, delete, or copy operations on a view.

When Vertica processes a query that contains a view, the view is treated as a subquery because the view name is replaced by the view's defining query. The following example defines a view (ship) and illustrates how a query that refers to the view is transformed.

View: `CREATE VIEW ship AS SELECT * FROM public.shipping_dimension;`

Original Query: `SELECT * FROM ship;`

Transformed query: `SELECT * FROM (SELECT * FROM public.shipping_dimension) AS ship;`

Use the ***DROP VIEW*** (page 591) statement to drop a view. Only the specified view is dropped. Vertica does not support CASCADE functionality for views, and it does not check for dependencies. Dropping a view causes any view that references it to fail.

Restrictions

To create a view, the user must be a superuser or have the following privileges:

- CREATE on the schema in which the view is created.
- SELECT on all the tables and views referenced within the view's defining query.

- USAGE on all the schemas that contain the tables and views referenced within the view's defining query.

Example

```
=> CREATE VIEW myview AS
   SELECT SUM(annual_income), customer_state
   FROM public.customer_dimension
   WHERE customer_key IN
     (SELECT customer_key
      FROM store.store_sales_fact)
   GROUP BY customer_state
   ORDER BY customer_state ASC;
```

The following example uses the *myview* view with a WHERE clause that limits the results to combined salaries of greater than 2,000,000,000.

```
=> SELECT * FROM myview WHERE SUM > 2000000000;
     SUM     | customer_state
-------------+----------------
  2723441590 | AZ
 29253817091 | CA
  4907216137 | CO
  3769455689 | CT
  3330524215 | FL
  4581840709 | IL
  3310667307 | IN
  2793284639 | MA
  5225333668 | MI
  2128169759 | NV
  2806150503 | PA
  2832710696 | TN
 14215397659 | TX
  2642551509 | UT
(14 rows)
```

See Also

SELECT (page 617)

DROP VIEW (page 591), ***GRANT (View)*** (page 602)

REVOKE (View) (page 612)

DELETE

Marks tuples as no longer valid in the current epoch. DELETE does not delete data from disk storage for base tables. By default, delete uses the WOS and if the WOS fills up overflows to the ROS.

Syntax

DELETE [/*+ direct */] FROM [*schema_name*.]*table* ***WHERE clause*** (on page 622)

Parameters

/*+ direct */	Writes the data directly to disk (ROS) bypassing memory (WOS). **Note:** If you delete using the direct hint, you still need to issue a COMMIT or ROLLBACK command to finish the transaction.
[*schema_name*.]	Specifies the name of an optional schema.
table	Specifies the name of a base table or temporary table.

Notes

- Subqueries and joins are permitted in DELETE statements, which is useful for deleting values in a table based on values that are stored in other tables. See Examples section below.

  The delete operation deletes rows that satisfy the WHERE clause from the specified table. If the WHERE clause is absent, all table rows are deleted. The result is a valid, even though the statement leaves an empty table. On successful completion, a delete operation returns a count, which represents the number of rows deleted. A count of 0 is not an error; it means that no rows matched the condition.
- To remove all rows from a temporary table, use a DELETE statement with no WHERE clause. In this special case, the rows are not stored in the system, which greatly improves performance. The effect is similar to when a COMMIT is issued, in that all rows are removed, but the columns, projections, and constraints are preserved, thus making it easy to re-populate the table.

  If you include a WHERE clause when performing delete operations on temporary tables, DELETE behaves the same as for base tables, marking all delete vectors for storage, and you lose any performance benefits.

  DELETE FROM temp_table is the only way to truncate a temporary table without ending the transaction.
- If the delete operation succeeds on temporary tables, you cannot roll back to a prior savepoint.
- DELETE marks records for deletion in the WOS.
- You cannot delete records from a projection.
- When using more than one schema, specify the schema that contains the table in your DELETE statement.

- To use DELETE or UPDATE (page 656) commands with a WHERE clause, the user must have both SELECT (page 617) and DELETE privileges on the table.

Examples

The following command truncates a temporary table called temp1:

```
=> DELETE FROM temp1;
```

The following command deletes all records from base table T where C1 = C2 - C1.

```
=> DELETE FROM T WHERE  C1=C2-C1;
```

The following command deletes all records from the customer table in the retail schema where the state attribute is in MA or NH:

```
=> DELETE FROM retail.customer WHERE  state IN ('MA', 'NH');
```

The following series of commands illustrate the use of subqueries in DELETE statements; they all use the following simple schema:

```
=> CREATE TABLE t (a INTEGER);
=> CREATE TABLE  t2 (a INTEGER);
=> INSERT INTO t VALUES (1);
=> INSERT INTO t VALUES (2);
=> INSERT INTO t2 VALUES (1);
=> COMMIT;
```

The following command deletes the expected row from table t:

```
=> DELETE FROM t WHERE t.a IN (SELECT t2.a FROM t2);
 OUTPUT
--------
      1
(1 row)
```

Notice that table t now has only one row,instead of two:

```
=> SELECT * FROM t;
 a
---
 2
(1 row)
```

To preserve the data for this example, issue the rollback command:

```
=> ROLLBACK;
```

The following command deletes the expected two rows:

```
=> DELETE FROM t WHERE EXISTS (SELECT * FROM t2);
 OUTPUT
--------
      2
(1 row)
```

Now table t contains no rows:

```
=> SELECT * FROM t;
 a
---
(0 rows)
```

Roll back to the previous state and verify that you still have two rows:

```
=> ROLLBACK;
SELECT * FROM t;
 a
---
 1
 2
(2 rows)
```

The following command uses a correlated subquery to delete all rows in table `t` where `t.a` matches a value of `t2.a`.

```
=> DELETE FROM t WHERE EXISTS (SELECT * FROM t2 WHERE t.a = t2.a);
 OUTPUT
--------
      1
(1 row)
```

Query the table to verify the row was deleted:

```
=> SELECT * FROM t;
 a
---
 2
(1 row)
```

Roll back to the previous state and query the table again:

```
=> ROLLBACK;
=> SELECT * FROM t;
 a
---
 1
 2
(2 rows)
```

See Also

DROP TABLE (page 589) and ***TRUNCATE TABLE*** (page 651)

Deleting Data and Best Practices for DELETE and UPDATE in the Administrator's Guide

Subqueries in the Programmer's Guide

DROP FUNCTION

Drops a SQL Macro from the Vertica catalog.

Syntax

```
DROP FUNCTION [ schema-name.]name [, ...]
... ( [ [ argname ] argtype  [, ...] ] )
```

Parameters

[*schema-name*.]	[Optional] Specifies the name of a schema. When using more than one schema, specify the schema that contains

	the function to drop.
name	Specifies a name for the SQL Macro (function) to drop.
argname	Specifies the name of the argument, typically a column name.
argtype	Specifies the data type for argument(s) that are passed to the function. Argument types must match Vertica type names. See ***SQL Data Types*** (page 60).

Notes

- Before you can drop a function, you must specify the argument type because there could be several functions that share the same name with different argument types.
- Vertica does not check for dependencies, so if you drop a SQL Macro where other objects reference it (such as views or other SQL Macros), Vertica returns an error when those objects are used and not when the function is dropped.

Permissions

Only the superuser or owner can drop the function.

Example

The following command drops the `zerowhennull` function in the `macros` schema:

```
=>  DROP FUNCTION macros.zerowhennull(x INT);
DROP FUNCTION
```

See Also

ALTER FUNCTION (page 477)

CREATE FUNCTION (page 515)

GRANT (Function) (page 596)

REVOKE (Function) (page 607)

V_CATALOG.USER_FUNCTIONS (page 683)

Using SQL Macros in the Programmer's Guide

DROP PROCEDURE

Removes an external procedure from Vertica.

Syntax

```
DROP PROCEDURE [schema-name.]name ( [ argname ] argtype [,...] ] )
```

Parameters

[*schema-name.*]	[Optional] Specifies the name of a schema. When using more than one schema, specify the schema that contains

	the procedure to drop.
name	Specifies the name of the procedure to be dropped.
argname	The argument name or names used when creating the procedure.
argtype	The argument type or types used when creating the procedure.

Note

- Only the database superuser can drop procedures.
- Only the reference to the procedure is removed. The external file remains in the *<database>/procedures* directory on each node in the database.

Example

```
=> DROP PROCEDURE helloplanet(arg1 varchar);
```

See Also

CREATE PROCEDURE (page 518)

DROP PROFILE

Removes a profile from the database. Only the superuser can drop a profile.

Syntax

```
DROP PROFILE name [, ...] [ CASCADE ]
```

Parameters

name	The name of one or more profiles (separated by commas) to be removed.
CASCADE	Moves all users assigned to the profile or profiles being dropped to the DEFAULT profile. If you do not include CASCADE in the DROP PROFILE command and a targeted profile has users assigned to it, the command returns an error.

Note: You cannot drop the DEFAULT profile.

DROP PROJECTION

Marks a projection to be dropped from the catalog so it is unavailable to user queries.

Syntax

```
DROP PROJECTION { base-projname |  projname-node [ , ...] }
... [ RESTRICT | CASCADE ]
```

Parameters

base-projname	Drops the base projection and all its replicated buddies on all nodes simultaneously. When using more than one schema, specify the schema that contains the projection. projname can be `'projname'` or `'schema.projname'`.
projname-node	Drops only the specified projection on the specified node. When using more than one schema, specify the schema that contains the projection. projname can be `'projname'` or `'schema.projname'`.
`RESTRICT`	Drops the projection only if it does not contain any objects. RESTRICT is the default.
`CASCADE`	Drops the projection even if it contains one or more objects.

Notes

To prevent data loss and inconsistencies, tables must contain one superprojection, so DROP PROJECTION fails if a projection is the table's only superprojection. In such cases, use the DROP TABLE command.

To a drop all projections:

```
=> DROP PROJECTION prejoin_p;
```

To drop the projection on node 2:

```
=> DROP PROJECTION prejoin_p_site02;
```

Alternatively, you can issue a command like the following, which drops projections on a particular schema:

```
=> DROP PROJECTION schema1.fact_proj_a, schema1.fact_proj_b;
```

If you want to drop a set of buddy projections, you could be prevented from dropping them individually using a sequence of DROP PROJECTION statements due to K-Safety violations. See ***MARK_DESIGN_KSAFE*** (page 365) for details.

See Also

CREATE PROJECTION (page 522), ***DROP TABLE*** (page 589), ***GET_PROJECTIONS*** (page 358), ***GET_PROJECTION_STATUS*** (page 357), and ***MARK_DESIGN_KSAFE*** (page 365)

Adding Nodes in the Administrator's Guide

DROP RESOURCE POOL

Drops a user-created resource pool. All memory allocated to the pool is returned back to the GENERAL ***pool*** (page 534).

Any requests queued against the pool are transferred to the GENERAL pool according to the priority of the pool compared to the GENERAL pool. If the pool's priority is higher than the GENERAL pool, the requests are placed at the head of the queue; otherwise the requests are placed at the end of the queue.

Any users who are using the pool are switched to use the GENERAL pool with a NOTICE:

```
NOTICE:  Switched the following users to the General pool: username
```

DROP RESOURCE POOL returns an error if a user using the pool doesn't have permission to use the GENERAL pool. Existing sessions are transferred to the GENERAL pool regardless of whether the session's user has permission to use the GENERAL pool. This can result in additional user privileges if the pool being dropped is more restrictive than the GENERAL pool. To prevent giving users additional privileges, follow this procedure to drop restrictive pools:

1. ***Revoke the permissions on the pool*** (page 608) for all users.
2. Close any sessions that had permissions on the pool.
3. Drop the resource pool.

Syntax

```
DROP RESOURCE POOL pool-name
```

Parameters

pool-name	Specifies the name of the resource pool to be dropped.

Example

The following command drops the resource pool that was created for the CEO:

```
=> DROP RESOURCE POOL ceo_pool;
```

See Also

ALTER RESOURCE POOL (page 481)

CREATE RESOURCE POOL (page 531)

Managing Workloads in the Administrator's Guide

DROP SCHEMA

Removes a schema from the database permanently. Be sure that you want to remove the schema and all its objects before you drop it because DROP SCHEMA is an irreversible process.

Syntax

```
DROP SCHEMA name [, ...] [ CASCADE | RESTRICT ]
```

Parameters

name	Specifies the name of the schema to drop.
CASCADE	Drops the schema even if it contains one or more objects.
RESTRICT	Drops the schema only if it does not contain any objects (the default).

Restrictions

- By default, a schema cannot be dropped if it contains one or more objects. To force a drop, use the CASCADE statement.
- The PUBLIC schema cannot be dropped.
- A schema can only be dropped by its owner or a superuser.

Notes

- A schema owner can drop a schema even if the owner does not own all the objects within the schema. All the objects within the schema is also dropped.
- If a user is accessing any object within a schema that is in the process of being dropped, the schema is not deleted until the transaction completes.
- Canceling a DROP SCHEMA statement can cause unpredictable results.

Examples

The following example drops schema S1 only if it doesn't contain any objects:

```
=> DROP SCHEMA S1;
```

The following example drops schema S1 whether or not it contains objects:

```
=> DROP SCHEMA S1 CASCADE;
```

DROP SEQUENCE

Removes the specified sequence number generator.

Syntax

```
DROP SEQUENCE [schema-name.]name [ , ... ]
```

Parameters

[*schema-name.*]	[Optional] Specifies the name of a schema. When using more than one schema, specify the schema that contains the sequence to drop.
name	Specifies the name of the sequence to drop.

Notes

- A sequence can only be dropped by its owner or by a superuser.
- For sequences mentioned in a table's default expression, the default expression fails the next time you try to load data. Vertica does not check for these instances.
- The CASCADE keyword is not supported. Sequences used in a default expression of a column cannot be dropped until all references to the sequence are removed from the default expression.

Example

The following command drops the sequence named `sequential`.

```
=> DROP SEQUENCE sequential;
```

See Also

ALTER SEQUENCE (page 485)

CREATE SEQUENCE (page 540)

CURRVAL (page 255)

GRANT (Sequence) (page 599)

NEXTVAL (page 254)

Using Sequences and Sequence Privileges in the Administrator's Guide

DROP TABLE

Removes a table and, optionally, its associated projections.

Syntax

```
DROP TABLE [ schema-name.]table [, ...] [ CASCADE ]
```

Parameters

[schema-name.]	[Optional] Specifies the name of a schema. When using more than one schema, specify the schema that contains the table to drop.
table	Specifies the name of a schema table. When using more than one schema, specify the schema that contains the table in the DROP TABLE statement.
CASCADE	[Optional] Drops all projections that include the table.

If you try to drop an table that has associated projections, a message listing the projections displays. For example:

```
=> DROP TABLE d1;
NOTICE: Constraint - depends on Table d1
NOTICE: Projection d1p1 depends on Table d1
NOTICE: Projection d1p2 depends on Table d1
NOTICE: Projection d1p3 depends on Table d1
NOTICE: Projection f1d1p1 depends on Table d1
NOTICE: Projection f1d1p2 depends on Table d1
NOTICE: Projection f1d1p3 depends on Table d1
ERROR: DROP failed due to dependencies: Cannot drop Table d1 because other objects
depend on it
HINT: Use DROP ... CASCADE to drop the dependent objects too.
=> DROP TABLE d1 CASCADE;
DROP TABLE
```

Notes

- The table owner, schema owner, or superuser can drop a table.

  Note: The schema owner can drop a table but cannot truncate a table.
- Canceling a DROP TABLE statement can cause unpredictable results.
- Make sure that all other users have disconnected before using DROP TABLE.
- Views that reference a table that is dropped and then replaced by another table with the same name continue to function and use the contents of the new table, as long as the new table contains the same columns and column names.
- Use the multiple projection syntax in K-safe clusters.

See Also

DELETE (page 580)

DROP PROJECTION (page 585)

TRUNCATE TABLE (page 651)

Adding Nodes and Deleting Data in the Administrator's Guide

DROP USER

Removes a name from the list of authorized database users.

Syntax

```
DROP USER name [, ...] [ CASCADE ]
```

Parameters

name	Specifies the name or names of the user to drop.
CASCADE	[Optional] Drops all user-defined objects created by the user dropped, including schema, table and all views that reference the table, and the table's associated projections.

Examples

`DROP USER <name>` fails if objects exist that were created by the user, such as schemas, tables and their associated projections:

```
=> DROP USER user1;
   NOTICE:  Table T_tbd1 depends on User user1
   ROLLBACK:  DROP failed due to dependencies
   DETAIL:  Cannot drop User user1 because other objects depend on it
   HINT:  Use DROP ... CASCADE to drop the dependent objects too
```

`DROP USER <name> CASCADE` succeeds regardless of any pre-existing user-defined objects. The statement forcibly drops all user-defined objects, such as schemas, tables and their associated projections:

```
=> DROP USER user1 CASCADE;
```

Caution: Tables owned by the user being dropped cannot be recovered after you issue `DROP USER CASCADE`.

`DROP USER` <username> succeeds if no user-defined objects exist (no schemas, tables or projections defined by the user):

```
=> CREATE USER user2;
=> DROP USER user2;
```

DROP VIEW

Removes the specified view.

Syntax

```
DROP VIEW name [ , ... ]
```

Parameters

name	Specifies the name of the view to drop.

Notes

- Only the specified view is dropped. Vertica does not support cascade functionality for views and it does not check for dependencies. Dropping a view causes any view that references it to fail.
- Views that reference a view or table that is dropped and then replaced by another view or table with the same name continue to function using the contents of the new view or table if it contains the same column names. If the column data type changes, the server coerces the old data type to the new one, if possible. Otherwise, it returns an error.

Restrictions

To drop a view, the user must be either a superuser or the person who created the view.

Examples

```
=> DROP VIEW myview;
```

EXPLAIN

Outputs the query plan.

Syntax

```
EXPLAIN { SELECT... | INSERT... | UPDATE... }
```

Output

Note: The EXPLAIN command is provided as a support feature and is not fully described here. For information on how to interpret the output, contact ***Technical Support*** (on page 1).

- A compact human-readable representation of the query plan, laid out hierarchically. For example:

```
Vertica QUERY PLAN DESCRIPTION:
------------------------------
  ID:1 Cost:2.7 Card:-1
    Projection: P0
       ID:2 Cost:0.1 Card:-1
         DS: Value Idx
         ProjCol:c_state, Table Oid.Attr#:25424.4
         Pred: Y         Out: P
       ID:3 Cost:0.3 Card:-1
         DS: Position Filtered by ID:2
         ProjCol:c_gender, Table Oid.Attr#:25424.2
         Pred: Y         Out: P
       ID:4 Cost:0.3 Card:-1
         DS: Position Filtered by ID:3
         ProjCol:c_name, Table Oid.Attr#:25424.3
         Pred: Y         Out: P
       ID:5 Cost:1 Card:-1
         DS: Position Filtered by ID:4
         ProjCol:c_cid, Table Oid.Attr#:25424.1
         Pred: N         Out: V
       ID:6 Cost:1 Card:-1
         DS: Position Filtered by ID:4
         ProjCol:c_state, Table Oid.Attr#:25424.4
         Pred: N         Out: V
```

- A GraphViz format of the graph for display in a graphical format. Graphviz is a graph plotting utility with layout algorithms, etc. You can obtain a Fedora Core 4 RPM for GraphViz from:

  ```
  yum -y install graphviz
  ```

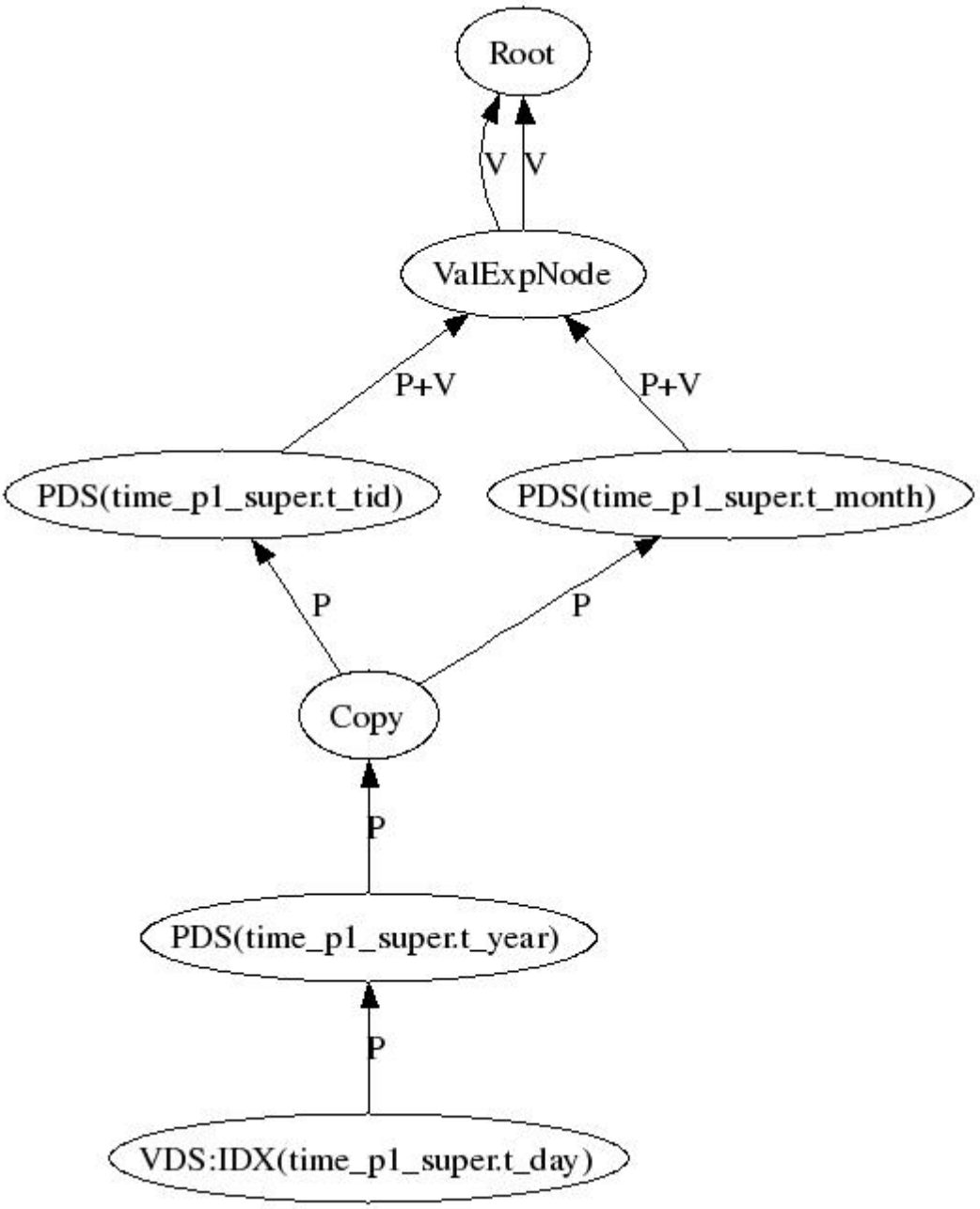
  A example of a GraphViz graph for a Vertica plan:

```
digraph G {
graph [rankdir=BT]
0[label="Root"];
1[label="ValExpNode"];
2[label="VDS:DVIDX(P0.c_state)"];
3[label="PDS(P0.c_gender)"];
```

```
4[label="PDS(P0.c_name)"];
5[label="Copy"];
6[label="PDS(P0.c_cid)"];
7[label="PDS(P0.c_state)"];
1->0 [label="V"];
1->0 [label="V"];
2->3 [label="P"];
3->4 [label="P"];
4->5 [label="P"];
5->6 [label="P"];
5->7 [label="P"];
6->1 [label="P+V"];
7->1 [label="P+V"]; }
```

- To create a picture of the plan, copy the output above to a file, in this example /tmp/x.txt:
  1. dot -Tps /tmp/x.txt > /tmp/x.ps
  2. ggv x.ps [evince x.ps works if you don't have ggv]
  3. Alternative: dot -Tps | ghostview - and paste in the digraph.
  4. Alternative: generate jpg using -Tjpg.
  5. To scale an image for printing (8.5"x11" in this example):
  6. Portrait: dot -Tps -Gsize="7.5,10" -Gmargin="0.5" ...
  7. Landscape: dot -Tps -Gsize="10,7.5" -Gmargin="0.5" -Grotate="90" ...

Example:



GraphViz Information

http://www.graphviz.org/Documentation.php (***http://www.graphviz.org/Documentation.php***)

GRANT (Database)

Grants the right to create schemas within the database to a user.

Syntax

```
GRANT {
... { CREATE [, ...]
... | { TEMPORARY | TEMP }
... | ALL [ PRIVILEGES ] } }
... ON DATABASE database-name [, ...]
... TO username [, ...]
... [ WITH GRANT OPTION ]
```

Parameters

CREATE	Allows the user to create schemas within the specified database.
TEMPORARY | TEMP	Allows the user to create temp tables in the database. **Note:** This privilege is provided by default with ***CREATE USER*** (page 576).
ALL	Applies to all privileges.
PRIVILEGES	Is for SQL standard compatibility and is ignored.
database-name	Identifies the database in which to grant the privilege.
username	Grants the privilege to the specified user.
WITH GRANT OPTION	Allows the recipient of the privilege to grant it to other users.

Notes

By default, only the superuser has the right to create a database schema.

Example

The following example grants Fred the right to create schemas on vmartdb.

```
=> GRANT CREATE ON DATABASE vmartdb TO Fred;
```

GRANT (Function)

Grants the EXECUTE privilege on a SQL Macro to a database user.

Syntax

```
GRANT EXECUTE
... ON FUNCTION [schema-name.]function-name [, ...]
... ( [ argname ] argtype [ ,... ] ] )
... TO { username | PUBLIC } [ , ... ]
```

Parameters

[*schema-name.*]*function-name*	Specifies the SQL Macro on which to grant the EXECUTE privilege. When using more than one schema, specify the schema that contains the function.
argname	Specifies the argument name(s).
argtype	Specifies the argument data types(s).
username	Grants the privilege to the specified user.
PUBLIC	Grants the privilege to all users.

Permissions

- Only the superuser and owner can grant EXECUTE privilege on a SQL Macro.
- Additionally, users must have USAGE privileges on the schema that contains the function. See ***GRANT (Schema)*** (page 599).

Example

The following command grants EXECUTE privileges to user Fred on the zeroifnull function:

```
=> GRANT EXECUTE ON FUNCTION zeroifnull (x INT) TO Fred;
```

See Also

REVOKE (Function) (page 607)

GRANT (Procedure)

Grants the execute privilege on a procedure to a database user.

Syntax

```
GRANT EXECUTE
... ON PROCEDURE [schema-name.]procedure-name [, ...]
... ( [ argname ] argtype [ ,... ] ] )
... TO { username | PUBLIC } [ , ... ]
```

Parameters

[*schema-name.*]*procedure-name*	Specifies the procedure on which to grant the execute privilege. When using more than one schema, specify the schema that contains the procedure.
argname	Specifies the argument name or names used when creating the procedure.
argtype	Specifies the argument types used when creating the procedure.
username	Grants the privilege to the specified user.
PUBLIC	Grants the privilege to all users.

Notes

- Only the superuser can grant `USAGE` on a procedure.
- Additionally, users must have privileges on the schema that contains the procedure.

See Also

REVOKE (procedure) (page 608)

GRANT (Resource Pool)

Grants access privilege for a resource pool to a database user.

Syntax

```
GRANT USAGE
... ON RESOURCE POOL resource-pool
... TO { username | PUBLIC } [ , ... ]
```

Parameters

resource-pool	Specifies the resource pool on which to grant the usage privilege.
username	Grants the privilege to the specified user.
PUBLIC	Grants the privilege to all users.

Notes

Once granted usage rights, users can switch to using the resource pool using ***ALTER USER*** (page 494) (by passing their own username) or ***SET SESSION RESOURCE POOL*** (page 643).

See Also

REVOKE (Resource Pool) (page 608)

GRANT (Schema)

Grants privileges on a schema to a database user.

Syntax

```
GRANT {
... { CREATE | USAGE } [ , ... ]
... | ALL [ PRIVILEGES ] }
... ON SCHEMA schemaname [ , ... ]
... TO { username | PUBLIC } [ , ... ]
... [ WITH GRANT OPTION ]
```

Parameters

CREATE	Allows the user read access to the schema and the right to create tables and views within the schema.
USAGE	Allows the user access to the objects contained within the schema. This allows the user to look up objects within the schema. Note that the user must also be granted access to the individual objects. See the ***GRANT TABLE*** (page 601) and ***GRANT VIEW*** (page 602) statements.
ALL	Applies to all privileges.
PRIVILEGES	Is for SQL standard compatibility and is ignored.
schemaname	Is the name of the schema for which privileges are being granted.
username	Grants the privilege to a specific user.
PUBLIC	Grants the privilege to all users.
WITH GRANT OPTION	Allows the recipient of the privilege to grant it to other users.

Notes

Newly-created users do not have access to schema PUBLIC by default. Make sure to grant USAGE on schema PUBLIC to all users you create.

GRANT (Sequence)

Grants privileges on a sequence generator to a user.

Syntax

```
GRANT {
... { USAGE | SELECT | UPDATE }
... | ALL [ PRIVILEGES ] }
... ON SEQUENCE [schema-name.]sequence_name [ , ... ]
... TO { username | PUBLIC } [ , ... ]
... [ WITH GRANT OPTION ]
```

Parameters

USAGE	Allows the user to use both the CURRVAL and NEXTVAL functions on the specified sequence.
SELECT	Allows the user to use the CURRVAL function on the specified sequence.
UPDATE	Allows the user to use the NEXTVAL function on the specified sequence.
ALL	Applies to all privileges.
PRIVILEGES	Is for SQL standard compatibility and is ignored.
[*schema-name.*] *sequence_name*	Specifies the sequence on which to grant the privileges. When using more than one schema, specify the schema that contains the sequence on which to grant privileges.
username	Grants the privilege to the specified user.
PUBLIC	Grants the privilege to all users.
WITH GRANT OPTION	Allows the user to grant the same privileges to other users.

Notes

The user must also be granted USAGE on the schema that contains the sequence. See ***GRANT (Schema)*** (page 599).

GRANT (Table)

Grants privileges on a table to a user.

Syntax

```
GRANT { { SELECT | INSERT | UPDATE | DELETE | REFERENCES } [ ,... ]
... | ALL [ PRIVILEGES ] }
... ON [ TABLE ] [schema-name.]tablename [ , ... ]
... TO { username | PUBLIC } [ , ... ]
... [ WITH GRANT OPTION ]
```

Parameters

SELECT	Allows the user to SELECT from any column of the specified table.
INSERT	Allows the user to INSERT tuples into the specified table and to use the ***COPY*** (page 497) command to load the table. **Note:** COPY FROM STDIN is allowed to any user granted the INSERT privilege, while COPY FROM <file> is an admin-only operation.
UPDATE	Allows the user to UPDATE tuples in the specified table.
DELETE	Allows DELETE of a row from the specified table.
REFERENCES	Is necessary to have this privilege on both the referencing and referenced tables in order to create a foreign key constraint.
ALL	Applies to all privileges.
PRIVILEGES	Is for SQL standard compatibility and is ignored.
[*schema-name.*]*tablename*	Specifies the table on which to grant the privileges. When using more than one schema, specify the schema that contains the table on which to grant privileges.
username	Grants the privilege to the specified user.
PUBLIC	Grants the privilege to all users.
WITH GRANT OPTION	Allows the user to grant the same privileges to other users.

Notes

- The user must also be granted USAGE on the schema that contains the table. See ***GRANT (Schema)*** (page 599).
- To use the ***DELETE*** (page 580) or ***UPDATE*** (page 656) commands with a ***WHERE clause*** (page 622), a user must have both SELECT and UPDATE and DELETE privileges on the table.
- The user can be granted privileges on a global temporary table, but not a local temporary table.

GRANT (View)

Grants privileges on a view to a database user.

Syntax

```
GRANT {
... { SELECT }
... | ALL [ PRIVILEGES ] }
... ON [schema-name.]viewname [, ...]
... TO { username | PUBLIC } [, ...]
... [ WITH GRANT OPTION ]
```

Parameters

SELECT	Allows the user to perform SELECT operations on a view and the resources referenced within it.
PRIVILEGES	Is for SQL standard compatibility and is ignored.
ALL	Applies to all privileges.
[*schema-name.*]*viewname*	Specifies the view on which to grant the privileges. When using more than one schema, specify the schema that contains the view.
username	Grants the privilege to the specified user.
PUBLIC	Grants the privilege to all users.
WITH GRANT OPTION	Allows the user to grant the same privileges to other users.

Notes

If userA wants to grant userB access to a view, userA must specify WITH GRANT OPTION on the base table, in addition to the view, regardless of whether userB (grantee) has access to the base table.

INSERT

Inserts values into all projections of a table. By default, Insert first uses the WOS and if the WOS is full then overflows to the ROS.

Note: If a table has no associated projections, Vertica creates a default superprojection for the table in which to insert the data.

Syntax

```
INSERT [ /*+ direct */ ]
... INTO [schema-name.]table
... [ ( column [, ...] ) ]
... { DEFAULT VALUES
... | VALUES ( { expression | DEFAULT } [, ...] )
... | SELECT... (page 617) }
```

Parameters

`/*+ direct */`	Writes the data directly to disk (ROS) bypassing memory (WOS). **Note:** If you insert using the `direct` hint, you still need to issue a COMMIT or ROLLBACK command to finish the transaction.
[*schema-name.*]*table*	Specifies the name of a table in the schema. You cannot INSERT tuples into a projection. When using more than one schema, specify the schema that contains the table.
column	Specifies a column of the table.
DEFAULT VALUES	Fills all columns with their default values as specified in ***CREATE TABLE*** (page 546).
VALUES	Specifies a list of values to store in the corresponding columns. If no value is supplied for a column, Vertica implicitly adds a DEFAULT value, if present. Otherwise Vertica inserts a NULL value or, if the column is defined as NOT NULL, returns an error.
expression	Specifies a value to store in the corresponding column.
DEFAULT	Stores the default value in the corresponding column.
SELECT...	Specifies a query (***SELECT*** (page 617) statement) that supplies the rows to be inserted.

Notes

- An INSERT ... SELECT statement refers to tables in both its INSERT and SELECT clauses. Isolation level applies only to the SELECT clauses and work just like an normal query.
- You can list the target columns in any order. If no list of column names is given at all, the default is all the columns of the table in their declared order; or the first N column names, if there are only N columns supplied by the VALUES clause or query. The values supplied by the VALUES clause or query are associated with the explicit or implicit column list left-to-right.
- You must insert one complete tuple at a time.

- Do not use meta-functions in INSERT statements.

Examples

```
=> INSERT INTO FACT VALUES (101, 102, 103, 104);
=> INSERT INTO CUSTOMER VALUES (10, 'male', 'DPR', 'MA', 35);
=> INSERT INTO Retail.T1 (C0, C1) VALUES (1, 1001);
=> INSERT INTO films
     SELECT * FROM tmp_films
     WHERE date_prod < '2004-05-07';
```

LCOPY

Loads a data file from a client system into the database. This statement is nearly identical to the ***COPY*** (page 497) statement with a few exceptions:

- It loads data from a client system, rather than a cluster host. This means LCOPY does not support `'pathToData' ON nodename`.
- It does not support the FORMAT parameter that COPY uses to specify the format of date/time and binary data types.
- Instead of REJECTED DATA, LCOPY has a REJECTEDFILE parameter that takes the path of a file on the client system where it should save a list of rejected data. The row numbers of rejected rows are written to this file rather than the full content.
- The LCOPY command is only available via the ODBC interface. You cannot use it interactively from vsql.

LCOPY converts the end of line sequence of the client platform into the standard end of line sequence used in Vertica. On Windows platforms, the end of line sequence is \r\n (carriage return character followed by a newline character) while on Linux platforms, the end of line sequence is just \n (newline). The Vertica client driver converts these end of line sequences as it loads the data.

For example, loading the following text file using LCOPY (with | set as the record terminator, and the escaped characters \r and \n replaced by actual control characters) is interpreted differently depending on the client system's platform:

```
1|2\r\n|3|
```

On a Windows platform, the \r\n is recognized as the end of line sequence, so the Vertica client driver translates it into the standard end of line sequence (\n). The result is a single-column table with the entries:

```
 a
---
 1
 2\n
 3
```

The \r is missing, since the \r\n sequence was translated to a single \n.

Using LCOPY from a Linux platform, only the \n is recognized as an end of line character, so the resulting table is:

```
 a
---
 1
```

```
 2\r\n
 3
```

To avoid confusion, you should ensure that the text files you load using LCOPY use the native line end sequence for your client's operating system.

Example

The following code loads the table TEST from the file `C:\load.dat` located on a system where the code is run.

```
ODBCConnection<ODBCDriverConnect> test("VerticaSQL");
test.connect();
char *sql = "LCOPY test FROM 'C:\load.dat' REJECTEDFILE 'c:\rejects.log' DELIMITER
'|';";
ODBCStatement stm(test.conn);
stm.execute(sql);
```

PROFILE

Profiles a single SQL statement.

Syntax

```
PROFILE { SELECT ... }
```

Output

Writes a hint to stderr, as described in the example below.

Notes

To profile a single statement add the PROFILE keyword to the beginning of the statement:

```
=> PROFILE SELECT customer_name, annual_income
   FROM public.customer_dimension
   WHERE (customer_gender, annual_income) IN (
     SELECT customer_gender, MAX(annual_income)
     FROM public.customer_dimension
     GROUP BY customer_gender);
```

PROFILE < SELECT ...> saves profiling information for future analysis.

A hint is written to `stderr` (the standard error stream and default destination for error messages and other diagnostic warnings, which are typically output to the screen) while the statement is executing:

```
NOTICE:  Statement is being profiled.
HINT:  select * from v_monitor.execution_engine_profiles where
transaction_id=45035996273740886 and statement_id=10;
NOTICE:  Initiator memory estimate for query:
[on pool general: 1418047 KB, minimum: 192290 KB]
NOTICE:  Total memory required by query: [1418047 KB]
   customer_name    | annual_income
--------------------+---------------
 Meghan U. Miller   |        999960
 Michael T. Jackson |        999981
```

```
(2 rows)
```

Tip: Use the statement returned by the hint as a starting point for reviewing the query's profiling data.

To see what counters are available, issue the following command:

=> SELECT DISTINCT(counter_name) FROM EXECUTION_ENGINE_PROFILES;

RELEASE SAVEPOINT

Destroys a savepoint without undoing the effects of commands executed after the savepoint was established.

Syntax

```
RELEASE [ SAVEPOINT ] savepoint_name
```

Parameters

savepoint_name	Specifies the name of the savepoint to destroy.

Notes

Once destroyed, the savepoint is unavailable as a rollback point.

Example

The following example establishes and then destroys a savepoint called my_savepoint. The values 101 and 102 are both inserted at commit.

```
=> INSERT INTO product_key VALUES (101);
=> SAVEPOINT my_savepoint;
=> INSERT INTO product_key VALUES (102);
=> RELEASE SAVEPOINT my_savepoint;
=> COMMIT;
```

See Also

SAVEPOINT (page 615) and ***ROLLBACK TO SAVEPOINT*** (page 614)

REVOKE (Database)

Revokes the right for the specified user to create schemas in the specified database.

Syntax

```
REVOKE [ GRANT OPTION FOR ]
... { CREATE | { TEMPORARY | TEMP } [ ,... ] }
... | ALL [ PRIVILEGES ] }
... ON DATABASE database-name [ , ... ]
... FROM username [ , ... ]
```

Parameters

CREATE	Revokes the right to create schemas in the specified database.
TEMPORARY | TEMP	Revokes the right to create temp tables in the database. **Note:** This privilege is provided by default with ***CREATE USER*** (page 576).
ALL	Applies to all privileges.
PRIVILEGES	Is for SQL standard compatibility and is ignored.
database-name	Identifies the database from which to revoke the privilege.
username	Identifies the user from whom to revoke the privilege.

Example

The following example revokes Fred's right to create schemas on vmartdb:

```
=> REVOKE CREATE ON DATABASE vmartdb FROM Fred;
```

The following revokes Fred's right to create temporary tables in vmartdb:

```
=> REVOKE TEMPORARY ON DATABASE vmartdb FROM Fred;
```

REVOKE (Function)

Revokes the EXECUTE privilege on a SQL Macro to a database user.

Syntax

```
REVOKE EXECUTE
... ON FUNCTION [schema-name.]function-name [, ...]
... ( [ argname ] argtype [ ,... ] ] )
... FROM { username | PUBLIC } [ , ... ]
```

Parameters

[*schema-name.*]*function-name*	Specifies the SQL Macro from which to revoke the EXECUTE privilege. When using more than one schema, specify the schema that contains the function.
argname	Specifies the argument name or names.
argtype	Specifies the argument data type or types.
username	Revokes the privilege from the specified user.
PUBLIC	Revokes the privilege from all users.

Permissions

Only the superuser and owner can revoke EXECUTE privilege on a SQL Macro.

Example

The following command revokes EXECUTE privileges from user Fred on the `zeroifnull` function:

```
=> REVOKE EXECUTE ON FUNCTION zeroifnull (x INT) FROM Fred;
```

See Also

GRANT (Function) (page 596)

REVOKE (Procedure)

Revokes the execute privilege on a procedure from a user.

Syntax

```
REVOKE EXECUTE
... ON [schema-name.]procedure-name [ , ... ]
... ( [ argname ] argtype [ ,... ] ] )
... FROM { username | PUBLIC } [ , ... ]
```

Parameters

[schema-name.]procedure-name	Specifies the procedure on which to revoke the execute privilege. When using more than one schema, specify the schema that contains the procedure.
argname	Specifies the argument names used when creating the procedure.
argtype	Specifies the argtypes used when creating the procedure.
username	Specifies the user from whom to revoke the privilege.
PUBLIC	Revokes the privilege from all users.

Notes

Only the superuser can revoke USAGE on a procedure.

See Also

GRANT (Procedure) (page 597)

REVOKE (Resource Pool)

Revokes a user's access privilege to a resource pool.

Syntax

```
REVOKE USAGE
... ON RESOURCE POOL resource-pool
... FROM { username | PUBLIC } [ , ... ]
```

Parameters

resource-pool	Specifies the resource pool from which to revoke the usage privilege.
username	Revokes the privilege from the specified user.
PUBLIC	Revokes the privilege from all users.

Notes

- Vertica checks resource pool permissions when a user initially switches to the pool, rather than on each access. Revoking a user's permission to use a resource pool does not affect existing sessions. You need to close the user's open sessions that are accessing the resource pool if you want to prevent them from continuing to use the pool's resources.
- It is an error to revoke a user's access permissions for the resource pool to which they are assigned (their default pool). You must first change the pool they are assigned to using ***ALTER USER ... RESOURCE POOL*** (page 494) (potentially using ***GRANT USAGE ON RESOURCE POOL*** (page 598) first to allow them to access the new pool) before revoking their access.

See Also

GRANT (Resource Pool) (page 598)

REVOKE (Schema)

Revokes privileges on a schema from a user.

Note: In a database with trust authentication, the GRANT and REVOKE statements appear to work as expected but have no actual effect on the security of the database.

Syntax

```
REVOKE [ GRANT OPTION FOR ] {
... { CREATE | USAGE } [ ,... ]
... | ALL [ PRIVILEGES ] }
... ON SCHEMA schema-name [ , ... ]
... FROM { username | PUBLIC } [ , ... ]
```

Parameters

GRANT OPTION FOR	Revokes the grant option for the privilege, not the privilege itself. If omitted, revokes both the privilege and the grant option.
CREATE	Allows the user read access to the schema and the right to create tables and views within the schema.
USAGE	Allows the user access to the objects contained within the schema. This allows the user to look up objects within the schema. Note that the user must also be granted access to the individual objects. See the ***GRANT TABLE*** (page 601) and ***GRANT VIEW*** (page 602) statements.
ALL	Applies to all privileges.
PRIVILEGES	Is for SQL standard compatibility and is ignored.
schemaname	Is the name of the schema for which privileges are being granted.
username	Grants the privilege to a specific user.
PUBLIC	Grants the privilege to all users.

REVOKE (Sequence)

Revokes privileges on a sequence generator from a user.

Syntax

```
REVOKE [ GRANT OPTION FOR ]
... { { USAGE | SELECT | UPDATE }
... | ALL [ PRIVILEGES ] }
... ON SEQUENCE [schema-name.]sequence_name [ , ... ]
... FROM { username | PUBLIC } [ , ... ]
```

Parameters

USAGE	Revokes the right to use both the CURRVAL and NEXTVAL functions on the specified sequence.
SELECT	Revokes the right to use the CURRVAL function on the specified sequence.
UPDATE	Revokes the right to use the NEXTVAL function on the specified sequence.
ALL	Applies to all privileges.
PRIVILEGES	Is for SQL standard compatibility and is ignored.
[*schema-name.*]*sequence_name*	Specifies the sequence from which to revoke privileges. When using more than one schema, specify the schema that contains the sequence from which to revoke privileges.
username	Revokes the privilege from the specified user.
PUBLIC	Revokes the privilege from all users.

REVOKE (Table)

Revokes privileges on a table from a user.

Note: In a database with trust authentication, the GRANT and REVOKE statements appear to work as expected but have no actual effect on the security of the database.

Syntax

```
REVOKE [ GRANT OPTION FOR ]
... { { SELECT | INSERT | UPDATE | DELETE | REFERENCES } [ ,... ]
... | ALL [ PRIVILEGES ] }
... ON [ TABLE ] [schema-name.]tablename [ , ... ]
... FROM { username | PUBLIC } [ , ... ]
```

Parameters

GRANT OPTION FOR	Revokes the grant option for the privilege, not the privilege itself. If omitted, revokes both the privilege and the grant option.
SELECT	Allows the user to SELECT from any column of the specified table.
INSERT	Allows the user to INSERT tuples into the specified table and to use the ***COPY*** (page 497) command to load the table. **Note:** COPY FROM STDIN is allowed to any user granted the INSERT privilege, while COPY FROM <file> is an admin-only operation.
UPDATE	Allows the user to UPDATE tuples in the specified table.
DELETE	Allows DELETE of a row from the specified table.
REFERENCES	Is necessary to have this privilege on both the referencing and referenced tables in order to create a foreign key constraint.
ALL	Applies to all privileges.
PRIVILEGES	Is for SQL standard compatibility and is ignored.
[*schema-name.*]*tablename*	Specifies the table on which to grant the privileges. When using more than one schema, specify the schema that contains the table on which to grant privileges.
username	Grants the privilege to the specified user.
PUBLIC	Grants the privilege to all users.

REVOKE (View)

Revokes privileges on a view from a user.

Note: In a database with trust authentication, the GRANT and REVOKE statements appear to work as expected but have no actual effect on the security of the database.

Syntax

```
REVOKE [ GRANT OPTION FOR ]
... { { SELECT } }
... ON [ VIEW ] [schema-name.]viewname [ , ... ]
... FROM { username | PUBLIC } [ , ... ]
```

Parameters

GRANT OPTION FOR	Revokes the grant option for the privilege, not the privilege itself. If omitted, revokes both the privilege and the grant option.
SELECT	Allows the user to perform SELECT operations on a view and the resources referenced within it.
PRIVILEGES	Is for SQL standard compatibility and is ignored.
[*schema-name.*]*viewname*	Specifies the view on which to revoke the privileges. When using more than one schema, specify the schema that contains the view.
username	Revokes the privilege from the specified user.
PUBLIC	Revokes the privilege from all users.

ROLLBACK

Ends the current transaction and discards all changes that occurred during the transaction.

Syntax

```
ROLLBACK [ WORK | TRANSACTION ]
```

Parameters

WORK TRANSACTION	Have no effect; they are optional keywords for readability.

Notes

When an operation is rolled back, any locks that are acquired by the operation are also rolled back.

ROLLBACK TO SAVEPOINT

Rolls back all commands that have been entered within the transaction since the given savepoint was established.

Syntax

```
ROLLBACK TO [SAVEPOINT] savepoint_name
```

Parameters

savepoint_name	Specifies the name of the savepoint to roll back to.

Notes

- The savepoint remains valid and can be rolled back to again later if needed.
- When an operation is rolled back, any locks that are acquired by the operation are also rolled back.
- ROLLBACK TO SAVEPOINT implicitly destroys all savepoints that were established after the named savepoint.

Example

The following example rolls back the values 102 and 103 that were entered after the savepoint, my_savepoint, was established. Only the values 101 and 104 are inserted at commit.

```
=> INSERT INTO product_key VALUES (101);
=> SAVEPOINT my_savepoint;
=> INSERT INTO product_key VALUES (102);
=> INSERT INTO product_key VALUES (103);
=> ROLLBACK TO SAVEPOINT my_savepoint;
=> INSERT INTO product_key VALUES (104);
=> COMMIT;
```

See Also

RELEASE SAVEPOINT (page 606) and ***SAVEPOINT*** (page 615)

SAVEPOINT

Creates a special mark, called a savepoint, inside a transaction. A savepoint allows all commands that are executed after it was established to be rolled back, restoring the transaction to the state it was in at the point in which the savepoint was established.

Tip: Savepoints are useful when creating nested transactions. For example, a savepoint could be created at the beginning of a subroutine. That way, the result of the subroutine could be rolled back if necessary.

Syntax

```
SAVEPOINT savepoint_name
```

Parameters

savepoint_name	Specifies the name of the savepoint to create.

Notes

- Savepoints are local to a transaction and can only be established when inside a transaction block.
- Multiple savepoints can be defined within a transaction.
- If a savepoint with the same name already exists, it is replaced with the new savepoint.

Example

The following example illustrates how a savepoint determines which values within a transaction can be rolled back. The values 102 and 103 that were entered after the savepoint, my_savepoint, was established are rolled back. Only the values 101 and 104 are inserted at commit.

```
=> INSERT INTO T1 (product_key) VALUES (101);
=> SAVEPOINT my_savepoint;
=> INSERT INTO T1 (product_key) VALUES (102);
=> INSERT INTO T1 (product_key) VALUES (103);
=> ROLLBACK TO SAVEPOINT my_savepoint;
=> INSERT INTO T1 (product_key) VALUES (104);
=> COMMIT;
=> SELECT product_key FROM T1;
--
101
104
(2 rows)
```

See Also

RELEASE SAVEPOINT (page 606) and ***ROLLBACK TO SAVEPOINT*** (page 614)

SELECT

Retrieves a result set from one or more tables.

Syntax

```
[ AT EPOCH LATEST ] | [ AT TIME 'timestamp' ]
SELECT [ ALL | DISTINCT ] ( expression [, ...] ) ] ]
... *
... | expression [ AS ] output_name ] [ , ... ]
... [ INTO (page 618) ]
... [ FROM (page 620) [, ...] ]
... [ WHERE (page 622) condition ]
... [ TIMESERIES (page 623) slice_time ]
... [ GROUP BY (page 626) expression [ , ... ] ]
... [ HAVING (page 628) condition [ , ... ] ]
... [ WINDOW window_name AS ( window_definition_clause ) [ ,... ] ]
... [ UNION (page 652) ]
... [ ORDER BY (page 629) expression [ ASC | DESC ] [ ,... ] ]
... [ LIMIT (page 631) { count | ALL } ]
... [ OFFSET (page 632) start ]
... [ FOR UPDATE [ OF table_name [ , ... ] ] ]
```

Parameters

AT EPOCH LATEST	Queries all data in the database up to but not including the current epoch without holding a lock or blocking write operations. See Snapshot Isolation for more information. AT EPOCH LATEST is ignored when applied to temporary tables (all rows are returned). By default, queries run under the READ COMMITTED isolation level, which means: ▪ AT EPOCH LATEST includes data from the latest committed DML transaction. ▪ Each epoch contains exactly one transaction—the one that modified the data. ▪ The Tuple Mover can perform moveout and mergeout operations on committed data immediately.
AT TIME *'timestamp'*	Queries all data in the database up to and including the epoch representing the specified date and time without holding a lock or blocking write operations. This is called a historical query. AT TIME is ignored when applied to temporary tables (all rows are returned).
*	Is equivalent to listing all columns of the tables in the FROM Clause. Vertica recommends that you avoid using SELECT * for performance reasons. An extremely large and wide result set can cause swapping.
DISTINCT	Removes duplicate rows from the result set (or group).The DISTINCT set quantifier must immediately follow the SELECT keyword. Only one DISTINCT keyword can appear in the select list.
expression	Forms the output rows of the SELECT statement. The expression can contain:

	▪ ***Column references*** (page 45) to columns computed in the FROM clause ▪ ***Literals*** (page 17) (constants) ▪ ***Mathematical operators*** (page 39) ▪ ***String concatenation operators*** (page 41) ▪ ***Aggregate expressions*** (page 43) ▪ ***CASE expressions*** (page 44) ▪ ***SQL functions*** (page 106)
output_name	Specifies a different name for an output column. This name is primarily used to label the column for display. It can also be used to refer to the column's value in ORDER BY and GROUP BY clauses, but not in the WHERE or HAVING clauses.
FOR UPDATE	Is most often used from READ COMMITTED isolation. When specified, the SELECT statement takes an X lock on all tables in the query. The FOR UPDATE keywords require update/delete permissions on the tables involved and cannot be issued from a read-only transaction. **Note:** Do not use FOR UPDATE on tables with unsegmented projections.

Example

When multiple clients run transactions like in the following example query, deadlocks can occur if FOR UPDATE is not used. Two transactions acquire an S lock, and when both attempt to upgrade to an X lock, they encounter deadlocks:

```
=> SELECT balance FROM accounts WHERE account_id=3476 FOR UPDATE; ...
=> UPDATE accounts SET balance = balance+10 WHERE account_id=3476;
=> COMMIT;
```

See Also

LOCKS (page 712)

Analytic Functions (page 120)

Using SQL Analytics and Using Time Series Analytics in the Programmer's Guide

Subqueries and Joins in the Programmer's Guide

INTO Clause

Creates a new table from the results of a query and fills it with data from the query.

Syntax

```
INTO [ { GLOBAL | LOCAL } { TEMPORARY | TEMP } ]
... [ TABLE ] table-name
... [ON COMMIT { PRESERVE | DELETE } ROWS ]
```

Parameters

GLOBAL	[Optional] Specifies that the table definition is visible to all sessions.
LOCAL	[Optional] Specifies that the table is visible only to the user who creates it for the duration of the session. When the session ends, the table definition is automatically dropped from the database catalogs.
TABLE	[Optional] Specifies that a table is to be created.
table-name	Specifies the name of the table to be created.
ON COMMIT { PRESERVE | DELETE } ROWS	[Optional] Specifies whether data is transaction- or session-scoped: ▪ DELETE marks a temporary table for transaction-scoped data. Vertica truncates the table (delete all its rows) after each commit. DELETE ROWS is the default. ▪ PRESERVE marks a temporary table for session-scoped data, which is preserved beyond the lifetime of a single transaction. Vertica truncates the table (delete all its rows) when you terminate a session.

Example

The following statement creates a table called newtable and fills it with the data from customer_dimension:

```
=> SELECT * INTO newtable FROM customer_dimension;
```

The following statement creates a temporary table called newtable and fills it with the data from customer_dimension:

```
=> SELECT * INTO temp TABLE newtable FROM customer_dimension;
```

The following example creates a local temporary table and inserts the contents from mytable into it:

```
=> SELECT * INTO LOCAL TEMP TABLE ltt FROM mytable;
   WARNING:  No rows are inserted into table "v_temp_schema"."ltt" because ON
COMMIT DELETE ROWS
   is the default for create temporary table
   HINT:  Use "ON COMMIT PRESERVE ROWS" to preserve the data in temporary table
   CREATE TABLE
```

See Also

Creating Temporary Tables in the Administrator's Guide

FROM Clause

Specifies one or more source tables from which to retrieve rows.

Syntax

```
FROM table-reference (on page 620) [ , ... ]
... [ subquery ] [AS] name ...
```

Parameters

table-reference	Is a ***table-primary*** (on page 620) or a ***joined-table*** (on page 621).

Example

The following example returns all records from the `customer_dimension` table:

```
=> SELECT * FROM customer_dimension
```

table-reference

Syntax

```
table-primary (on page 620) | joined-table (on page 621)
```

Parameters

table-primary	Specifies an optionally qualified table name with optional table aliases, column aliases, and outer joins.
joined-table	Specifies an outer join.

table-primary

Syntax

```
{ table-name [ AS ] alias
    [ ( column-alias [ , ...] ) ] [ , ...] ]
  | ( joined-table (on page 621) ) }
```

Parameters

table-name	Specifies a table in the logical schema. Vertica selects a suitable projection to use.
alias	Specifies a temporary name to be used for references to the table.
column-alias	Specifies a temporary name to be used for references to the column.
joined-table	Specifies an outer join.

joined-table

Syntax

table-reference join-type table-reference
ON *join-predicate* (on page 54)

Parameters

table-reference	Is a *table-primary* (page 620) or another *joined-table*.
join-type	Is one of the following: INNER JOIN LEFT [OUTER] JOIN RIGHT [OUTER] JOIN FULL [OUTER] JOIN
join-predicate	An equi-join based on one or more columns in the joined tables.

Notes

A query that uses INNER JOIN syntax in the FROM clause produces the same result set as a query that uses the WHERE clause to state the join-predicate. See Joins in the Programmer's Guide for more information.

WHERE Clause

Eliminates rows from the result table that do not satisfy one or more predicates.

Syntax

```
WHERE boolean-expression
     [ subquery ] ...
```

Parameters

boolean-expression	Is an expression that returns true or false. Only rows for which the expression is true become part of the result set.

The *boolean-expression* can include ***Boolean operators*** (on page 36) and the following elements:

- ***BETWEEN-predicate*** (on page 50)
- ***Boolean-predicate*** (on page 51)
- ***Column-value-predicate*** (on page 52)
- ***IN-predicate*** (on page 53)
- ***Join-predicate*** (on page 54)
- ***LIKE-predicate*** (on page 55)
- ***NULL-predicate*** (on page 59)

Notes

You can use parentheses to group expressions, predicates, and boolean operators. For example:

```
=> ... WHERE NOT (A=1 AND B=2) OR C=3;
```

Example

The following example returns the names of all customers in the Eastern region whose name starts with 'Amer'. Without the WHERE clause filter, the query returns *all* customer names in the customer_dimension table.

```
=> SELECT DISTINCT customer_name
   FROM customer_dimension
   WHERE customer_region = 'East'
   AND customer_name ILIKE 'Amer%';
 customer_name
---------------
 Americare
 Americom
 Americore
 Americorp
 Ameridata
 Amerigen
 Amerihope
 Amerimedia
 Amerishop
 Ameristar
```

```
 Ameritech
(11 rows)
```

TIMESERIES Clause

Provides gap-filling and interpolation (GFI) computation, an important component of time series analytics computation. See Using Time Series Analytics in the Programmer's Guide for details and examples.

Syntax

```
TIMESERIES slice_time AS 'length_and_time_unit_expression' OVER (
... [ PARTITION BY expression [ , ... ] ] ORDER BY time_expression )
... [ ORDER BY table_column [ , ... ] ]
```

Parameters

slice_time	A time column produced by the TIMESERIES clause, which stores the time slice start times generated from gap filling. Note: This parameter is an alias, so you can use any name that an alias would take.
'length_and_time_unit_expression'	The length of time unit of time slice computation; for example, `TIMESERIES slice_time AS '3 seconds' ...`
`OVER()`	Specifies partitioning and ordering for the function. OVER() also specifies that the time series function operates on a query result set (the rows that are returned after the FROM, WHERE, GROUP BY, and HAVING clauses have been evaluated).
`PARTITION BY`	Partitions the data by expressions (*column1 ..., column_n, slice_time*).
expression	Expressions on which to partition the data, where each partition is sorted by *time_expression*. Gap filling and interpolation is performed on each partition separately.
`ORDER BY`	Sorts the data by *time_expression*.
time_expression	An expression that computes the time information of the time series data. The *time_expression* can be TIMESTAMP data type only.

Notes

If the `window_partition_clause` is not specified in TIMESERIES OVER(), for each defined time slice, exactly one output record is produced; otherwise, one output record is produced per partition per time slice. Interpolation is computed there.

Given a query block that contains a TIMESERIES clause, the following are the semantic phases of execution (after evaluating the FROM and the optional WHERE clauses):

1 Compute *time_expression.*

2 Perform the same computation as the TIME_SLICE() function on each input record based on the result of *time_expression* and '*length_and_time_unit_expression'*.

1. Perform gap filling to generate time slices missing from the input.

2. Name the result of this computation as *slice_time*, which represents the generated "time series" column (alias) after gap filling.

3 Partition the data by *expression*, *slice_time*. For each partition, do step 4.

4 Sort the data by *time_expression*. Interpolation is computed here.

There is semantic overlap between the TIMESERIES clause and the ***TIME_SLICE*** (page 205) function with the following key differences:

- Unlike TIME_SLICE, the time slice length and time unit expressed in *length_and_time_unit_expr* must be constants in order that gaps in the time slices be well-defined.
- TIMESERIES performs gap filling; the TIME_SLICE function does not.
- TIME_SLICE can return the start or end time of a time slice, depending on the value of its fourth input parameter (*start_or_end*). TIMESERIES, on the other hand, always returns the start time of each time slice. To output the end time of each time slice, you can write a SELECT statement like the following:

  ```
  SELECT slice_time + <slice_length>;
  ```

Restrictions

- When the TIMESERIES clause occurs in a SQL query block, only SELECT, FROM, WHERE, and ORDER BY clauses can be used in that same query block. GROUP BY and HAVING clauses are not allowed.

  If a GROUP BY operation is needed before or after gap-filling and interpolation (GFI), use a subquery and place the GROUP BY In the outer query. For example:

  ```
  => SELECT symbol, AVG(first_bid) as avg_bid FROM ( SELECT symbol,
     slice_time, TS_FIRST_VALUE(bid1) AS first_bid
          FROM Tickstore
          WHERE symbol IN ('MSFT', 'IBM')
          TIMESERIES slice_time AS '5 seconds' OVER (PARTITION BY symbol
     ORDER BY ts)
          ) AS resultOfGFI
  GROUP BY symbol;
  ```

- When the TIMESERIES clause is present in the SQL query block, only time series aggregate functions (such as ***TS_FIRST_VALUE*** (page 314) and ***TS_LAST_VALUE*** (page 316)), the slice_time column, PARTITION BY expressions, and ***TIME_SLICE*** (page 205) are allowed in the SELECT list. For example, the following two queries would return a syntax error because bid1 was not a PARTITION BY or GROUP BY column:

  ```
  => SELECT bid, symbol, TS_FIRST_VALUE(bid) FROM Tickstore
     TIMESERIES slice_time AS '5 seconds' OVER (PARTITION BY symbol ORDER
     BY ts);
     ERROR:  column "Tickstore.bid" must appear in the PARTITION BY list
     of Timeseries clause or be used in a Timeseries Output function
  => SELECT bid, symbol, AVG(bid) FROM Tickstore GROUP BY symbol;
     ERROR:  column "Tickstore.bid" must appear in the GROUP BY clause or
     be used in an aggregate function
  ```

- If you use the analytic OVER(***window_order_clause*** (page 123)), you can order the data by a TIMESTAMP column only, not by, for example, an INTEGER column.

Examples

See Gap Filling and Interpolation (GFI) in the Programmer's Guide.

See Also

TIME_SLICE (page 205), ***TS_FIRST_VALUE*** (page 314), and ***TS_LAST_VALUE*** (page 316)

Using Time Series Analytics in the Programmer's Guide

GROUP BY Clause

Divides a query result set into sets of rows that match an expression.

Syntax

```
GROUP BY expression [ ,... ]
```

Parameters

expression	Is any expression including constants and ***references to columns*** (see "***Column References***" on page 45) in the tables specified in the FROM clause. For example: `column1, ..., column_n, aggregate_function (expression)`

Notes

- The *expression* cannot include ***aggregate functions*** (page 107); however, the GROUP BY clause is often used with ***aggregate functions*** (page 107) to return summary values for each group.
- The GROUP BY clause without aggregates is similar to using SELECT DISTINCT. For example, the following two queries are equal:

  ```
  SELECT DISTINCT household_id from customer_dimension;
   SELECT household_id from customer_dimension GROUP BY household_id;
  ```
- All non-aggregated columns in the SELECT list must be included in the GROUP BY clause.
- Using the WHERE clause with the GROUP BY clause is useful in that all rows that do not satisfy the WHERE clause conditions are eliminated before any grouping operations are computed.
- The GROUP BY clause does not order data. If you want to sort data a particular way, place the ***ORDER BY clause*** (page 629) after the GROUP BY clause.

Examples

In the following example, the WHERE clause filters out all employees whose last name does not begin with S. The GROUP BY clause returns the groups of last names that begin with S, and the SUM aggregate function computes the total vacation days for each group.

```
=> SELECT employee_last_name, SUM(vacation_days)
   FROM employee_dimension
   WHERE employee_last_name ILIKE 'S%'
   GROUP BY employee_last_name;
 employee_last_name | SUM
--------------------+------
 Sanchez            | 2892
 Smith              | 2672
 Stein              | 2660
(3 rows)
=> SELECT vendor_region, MAX(deal_size) as "Biggest Deal"
   FROM vendor_dimension
   GROUP BY vendor_region;
 vendor_region | Biggest Deal
```

```
---------------+--------------
 East          |       990889
 MidWest       |       699163
 NorthWest     |        76101
 South         |       854136
 SouthWest     |       609807
 West          |       964005
(6 rows)
```

The only difference between the following query and the one before it is the HAVING clause filters the groups to deal sizes greater than $900,000:

```
=> SELECT vendor_region, MAX(deal_size) as "Biggest Deal"
   FROM vendor_dimension
   GROUP BY vendor_region
   HAVING MAX(deal_size) > 900000;
 vendor_region | Biggest Deal
---------------+--------------
 East          |       990889
 West          |       964005
(2 rows)
```

HAVING Clause

Restricts the results of a ***GROUP BY clause*** (page 626).

Syntax

```
HAVING condition [, ...]
```

Parameters

condition	Must unambiguously reference a grouping column, unless the reference appears within an aggregate function

Notes

- Semantically the having clause occurs after the group by operation.
- You can use expressions in the HAVING clause.
- The HAVING clause was added to the SQL standard because you cannot use WHERE with ***aggregate functions*** (page 107).

Example

The following example returns the employees with salaries greater than $50,000:

```
=> SELECT employee_last_name, MAX(annual_salary) as "highest_salary"
   FROM employee_dimension
   GROUP BY employee_last_name
   HAVING MAX(annual_salary) > 50000;
 employee_last_name | highest_salary
--------------------+----------------
 Bauer              |         920149
 Brown              |         569079
 Campbell           |         649998
 Carcetti           |         195175
 Dobisz             |         840902
 Farmer             |         804890
 Fortin             |         481490
 Garcia             |         811231
 Garnett            |         963104
 Gauthier           |         927335
(10 rows)
```

ORDER BY Clause

Sorts a query result set on one or more columns.

Syntax

```
ORDER BY expression [ ASC | DESC ] [, ...]
```

Parameters

expression	Can be: ▪ The name or ***ordinal number*** (***http://en.wikipedia.org/wiki/Ordinal_number***) of a SELECT list item ▪ An arbitrary expression formed from columns that do not appear in the SELECT list ▪ A ***CASE*** (page 44) expression

Notes

- The ordinal number refers to the position of the result column, counting from the left beginning at one. This makes it possible to order by a column that does not have a unique name. (You can assign a name to a result column using the AS clause.)
- Vertica uses the ASCII collating sequence to store data and to compare character strings. The ordering varies by collation.
- For INTEGER, INT, and DATE/TIME data types, NULL appears first (smallest) in ascending order.
- For FLOAT, BOOLEAN, CHAR, and VARCHAR, NULL appears last (largest) in ascending order.

Example

The follow example returns all the city and deal size for customer Metamedia, sorted by deal size in descending order.

```
=> SELECT customer_city, deal_size
   FROM customer_dimension
   WHERE customer_name = 'Metamedia'
   ORDER BY deal_size DESC;
  customer_city   | deal_size
------------------+-----------
 El Monte         |   4479561
 Athens           |   3815416
 Ventura          |   3792937
 Peoria           |   3227765
 Arvada           |   2671849
 Coral Springs    |   2643674
 Fontana          |   2374465
 Rancho Cucamonga |   2214002
 Wichita Falls    |   2117962
 Beaumont         |   1898295
 Arvada           |   1321897
```

```
 Waco             |   1026854
 Joliet           |    945404
 Hartford         |    445795
(14 rows)
```

LIMIT Clause

Specifies the maximum number of result set rows to return.

Syntax

```
LIMIT { rows | ALL }
```

Parameters

rows	Specifies the maximum number of rows to return
ALL	Returns all rows (same as omitting LIMIT)

Notes

When both LIMIT and ***OFFSET*** (page 632) are used, Vertica skips the specified number of rows before it starts to count the rows to be returned.

You can use LIMIT without an ***ORDER BY clause*** (page 629) that includes all columns in the select list, but the query could produce nondeterministic results.

Nondeterministic: Omits the ORDER BY clause and returns *any* five records from the customer_dimension table:

```
=> SELECT customer_city
   FROM customer_dimension
   LIMIT 5;
 customer_city
---------------
 Baltimore
 Nashville
 Allentown
 Clarksville
 Baltimore
(5 rows)
```

Deterministic: Specifies the ORDER BY clause:

```
=> SELECT customer_city
   FROM customer_dimension
   ORDER BY customer_city
   LIMIT 5;
 customer_city
---------------
 Abilene
 Abilene
 Abilene
 Abilene
 Abilene
(5 rows)
```

OFFSET Clause

Omits a specified number of rows from the beginning of the result set.

Syntax

```
OFFSET rows
```

Parameters

rows	specifies the number of result set rows to omit.

Notes

- When both ***LIMIT*** (page 631) and OFFSET are specified, specified number of rows are skipped before starting to count the rows to be returned.
- When using OFFSET, use an ***ORDER BY clause*** (page 629). Otherwise the query returns an undefined subset of the result set.

Example

The following example is similar to the the example used in the ***LIMIT clause*** (page 631). If you want to see just records 6-10, however, use the OFFSET clause to skip over the first five cities:

```
=> SELECT customer_city
   FROM customer_dimension
   WHERE customer_name = 'Metamedia'
   ORDER BY customer_city
   OFFSET 5;
  customer_city
-----------------
 El Monte
 Fontana
 Hartford
 Joliet
 Peoria
 Rancho Cucamonga
 Ventura
 Waco
 Wichita Falls
(9 rows)
```

The following are the results without the OFFSET clause:

```
  customer_city
-----------------
 Arvada
 Arvada
 Athens
 Beaumont
 Coral Springs
 El Monte
 Fontana
 Hartford
 Joliet
```

```
 Peoria
 Rancho Cucamonga
 Ventura
 Waco
 Wichita Falls
(14 rows)
```

SET

Sets one of several run-time parameters.

Syntax

```
SET run-time-parameter
```

Parameters

run-time-parameter	Is one of the following: ▪ ***DATESTYLE*** (page 634) ▪ ***ESCAPE_STRING_WARNING*** (page 635) ▪ ***INTERVALSTYLE*** (page 635) ▪ ***LOCALE*** (page 636) ▪ ***SEARCH_PATH*** (page 639) ▪ ***SESSION CHARACTERISTICS*** (page 641) ▪ ***SESSION MEMORYCAP*** (page 642) ▪ ***SESSION RESOURCE POOL*** (page 643) ▪ ***SESSION RUNTIMECAP*** (page 643) ▪ ***SESSION TEMPSPACECAP*** (page 645) ▪ ***STANDARD_CONFORMING_STRINGS*** (page 646) ▪ ***TIME ZONE*** (page 647)

Notes

For syntax, usage notes, and examples, click the links in the above table.

DATESTYLE

Changes the DATESTYLE run-time parameter for the current session.

Syntax

```
SET DATESTYLE TO { value | 'value' } [ ,... ]
```

Parameters

The DATESTYLE parameter can have multiple, non-conflicting values:

Value	Interpretation	Example
MDY	month-day-year	12/17/2007
DMY	day-month-year	17/12/2007
YMD	year-month-day	2007-12-17
ISO	ISO 8601/SQL standard (default)	2007-12-17 07:37:16-08
SQL	traditional style	12/17/2007 07:37:16.00 PST
GERMAN	regional style	17.12.2007 07:37:16.00 PST

In the SQL style, day appears before month if DMY field ordering has been specified, otherwise month appears before day. (See ***Date/Time Literals*** (page 27) for how this setting also affects interpretation of input values.) The table below shows an example.

DATESTYLE	Input Ordering	Example Output
SQL, DMY	day/month/year	17/12/2007 15:37:16.00 CET
SQL, MDY	month/day/year	12/17/2007 07:37:16.00 PST

Notes

- The SQL standard requires the use of the ISO 8601 format. The name of the "SQL" output format is a historical accident.
- INTERVAL output looks like the input format, except that units like CENTURY or WEEK are converted to years and days and AGO is converted to an appropriate sign. In ISO mode the output looks like
  [*quantity unit* [...]] [*days*] [*hours*:*minutes*:*seconds*]
- The ***SHOW*** (page 650) command displays the run-time parameters.

Example

```
=> SET DATESTYLE TO SQL, MDY;
=> SHOW DATESTYLE;
   name     | setting
------------+----------
 datestyle | ISO, MDY
```

```
(1 row)
```

ESCAPE_STRING_WARNING

Issues a warning when a backslash is used in a string literal during the current session.

Syntax

```
SET ESCAPE_STRING_WARNING TO { ON | OFF }
```

Parameters

ON	[Default] Issues a warning when a back slash is used in a string literal. **Tip:** Organizations that have upgraded from earlier versions of Vertica can use this as a debugging tool for locating backslashes that used to be treated as escape characters, but are now treated as literals.
OFF	Ignores back slashes within string literals.

Notes

- This statement works under vsql only.
- Turn off standard conforming strings before you turn on this parameter.

Tip: To set escape string warnings across all sessions, use the EscapeStringWarnings configuration parameter. See the Internationalization Parameters in the Administrator's Guide.

Examples

The following example shows how to turn OFF escape string warnings for the session.

```
=> SET ESCAPE_STRING_WARNING TO OFF;
```

See Also

STANDARD_CONFORMING_STRINGS (page 646)

INTERVALSTYLE

Changes the INTERVALSTYLE run-time parameter for the current session.

Syntax

```
SET INTERVALSTYLE TO [ plain | units (see "interval-literal" on page 30) ]
```

Parameters

plain	[Default] Returns no units on output. When interval units are enabled, their format is controlled by ***DATESTYLE*** (page 634)

units	Returns units on output.

Notes

- Use the ***SHOW*** (page 650) command displays the run-time parameters.
- When units are enabled, their format is controlled by ***DATESTYLE*** (page 634). If you are expecting units on output but not seeing them, issue the SHOW DATESTYLE command. DATESTYLE must be set to ISO for INTERVAL to display units on output.

Examples

The following command sets the INTERVALSTYLE to show units on output:

```
=> SET INTERVALSTYLE TO UNITS;
 SET
=> SELECT INTERVAL '3 2' DAY TO HOUR;
   ?column?
--------------
 3 days 02:00
(1 row)
```

The following command sets the INTERVALSTYLE to no units on output:

```
=> SET INTERVALSTYLE TO PLAIN;
 SET
=> SELECT INTERVAL '3 2' DAY TO HOUR;
 ?column?
----------
 3 02
(1 row)
```

Use the ***SHOW*** (page 650) command to display the run-time parameters:

```
=> SHOW INTERVALSTYLE;
     name      | setting
---------------+---------
 intervalstyle | plain
(1 row)
```

See Also

INTERVAL (page 70)

LOCALE

Specifies the locale for the current session.

Syntax

SET LOCALE TO < *ICU-locale-identifier* >

Parameters

< *ICU-locale-identifier* >	Specifies the ICU locale identifier to use. By default, the locale for the database is en_US@collation=binary

	(English as in the United States of America). ICU Locales were developed by the ICU Project. See the ICU User Guide (http://userguide.icu-project.org/locale) for a complete list of parameters that can be used to specify a locale. **Note:** The only keyword Vertica supports is the COLLATION keyword.

Notes

Though not inclusive, the following are some commonly-used locales:

- German (Germany) `de_DE`
- English (Great Britain) `en_GB`
- Spanish (Spain) `es_ES`
- French (France) `fr_FR`
- Portuguese (Brazil) `pt_BR`
- Portuguese (Portugal) `pt_PT`
- Russian (Russia) `ru_RU`
- Japanese (Japan) `ja_JP`
- Chinese (China, simplified Han) `zh_CN`
- Chinese (Taiwan, traditional Han) `zh_Hant_TW`

Session related:

- The locale setting is session scoped and applies to queries only (no DML/DDL) run in that session. You cannot specify a locale for an individual query.
- The default locale for new sessions can be set using a configuration parameter

Query related:

The following restrictions apply when queries are run with locale other than the default en_US@collation=binary:

- Multicolumn NOT IN subqueries are not supported when one or more of the left-side NOT IN columns is of CHAR or VARCHAR data type. For example:

```
=> CREATE TABLE test (x VARCHAR(10), y INT);
=> SELECT ... FROM test WHERE (x,y) NOT IN (SELECT ...);
   ERROR: Multi-expression NOT IN subquery is not supported because a
  left hand expression could be NULL
```

  Note: An error is reported even if columns `test.x` and `test.y` have a "NOT NULL" constraint.

- Correlated HAVING clause subqueries are not supported if the outer query contains a GROUP BY on a CHAR or a VARCHAR column. In the following example, the `GROUP BY x` in the outer query causes the error:

```
=> DROP TABLE test CASCADE;
=> CREATE TABLE test (x VARCHAR(10));
```

```
=> SELECT COUNT(*) FROM test t GROUP BY x HAVING x IN (SELECT x FROM test
   WHERE t.x||'a' = test.x||'a' );
   ERROR: subquery uses ungrouped column "t.x" from outer query
```

- Subqueries that use analytic functions in the HAVING clause are not supported. For example:

```
=> DROP TABLE test CASCADE;
=> CREATE TABLE test (x VARCHAR(10));
=> SELECT MAX(x)OVER(PARTITION BY 1 ORDER BY 1)
   FROM test GROUP BY x HAVING x IN (
     SELECT MAX(x) FROM test);
   ERROR: Analytics query with having clause expression that involves
   aggregates
   and subquery is not supported
```

- The operators LIKE/ILIKE do not currently respect UTF-8 character boundaries. Therefore, expressions such as 'SS' LIKE 'ß' and 'SS' ILIKE 'ß' always return false even in locales where 'SS' = 'ß' return true.

DML/DDL related:

- SQL identifiers (such as table names, column names, and so on) are restricted to ASCII characters. For example, the following CREATE TABLE statement fails because it uses the non-ASCII ß in the table name:

```
=> CREATE TABLE straße(x int, y int);
   ERROR:  Non-ASCII characters are not supported in names
```

- Projection sort orders are made according to the default en_US@collation=binary collation. Thus, regardless of the session setting, issuing the following command creates a projection sorted by `col1` according to the binary collation:

```
=> CREATE PROJECTION p1 AS SELECT * FROM table1 ORDER BY col1;
```

  Note that in such cases, `stra`ße and strasse would not be near each other on disk.

  Sorting by binary collation also means that sort optimizations do not work in locales other than binary. Vertica returns the following warning if you create tables or projections in a non-binary locale:

```
WARNING:  Projections are always created and persisted in the default
Vertica locale. The current locale is de_DE
```

- When creating pre-join projections, the projection definition query does not respect the locale or collation setting. This means that when you insert data into the fact table of a pre-join projection, referential integrity checks are not locale or collation aware.

  For example:

```
\locale LDE_S1    -- German
=> CREATE TABLE dim (col1 varchar(20) primary key);
=> CREATE TABLE fact (col1 varchar(20) references dim(col1));
=> CREATE PROJECTION pj AS SELECT * FROM fact JOIN dim ON fact.col1 =
   dim.col1 UNSEGMENTED ALL NODES;
=> INSERT INTO dim VALUES('ß');
=> COMMIT;
```

  The following INSERT statement fails with a "nonexistent FK" error even though 'ß' is in the dim table, and in the German locale 'SS' and 'ß' refer to the same character.

```
=> INSERT INTO fact VALUES('SS');
   ERROR:  Nonexistent foreign key value detected in FK-PK join (fact
   x dim)
   using subquery and dim_node0001; value SS
=> => ROLLBACK;
=> DROP TABLE dim, fact CASCADE;
```

- When the locale is non-binary, the collation function is used to transform the input to a binary string which sorts in the proper order.

  This transformation increases the number of bytes required for the input according to this formula:

  ```
  result_column_width = input_octet_width * CollationExpansion + 4
  ```

  CollationExpansion defaults to 5 and should be changed only under the supervision of Vertica ***Technical Support*** (on page 1).
- CHAR fields are displayed as fixed length, including any trailing spaces. When CHAR fields are processed internally, they are first stripped of trailing spaces. For VARCHAR fields, trailing spaces are usually treated as significant characters; however, trailing spaces are ignored when sorting or comparing either type of character string field using a non-BINARY locale.

Examples

This example sets the locale for the session to en_GB (English as in Great Britain).

```
SET LOCALE TO en_GB;
SET LOCALE TO en_GB;
INFO:  Locale: 'en_GB'
INFO:    English (United Kingdom)
INFO:  Short form: 'LEN'
```

You can also use the short form of a locale in this command:

```
SET LOCALE TO LEN;
INFO:  Locale: 'en'
INFO:    English
INFO:  Short form: 'LEN'
```

See Also

Implement Locales for International Data Sets and Appendix: Locales in the Administrator's Guide

SEARCH_PATH

Specifies the order in which Vertica searches schemas when a SQL statement contains an unqualified table name.

Vertica provides the SET search_path statement instead of the CURRENT_SCHEMA statement found in some other databases.

Syntax

```
SET SEARCH_PATH TO schemaname [ , ... ]
```

Parameters

schemaname	A comma-delimited list of schemas that indicates the order in which Vertica searches schemas when a SQL statement contains an unqualified table name. The default value for this parameter is '"$user", public' Where: ▪ $User is the schema with the same name as the current user. If the schema does not exist, $User is ignored. ▪ public is the public database. Public is ignored if there is no schema named 'public'.

Notes

The first schema named in the search path is called the current schema. The current schema is the first schema that Vertica searches. It is also the schema in which new tables are created if the ***CREATE TABLE*** (page 546) command does not specify a schema name.

Restrictions

None

Examples

The following example shows the current search path settings:

```
=> SHOW SEARCH_PATH;
    name     |                       setting
-------------+-------------------------------------------------
 search_path | "$user", public, v_catalog, v_monitor, v_internal
(1 row)
```

The following example sets the order in which Vertica searches schemas to T1, U1, and V1:

```
=> SET SEARCH_PATH TO T1, U1, V1;
```

SESSION CHARACTERISTICS

Sets the transaction characteristics for subsequent transactions of a user session. These are the isolation level and the access mode (read/write or read-only).

Syntax

```
SET SESSION CHARACTERISTICS AS
... TRANSACTION ISOLATION LEVEL {
... SERIALIZABLE
... | REPEATABLE READ
... | READ COMMITTED
... | READ UNCOMMITTED }
... { READ WRITE | READ ONLY }
```

Parameters

Isolation levels, described in the following table, determines what data the transaction can access when other transactions are running concurrently. It does not apply to temporary tables. The isolation level cannot be changed after the first query (`SELECT`) or DML statement (`INSERT`, `DELETE`, `UPDATE`) of a transaction has been run. A transaction retains its isolation level until it completes, even if the session's transaction isolation level has changed mid-transaction. Vertica internal processes (such as the Tuple Mover and Refresh operations) and DDL operations are run at `SERIALIZABLE` isolation to ensure consistency.

`SERIALIZABLE`	Provides the strictest level of SQL transaction isolation. This level emulates transactions run one after another, serially, rather than concurrently. It holds locks and blocks write operations and is thus not recommended for normal query operations.
`REPEATABLE READ`	Is automatically converted to SERIALIZABLE by Vertica.
`READ COMMITTED`	(Default) Allows concurrent transactions. Use READ COMMITTED isolation or Snapshot Isolation for normal query operations but be aware that there is a subtle difference between them. (See section below this table.)
`READ UNCOMMITTED`	Is automatically converted to READ COMMITTED by Vertica.
`READ WRITE` `READ ONLY`	Determines whether the transaction is read/write or read-only. Read/write is the default. When a transaction is read-only, the following SQL commands are disallowed: INSERT, UPDATE, DELETE, and COPY if the table they would write to is not a temporary table; all CREATE, ALTER, and DROP commands; GRANT, REVOKE, and EXPLAIN if the command it would run is among those listed. This is a high-level notion of read-only that does not prevent all writes to disk.

READ COMMITTED vs. Snapshot Isolation

By itself, AT EPOCH LATEST produces purely historical query behavior. However, with READ COMMITTED, SELECT queries return the same result set as AT EPOCH LATEST plus any changes made by the current transaction.

This is standard ANSI SQL semantics for ACID transactions. Any select query within a transaction sees the transactions's own changes regardless of isolation level.

Notes

- SERIALIZABLE isolation does not apply to temporary tables, which are isolated by their transaction scope.
- Applications using SERIALIZABLE must be prepared to retry transactions due to serialization failures.

Example

```
=> SET SESSION CHARACTERISTICS AS TRANSACTION ISOLATION LEVEL SERIALIZABLE;
SET
```

SESSION MEMORYCAP

Specifies a limit on the amount of memory that any request issued by the session can consume.

Syntax

```
SET SESSION MEMORYCAP 'memory-limit' | = default
```

Parameters

memory-limit | = default	The maximum amount of memory the session can use. To set a value, supply number followed by a unit. Units can be one of the following: ▪ % percentage of total memory available to the Resource Manager. (In this case, size must be 0-100). ▪ K Kilobytes ▪ M Megabytes ▪ G Gigabytes ▪ T Terabytes If you use the value = default the session's `MEMORYCAP` is set to the user's `MEMORYCAP` value.

Notes

- This command requires superuser privileges if the MEMORYCAP is being increased over the user's MEMORYCAP limit (see ***CREATE USER*** (page 576) for details).
- Non-superusers can change this value to anything below or equal to their MEMORYCAP limit.

Example

The following command sets a memorycap of 4 gigabytes on the session:

```
=> SET SESSION MEMORYCAP '4G';
```

To return the memorycap to the previous setting:

```
=> SET SESSION MEMORYCAP NONE;
=> SHOW MEMORYCAP;
   name    |  setting
-----------+-----------
 memorycap | UNLIMITED
(1 row)
```

See Also

ALTER RESOURCE POOL (page 481)

CREATE RESOURCE POOL (page 531)

CREATE USER (page 576)

DROP RESOURCE POOL (page 586)

SET SESSION RESOURCE POOL (page 643)

Managing Workloads in the Administrator's Guide

SESSION RESOURCE POOL

Associates the user session with the specified resource pool.

Syntax

```
SET SESSION RESOURCE POOL pool-name | = default
```

Parameters

pool-name | = default	Specifies the name of the resource pool to be associated with session. If you use the value = default, then the session's resource pool is set to the default resource pool for the user.

Notes

- The pool must have been created beforehand.
- This command requires non-superusers to have usage privileges for the resource pool.
- Superusers can assign their session to any resource pool they want.

See Also

ALTER RESOURCE POOL (page 481)

CREATE RESOURCE POOL (page 531)

CREATE USER (page 576)

DROP RESOURCE POOL (page 586)

GRANT (Resource Pool) (page 598)

SET SESSION MEMORYCAP (page 642)

Managing Workloads in the Administrator's Guide

SESSION RUNTIMECAP

Sets the maximum amount of time a session's query can run.

Syntax

```
SET SESSION RUNTIMECAP [ 'duration' | NONE | = default ]
```

Parameters

'duration' | NONE | DEFAULT	One of three values: ▪ An interval such as `'1 minute'` or `'100 seconds'` (see ***Interval Values*** (page 29) for a full explanation) setting the maximum amount of time this session's queries should be allowed to run. ▪ `NONE` which eliminates any limit on the amount of time the session's queries can run (the default value). ▪ `= default` which sets the session's RUNTIMECAP to the user's RUNTIMECAP value.

Notes

- The largest allowable RUNTIMECAP value is 1 year (365 days).
- This command requires superuser privileges if the RUNTIMECAP is being increased over the user's RUNTIMECAP limit.
- Normal users can change the RUNTIMECAP of their own sessions to any value below their own RUNTIMECAP. They cannot increase the RUNTIMECAP beyond any limit set for them by the superuser.
- The timeout is not precise, so a query may run a little longer than the value set in RUNTIMECAP.
- Queries that violate the RUNTIMECAP are terminated with the error message `Execution time exceeded run time cap`.

Example

The following command sets the session's runtimecap to 10 minutes:

```
=> SET SESSION RUNTIMECAP '10 minutes';
```

To return the RUNTIMECAP to the user's default setting:

```
=> SET SESSION RUNTIMECAP DEFAULT;
SET
=> SHOW RUNTIMECAP;
    name    |  setting
------------+-----------
 runtimecap | UNLIMITED
(1 row)
```

See Also

CREATE USER (page 576)

ALTER USER (page 494)

Managing Workloads in the Administrator's Guide

SESSION TEMPSPACECAP

Sets the maximum amount of temporary file storage space that any request issued by the session can consume.

Syntax

```
SET SESSION TEMPSPACECAP 'space-limit' | = default | NONE
```

Parameters

'space-limit'	The maximum amount of temporary file space the session can use. To set a limit, use a numeric value followed by a unit (for example: '10G'). The unit can be one of the following: ▪ % percentage of total temporary storage space available. (In this case, the numeric value must be 0-100). ▪ K Kilobytes ▪ M Megabytes ▪ G Gigabytes ▪ T Terabytes Setting this value to `= default` sets the session's TEMPSPACECAP to the user's TEMPSPACECAP value. Setting this value to `NONE` results in the session having unlimited temporary storage space. This is the default value.

Notes

- This command requires superuser privileges to increase the TEMPSPACECAP over the user's TEMPSPACECAP limit.
- Regular users can change the TEMPSPACECAP associated with their own sessions to any value less than or equal to their own TEMPSPACECAP. They cannot increase its value beyond their own TEMPSPACECAP value.
- Any execution plan that exceeds its TEMPSPACECAP usage results in the error:
  `ERROR: Exceeded temp space cap.`

Example

The following command sets a TEMPSPACECAP of 20gigabytes on the session:

```
=> SET SESSION TEMPSPACECAP '20G';
SET
=> SHOW TEMPSPACECAP;
     name     | setting
--------------+----------
 tempspacecap | 20971520
(1 row)
```

Note: SHOW displays the TEMPSPACECAP in kilobytes.

To return the memorycap to the previous setting:

```
=> SET SESSION TEMPSPACECAP NONE;
SET
=> SHOW TEMPSPACECAP;
     name     |  setting
--------------+-----------
 tempspacecap | UNLIMITED
(1 row)
```

See Also

ALTER USER (page 494)

CREATE USER (page 576)

Managing Workloads in the Administrator's Guide

STANDARD_CONFORMING_STRINGS

Treats backslashes as escape characters for the current session.

Syntax

```
SET STANDARD_CONFORMING_STRINGS TO { ON | OFF }
```

Parameters

ON	Makes ordinary string literals ('...') treat back slashes (\) literally. This means that back slashes are treated as string literals, not escape characters. (This is the default.)
OFF	Treats back slashes as escape characters.

Notes

- This statement works under vsql only.
- When standard conforming strings are on, Vertica supports SQL-2008 string literals within Unicode escapes.
- Standard conforming strings must be ON to use Unicode-style string literals (`U&'\nnnn'`).

TIP: To set conforming strings across all sessions (permanently), use the `StandardConformingStrings` as described in Internationalization Parameters in the Administrator's Guide.

Examples

The following example shows how to turn off conforming strings for the session.

```
=> SET STANDARD_CONFORMING_STRINGS TO OFF;
```

The following command lets you verify the settings:

```
=> SHOW STANDARD_CONFORMING_STRINGS;
            name             | setting
-----------------------------+---------
 standard_conforming_strings | off
```

```
(1 row)
```

The following example shows how to turn on conforming strings for the session.

```
=> SET STANDARD_CONFORMING_STRINGS TO ON;
```

See Also

ESCAPE_STRING_WARNING (page 635)

TIME ZONE

Changes the TIME ZONE run-time parameter for the current session.

Syntax

```
SET TIME ZONE TO { value | 'value' }
```

Parameters

value	Is one of the following: ▪ One of the time zone names specified in the tz database, as described in ***Sources for Time Zone and Daylight Saving Time Data http://www.twinsun.com/tz/tz-link.htm***. ***Time Zone Names for Setting TIME ZONE*** (page 648) listed in the next section are for convenience only and could be out of date. ▪ A signed integer representing an offset from UTC in hours ▪ An ***interval value*** (page 29)

Notes

- TIME ZONE is a synonym for TIMEZONE. Both are allowed in Vertica syntax.
- The built-in constants LOCAL and DEFAULT, which set the time zone to the one specified in the TZ environment variable or, if TZ is undefined, from the operating system time zone. See Set the Default Time Zone and Using Time Zones with Vertica in the Installation Guide.
- When using a Country/City name, do not omit the country or the city. For example:
  ```
  SET TIME ZONE TO 'Africa/Cairo'; -- valid
  SET TIME ZONE TO 'Cairo'; -- invalid
  ```
- Include the required keyword TO.
- Positive integer values represent an offset east from UTC.
- The ***SHOW*** (page 650) command displays the run-time parameters.

Examples

```
=> SET TIME ZONE TO DEFAULT;
=> SET TIME ZONE TO 'PST8PDT'; -- Berkeley, California
=> SET TIME ZONE TO 'Europe/Rome'; -- Italy
=> SET TIME ZONE TO '-7'; -- UDT offset equivalent to PDT
=> SET TIME ZONE TO INTERVAL '-08:00 HOURS';
```

See Also

Using Time Zones with Vertica in the Installation Guide

Time Zone Names for Setting TIME ZONE

The following time zone names are recognized by Vertica as valid settings for the SQL time zone (the TIME ZONE run-time parameter).

Note: The names listed here are for convenience only and could be out of date. Refer to the ***Sources for Time Zone and Daylight Saving Time Data http://www.twinsun.com/tz/tz-link.htm*** page for precise information.

These names are not the same as the names shown in `/opt/<DBMS_LOWERCASE/share/timezonesets`, which are recognized by Vertica in date/time input values. The TIME ZONE names shown below imply a local daylight-savings time rule, where date/time input names represent a fixed offset from UTC.

In many cases there are several equivalent names for the same zone. These are listed on the same line. The table is primarily sorted by the name of the principal city of the zone.

In addition to the names listed in the table, Vertica accepts time zone names of the form *STDoffset* or *STDoffsetDST*, where *STD* is a zone abbreviation, *offset* is a numeric offset in hours west from UTC, and *DST* is an optional daylight-savings zone abbreviation, assumed to stand for one hour ahead of the given offset. For example, if `EST5EDT` were not already a recognized zone name, it would be accepted and would be functionally equivalent to USA East Coast time. When a daylight-savings zone name is present, it is assumed to be used according to USA time zone rules, so this feature is of limited use outside North America. Be wary that this provision can lead to silently accepting bogus input, since there is no check on the reasonableness of the zone abbreviations. For example, `SET TIME ZONE TO FOOBANKO` works, leaving the system effectively using a rather peculiar abbreviation for GMT.

Time Zone
Africa
America
Antarctica
Asia
Atlantic
Australia
CET
EET
Etc/GMT
Europe

Factory
GMT GMT+0 GMT-0 GMT0 Greenwich Etc/GMT Etc/GMT+0 Etc/GMT-0 Etc/GMT0 Etc/Greenwich
Indian
MET
Pacific
UCT Etc/UCT
UTC Universal Zulu Etc/UTC Etc/Universal Etc/Zulu
WET

SHOW

Displays run-time parameters for the current session.

Syntax

```
SHOW { name | ALL }
```

Parameters

name	Is one of the following: ▪ ***DATESTYLE*** (page 634) ▪ ***ESCAPE_STRING_WARNING*** (page 635) ▪ ***INTERVALSTYLE*** (page 635) ▪ ***LOCALE*** (page 636) ▪ ***SEARCH_PATH*** (page 639) ▪ ***SESSION CHARACTERISTICS*** (page 641) ▪ ***MEMORYCAP*** (page 642) ▪ ***RESOURCE POOL*** (page 643) ▪ ***RUNTIMECAP*** (page 643) ▪ ***TEMPSPACECAP*** (page 645) ▪ ***STANDARD_CONFORMING_STRINGS*** (page 646) ▪ ***TIMEZONE*** (page 647) ▪ ***DATESTYLE*** (page 634)
ALL	Shows all run-time parameters.

Notes

The ***SET*** (page 633) < runtime-parameter > command sets the run-time parameters.

Examples

The following command returns all the run-time parameter settings:

```
=> SHOW ALL;
            name             |                       setting
-----------------------------+-------------------------------------------------
 locale                      | en_US@collation=binary (LEN_KBINARY)
 standard_conforming_strings | off
 escape_string_warning       | on
 datestyle                   | ISO, MDY
 intervalstyle               | plain
 timezone                    | America/New_York
 search_path                 | "$user", public, v_catalog, v_monitor, v_internal
 transaction_isolation       | READ COMMITTED
 resource_pool               | general
 memorycap                   | UNLIMITED
 tempspacecap                | UNLIMITED
 runtimecap                  | UNLIMITED
(12 rows)
```

The following command returns only the search path settings:

```
=> SHOW SEARCH_PATH;
     name     |     setting
--------------+-----------------
 search_path | "$user", public
(1 row)
```

The following commands shows the session transaction isolation level:

```
=> SHOW TRANSACTION ISOLATION LEVEL;
          name           |    setting
-------------------------+---------------
 transaction_isolation | READ COMMITTED
(1 row)
```

TRUNCATE TABLE

Removes all storage associated with a table, while preserving the table definitions. TRUNCATE TABLE auto-commits the current transaction after statement execution and cannot be rolled back.

Syntax

```
TRUNCATE TABLE [schema_name.]table
```

Parameters

[*schema_name*.]	Specifies the name of an optional schema.
table	Specifies the name of a base table or temporary table.

Notes

- The superuser, database owner, and table owner can truncate a table.
- The schema owner can drop a table but cannot truncate a table.
- TRUNCATE TABLE is useful for testing; you can remove all table data without having to recreate projections when you reload table data.
- TRUNCATE TABLE commits the entire transaction, even if the TRUNCATE statement fails.
- If the truncated table is a large single (fact) table that contains prejoin projections, the projections show 0 rows after the transaction completes and are ready for data reload.
- If the truncated table is a dimension table, the system returns the following error:

  ```
  Cannot truncate a dimension table with pre-joined projections
  ```

  Drop the prejoin projection first, and then issue the TRUNCATE command.
- If the truncated table has out-of-date projections, those projections are cleared and marked up-to-date after the truncation operation completes.
- TRUNCATE TABLE takes an O (Owner) lock on the table until the truncation process completes, when savepoint is then released.

- To truncate an `ON COMMIT DELETE ROWS` temporary table without ending the transaction, use ***DELETE FROM temp_table*** (page 580) syntax.

  Note: The effect of DELETE FROM depends on the table type. If the table is specified as ON COMMIT DELETE ROWS, then DELETE FROM works like TRUNCATE TABLE; otherwise it behaves like a normal delete in that it does not truncate the table.
- After truncate operations complete, the data recovers from that current epoch onward. Because TRUNCATE TABLE removes table history, AT EPOCH queries return nothing. TRUNCATE TABLE behaves the same when you have data in WOS, ROS, or both, as well as for unsegmented/segmented projections.

See Also

DELETE (page 580), ***DROP TABLE*** (page 589), and ***LOCKS*** (page 712)

Transactions in the Concepts Guide

Deleting Data and Best Practices for DELETE and UPDATE in the Administrator's Guide

UNION

Combines the results of two or more select statements.

Syntax

```
SELECT
... UNION [ ALL ] select
... [ UNION [ ALL ] select ]...
... [ ORDER BY { column-name
... | ordinal-number }
... [ ASC | DESC ] [ , ... ] ]
... [ LIMIT { integer | ALL } ]
... [ OFFSET integer ]
```

Note: SELECT statements can contain ORDER BY, LIMIT or OFFSET clauses if the statement is enclosed within parentheses.

Notes

The results of several SELECT statements can be combined into a larger result using UNION. Each SELECT statement produces results in which the UNION combines all those results into a final single result. Specifically, a row in the results of a UNION operation must have existed in the results from one of the SELECT statements. Each SELECT statement must have the same number of items in the select list as well as compatible data types. If the data types are incompatible, Vertica returns an error.

The results of a UNION contain only distinct rows. so use UNION ALL to keep duplicate rows. UNION pays the performance price of eliminating duplicates; therefore, unless duplicate rows are not wanted, use UNION ALL for its performance benefits.

A SELECT statement containing ORDER BY, LIMIT, or OFFSET clauses must be enclosed in parentheses . If the statement is not enclosed in parentheses an error is returned. However, the rightmost ORDER BY, LIMIT, or OFFSET clause in the UNION query does not need to be enclosed in parentheses to the rightmost query. This indicates to perform these operations on results of the UNION operation. GROUP BY and HAVING operations cannot be applied to the results.

The ordering of the results of a UNION operation does not necessarily depend on the ordering of the results for each SELECT statement. The resulting rows can be ordered by adding an ORDER BY to the UNION operation, as in the syntax above. If ORDER BY is used, only integers and column names from the first (leftmost) SELECT statement are allowed in the order by list. The integers specify the position of the columns on which to sort. The column names displayed in the results are the same column names that display for the first (leftmost) select statement.

UNION correlated and noncorrelated subquery predicates are also supported.

```
=> SELECT * FROM T1
   WHERE T1.x IN
      (SELECT MAX(c1) FROM T2
       UNION ALL
          SELECT MAX(cc1) FROM T3
       UNION ALL
          SELECT MAX(d1) FROM T4);
```

Examples

Consider the following two tables:

Company_A

```
Id       emp_lname     dept        sales
------+------------+-------------+-------
1234  | Vincent    | auto parts  | 1000
5678  | Butch      | auto parts  | 2500
9012  | Marcellus  | floral      |  500
```

Company B

```
Id       emp_lname     dept        sales
------+------------+-------------+-------
4321  | Marvin     | home goods  |   250
9012  | Marcellus  | home goods  |   500
8765  | Zed        | electronics | 20000
```

The following query lists all **distinct** IDs and surnames of employees:

```
=> SELECT id, emp_lname
   FROM company_A
   UNION
   SELECT id, emp_lname
   FROM company_B;

 id   | emp_lname
------+-----------
 1234 | Vincent
 4321 | Marvin
```

```
 5678 | Butch
 8765 | Zed
 9012 | Marcellus
(5 rows)
```

The following query lists *all* IDs and surnames of employees:

```
=> SELECT id, emp_lname
   FROM company_A
   UNION ALL
   SELECT id, emp_lname
   FROM company_B;

  id  | emp_lname
------+-----------
 1234 | Vincent
 5678 | Butch
 9012 | Marcellus
 4321 | Marvin
 8765 | Zed
 9012 | Marcellus
(6 rows)
```

The next example returns the top two performing salespeople in each company combined:

```
=> (SELECT id, emp_lname, sales
   FROM company_A
   ORDER BY sales
   LIMIT 2)
   UNION ALL
   (SELECT id, emp_lname, sales
   FROM company_B
   ORDER BY sales
   LIMIT 2);

  id  | emp_lname | sales
------+-----------+-------
 4321 | Marvin    |   250
 9012 | Marcellus |   500
 9012 | Marcellus |   500
 1234 | Vincent   |  1000
(4 rows)
```

In this example, return all employee orders by sales. Note that the ORDER BY clause is applied to the entire result:

```
=> SELECT id, emp_lname, sales
   FROM company_A
   UNION
   SELECT id, emp_lname, sales
   FROM company_B
   ORDER BY sales;

  id  | emp_lname | sales
------+-----------+-------
 4321 | Marvin    |   250
 9012 | Marcellus |   500
```

```
 1234 | Vincent   |  1000
 5678 | Butch     |  2500
 8765 | Zed       | 20000
(5 rows)
```

And now sum the sales for each company, ordered by sales in descending order, and grouped by department:

```
=> (SELECT 'company a' as company, dept, SUM(sales)
    FROM company_a
    GROUP BY dept
    ORDER by 2 DESC)
    UNION
   (SELECT 'company b' as company, dept, SUM(sales)
    FROM company_b
    GROUP BY dept
    ORDER by 2 DESC)
    ORDER BY 1;
 company   |    dept     |  sum
-----------+-------------+-------
 company a | auto parts  |  3500
 company a | floral      |   500
 company b | electronics | 20000
 company b | home goods  |   750
(4 rows)
```

The final query shows the results of a mismatched data types:

```
=> SELECT id, emp_lname
   FROM company_a
   UNION
   SELECT emp_lname, id
   FROM company_b;
   ERROR: UNION types int8 and character varying cannot be matched
```

See Also

SELECT (page 617)

Subqueries and UNION in Subqueries in the Programmer's Guide

UPDATE

Replaces the values of the specified columns in all rows for which a specific condition is true. All other columns and rows in the table are unchanged. By default UPDATE uses the WOS and if the WOS fills up, overflows to the ROS.

Syntax

```
UPDATE [ /*+ direct */ ] [schemaname.]table SET column =
... { expression | DEFAULT } [ , ... ]
... [ FROM from-list ]
... [ WHERE clause (on page 622) ]
```

Parameters

`/*+ direct */`	Writes the data directly to disk (ROS) bypassing memory (WOS). **Note:** If you update using the `direct` hint, you still need to issue a `COMMIT` or `ROLLBACK` command to finish the transaction.
[*schemaname.*]*table*	Specifies the name of a table in the schema. When using more than one schema, specify the schema that contains the table. You cannot update a projection.
column	Specifies the name of a non-key column in the table.
expression	Specifies a value to assign to the column. The expression can use the current values of this and other columns in the table. For example: `UPDATE T1 SET C1 = C1+1;`
from-list	A list of table expressions, allowing columns from other tables to appear in the `WHERE` condition and the `UPDATE` expressions. This is similar to the list of tables that can be specified in the `FROM` (see "`FROM Clause`" on page 620) clause of a `SELECT` command. Note that the target table must not appear in the *from-list*.

Notes

- Subqueries and joins are permitted in UPDATE statements, which is useful for updating values in a table based on values that are stored in other tables. See Examples section below.

  UPDATE changes the values of the specified columns in all rows that satisfy the condition. Only the columns to be modified need to be specified in the SET clause. Columns that are not explicitly modified retain their previous values. On successful completion, an UPDATE operation returns a count, which represents the number of rows updated. A count of 0 is not an error; it means that no rows matched the condition.
- You cannot use the SET column = {expression} to specify a subquery.
- The table specified in the UPDATE list cannot also appear in the from-list (no self joins); for example:

```
=> BEGIN;
=> UPDATE result_table SET address='new' || r2.address FROM result_table
   r2
```

```
    WHERE r2.cust_id = result_table.cust_id + 10;
    ERROR:  Self joins in UPDATE statements are not allowed
    DETAIL:  Target relation result_table also appears in the FROM list
```

- If the joins specified in the WHERE predicate produce more than one copy of the row in the table to be updated, the new value of the row in the table is chosen arbitrarily.
- UPDATE inserts new records into the WOS and marks the old records for deletion.
- You cannot UPDATE columns that have primary key or foreign key referential integrity constraints.
- To use the ***DELETE*** (page 580) or ***UPDATE*** (page 656) commands with a ***WHERE clause*** (page 622), you must have both SELECT and DELETE privileges on the table.

Examples

```
=> UPDATE FACT SET PRICE = PRICE - COST * 80 WHERE COST > 100;
=> UPDATE Retail.CUSTOMER SET STATE = 'NH' WHERE CID > 100;
```

The following series of commands illustrate the use of subqueries in `UPDATE` statements; they all use the following simple schema:

```
=> CREATE TABLE result_table(
       cust_id INTEGER,
       address VARCHAR(2000)
   );
```

Enter some customer data:

```
=> COPY result_table FROM stdin delimiter ',' DIRECT;
   20, Lincoln Street
   30, Booth Hill Road
   30, Beach Avenue
   40, Mt. Vernon Street
   50, Hillside Avenue
   \.
```

Query the table you just created:

```
=> SELECT * FROM result_table;
 cust_id |      address
---------+--------------------
      20 |  Lincoln Street
      30 |  Beach Avenue
      30 |  Booth Hill Road
      40 |  Mt. Vernon Street
      50 |  Hillside Avenue
(5 rows)
```

Create a second table called `new_addresses`:

```
=> CREATE TABLE new_addresses(
     new_cust_id integer,
     new_address VARCHAR(200)
   );
```

Enter some customer data.

Note: The following COPY statement creates an entry for a customer ID with a value of 60, which does not have a matching value in the result_table table:

```
=> COPY new_addresses FROM stdin delimiter ',' DIRECT;
   20, Infinite Loop
   30, Loop Infinite
   60, New Addresses
   \.
```

Query the new_addresses table:

```
=> SELECT * FROM new_addresses;
 new_cust_id |  new_address
-------------+----------------
          20 |  Infinite Loop
          30 |  Loop Infinite
          60 |  New Addresses
(3 rows)
```

Commit the changes:

```
=> COMMIT;
```

In the following example, a noncorrelated subquery is used to change the address record in results_table to 'New Address' when the query finds a customer ID match in both tables:

```
=> UPDATE result_table
   SET address='New Address'
   WHERE cust_id IN (SELECT new_cust_id FROM new_addresses);
```

The output returns the expected count indicating that three rows were updated:

```
 OUTPUT
--------
      3
(1 row)
```

Now query the result_table table to see the changes for matching customer ID 20 and 30. Addresses for customer ID 40 and 50 are not updated:

```
=> SELECT * FROM result_table;
 cust_id |     address
---------+-----------------
      20 | New Address
      30 | New Address
      30 | New Address
      40 | Mt. Vernon Street
      50 | Hillside Avenue
(5 rows)
```

To preserve your original data, issue the ROLLBACK command:

```
=> ROLLBACK;
```

In the following example, a correlated subquery is used to replace all address records in the results_table with the new_address record from the new_addresses table when the query finds match on the customer ID in both tables:

```
=> UPDATE result_table
```

```
   SET address=new_addresses.new_address
   FROM new_addresses
   WHERE cust_id = new_addresses.new_cust_id;
```

Again, the output returns the expected count indicating that three rows were updated:

```
 OUTPUT
--------
       3
(1 row)
```

Now query the `result_table` table to see the changes for customer ID 20 and 30. Addresses for customer ID 40 and 50 are not updated, and customer ID 60 is omitted because there is no match:

```
=> SELECT * FROM result_table;
 cust_id |     address
---------+------------------
       20 | Infinite Loop
       30 | Loop Infinite
       30 | Loop Infinite
       40 | Mt. Vernon Street
       50 | Hillside Avenue
(5 rows)
```

See Also

Subqueries in the Programmer's Guide

SQL System Tables (Monitoring APIs)

Vertica provides system tables that let you monitor the health of your database. These tables can be queried the same way you perform query operations on base or temporary tables using SELECT. Queries against system tables may use expressions, predicates, aggregates, analytics, subqueries, joins, and historical query syntax. It is also possible to save the results of a system table query into a user table for future analysis using, for example, `INSERT INTO <user_table> SELECT * FROM <system_table>;`

System tables are grouped into the following schemas:

- `V_CATALOG (page 664)` – information about persistent objects in the catalog
- `V_MONITOR (page 689)` – information about transient system state

These schemas reside in the default search path so there is no need to specify `schema.table` in your queries unless you change the search path to exclude `V_MONITOR` or `V_CATALOG` or both.

Notes and Restrictions

- You can use external monitoring tools or scripts to query the system tables and act upon the information, as necessary. For example, when a host failure causes the K-safety level to fall below a desired level, the tool or script can notify the database administrator and/or appropriate IT personnel of the change, typically in the form of an e-mail.

  Note: When a cluster is a recovering state, the database refuses connection requests and cannot be monitored using the SQL monitoring API.
- To view all of the system tables issue the following command:
  ```
  => SELECT * FROM system_tables;
  ```
- DDL and DML operations are not supported on system tables.
- With the exception of the `PROJECTION_REFRESHES` (page 717) table, system tables do not hold historical data.
- Vertica reserves some memory to help monitor busy systems. Using simple system table queries makes it easier to troubleshoot issues. See also `sysquery` and `sysdata` pools under ***Built-in pools*** (page 536) topic in SQL Reference Manual.
- In `V_CATALOG.TABLES`, columns `TABLE_SCHEMA` and `TABLE_NAME` are case sensitive when equality (=) predicates are used in queries. For example, given the following schema:
  ```
  => CREATE SCHEMA SS;
  => CREATE TABLE SS.TT (c1 int);
  => INSERT INTO ss.tt VALUES (1);
  ```
  If you run a query using the = predicate, Vertica returns 0 rows:
  ```
  => SELECT table_schema, table_name FROM v_catalog.tables WHERE
     table_schema ='ss';
   table_schema | table_name
  --------------+------------
  (0 rows)
  ```
  Use the case-insensitive ILIKE predicate to return the expected results:

```
=> SELECT table_schema, table_name FROM v_catalog.tables WHERE
   table_schema ILIKE 'ss';
 table_schema | table_name
--------------+------------
 SS           | TT
```

(1 row)Querying case-sensitive data in system tables

The V_CATALOG.TABLES (page 681).TABLE_SCHEMA and TABLE_NAME columns are case sensitive when used with an equality (=) predicate in queries. For example, given the following schema:

```
=> CREATE SCHEMA SS;
=> CREATE TABLE SS.TT (c1 int);
=> INSERT INTO ss.tt VALUES (1);
```

If you execute a query using the = predicate, Vertica returns 0 rows:

```
=> SELECT table_schema, table_name FROM v_catalog.tables WHERE table_schema ='ss';
table_schema | table_name
--------------+------------
(0 rows)
```

Use the case-insensitive ILIKE predicate to return the expected results:

```
=> SELECT table_schema, table_name FROM v_catalog.tables WHERE table_schema ILIKE
'ss';
 table_schema | table_name
--------------+------------
 SS           | TT
(1 row)
```

Examples

See Using the SQL Monitoring API in the Administrator's Guide

Summary of tables

The following table lists all system tables with a brief description and link to the details about an individual table.

Monitor Tables	Description	Schema
ACTIVE_EVENTS (page 689)	Displays all the active events in the cluster.	V_MONITOR
COLUMN_STORAGE (page 691)	Returns the amount of disk storage used by each column of each projection on each node.	V_MONITOR
COLUMNS (page 664)	Provides information about columns.	V_CATALOG
CONFIGURATION_PARAMETERS (page 693)	Provides information about configuration parameters currently in use by the system.	V_MONITOR
CURRENT_SESSION (page 694)	Returns information about the current active session.	V_MONITOR
DELETE_VECTORS (page 697)	Holds information on deleted rows to speed up the delete process.	V_MONITOR

DISK_RESOURCE_REJECTIONS (page 698)	Returns requests for resources that are rejected due to disk space shortages.	V_MONITOR
DISK_STORAGE (page 699)	Returns the amount of disk storage used by the database on each node.	V_MONITOR
DUAL (page 665)	A single-column "dummy" table with one record whose value is X.	V_CATALOG
EVENT_CONFIGURATIONS (page 703)	Returns configuration information about current events.	V_MONITOR
EXECUTION_ENGINE_PROFILES (page 704)	Returns information regarding query execution runs.	V_MONITOR
FOREIGN_KEYS (page 666)	Provides foreign key information.	V_CATALOG
GRANTS (page 667)	Provides grant information.	V_CATALOG
HOST_RESOURCES (page 708)	Returns information about host profiling.	V_MONITOR
LOAD_STREAMS (page 710)	Returns load metrics for each load stream on each node.	V_MONITOR
LOCKS (page 712)	Monitors lock grants and requests for all nodes.	V_MONITOR
NODE_RESOURCES (page 714)	Provides a snapshot of the node. This is useful for regularly polling the node with automated tools or scripts.	V_MONITOR
PARTITIONS (page 716)	Displays partition metadata, one row per partition key, per ROS container.	V_MONITOR
PASSWORDS (page 669)	Contains password information.	V_CATALOG
PRIMARY_KEYS (page 669)	Provides primary key information.	V_CATALOG
PROFILE_PARAMETERS (page 670)	Defines what user profiles conatin.	V_CATALOG
PROFILES (page 671)	Provides user profile information.	V_CATALOG
PROJECTION_COLUMNS (page 672)	Provides projection column information.	V_CATALOG
PROJECTION_REFRESHES (page 717)	Returns information about refresh operations for projections.	V_MONITOR
PROJECTION_STORAGE (page 719)	Returns the amount of disk storage used by each projection on each node.	V_MONITOR
PROJECTIONS (page 673)	Provides information about projections.	V_CATALOG
QUERY_METRICS (page 721)	Monitors the sessions and queries executing on each node.	V_MONITOR
QUERY_PROFILES (page 722)	Provides information regarding queries that have run.	V_MONITOR
RESOURCE_ACQUISITIONS (page 724)	Provides details of resources (memory, open file handles, threads) acquired by each running request for each resource pool in the system.	V_MONITOR

RESOURCE_ACQUISITIONS_HISTORY (page 727)	Provides details of resources (memory, open file handles, threads) acquired by any profiled query for each resource pool in the system.	V_MONITOR
RESOURCE_POOL_STATUS (page 730)	Provides resource pool usage information.	V_MONITOR
RESOURCE_POOLS (page 676)	Provides configuration of resource pools, both user-defined and built-in.	V_CATALOG
RESOURCE_QUEUES (page 734)	Provides information about queries waiting for resources	V_MONITOR
RESOURCE_REJECTIONS (page 735)	Returns requests for resources that are rejected by the resource manager.	V_MONITOR
RESOURCE_USAGE (page 736)	Returns system resource management on each node.	V_MONITOR
SESSION_PROFILES (page 739)	Provides basic session parameters and lock time out data.	V_MONITOR
SESSIONS (page 741)	Monitors external sessions.	V_MONITOR
STORAGE_CONTAINERS (page 743)	Monitors information about each storage container in the database.	V_MONITOR
STRATA (page 746)	Provides information of strata used in Tuple Mover, one row per stratum. (Vertica Internal use only)	V_MONITOR
STRATA_STRUCTURES (page 749)	Provides information of strata structures used in Tuple Mover, one row per strata structure. (Vertica Internal use only)	V_MONITOR
SYSTEM (page 751)	Monitors the overall state of the database.	V_MONITOR
SYSTEM_TABLES (page 679)	Displays a list of all system table names.	V_CATALOG
TABLE_CONSTRAINTS (page 680)	Provides information about table constraints.	V_CATALOG
TABLES (page 681)	Provides information about all tables in the database.	V_CATALOG
TUPLE_MOVER_OPERATIONS (page 752)	Monitors the status of the Tuple Mover on each node.	V_MONITOR
TYPES (page 682)	Provides information about supported data types.	V_CATALOG
USER_FUNCTIONS (page 683)	Returns metadata about user-defined SQL Macros, which store commonly used SQL expressions in a function.	V_CATALOG
USER_PROCEDURES (page 684)	Provides information about external procedures that have been defined for Vertica	V_CATALOG
USERS (page 685)	Provides information about users.	V_CATALOG
VIEW_COLUMNS (page 686)	Provides view attribute information.	V_CATALOG
VIEWS (page 688)	Provides information about all views within the	V_CATALOG

	system.	
WOS_CONTAINER_STORAGE (page 753)	Monitors information about WOS storage, which is divided into regions.	V_MONITOR

V_CATALOG Schema

The system tables in this section reside in the `v_catalog` schema. These tables provide information (metadata) about the objects in a database; for example, tables, constraints, users, projections, and so on.

COLUMNS

Provides table column information.

Column Name	Data Type	Description
TABLE_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the table.
TABLE_SCHEMA	VARCHAR	The schema name for which information is listed.
TABLE_NAME	VARCHAR	The table name for which information is listed.
IS_SYSTEM_TABLE	BOOLEAN	Indicates whether the table is a system table, where *t* is true and *f* is false.
COLUMN_NAME	VARCHAR	The column name for which information is listed in the database.
DATA_TYPE	VARCHAR	The data type assigned to the column; for example VARCHAR.
DATA_TYPE_DESCRIPTION	VARCHAR	The description of the data type; for example VARCHAR(16).
DATA_TYPE_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the data type.
DATA_TYPE_LENGTH	INTEGER	The maximum allowable length of the data type.
CHARACTER_MAXIMUM_ LENGTH	VARCHAR	The maximum allowable length of the column.
NUMERIC_PRECISION	INTEGER	The number of significant decimal digits.
NUMERIC_SCALE	INTEGER	The number of fractional digits.
DATETIME_PRECISION	INTEGER	For TIMESTAMP data type, returns the declared precision; returns null if no precision was declared.
INTERVAL_PRECISION	INTEGER	The number of fractional digits retained in the seconds field.
ORDINAL_POSITION	VARCHAR	The position of the column respective to other columns

		in the table.
IS_NULLABLE	BOOLEAN	Indicates whether the column can contain null values, where *t* is true and *f* is false.
COLUMN_DEFAULT	VARCHAR	The default value of a column, such as empty or expression.

Example

```
=> SELECT table_schema, table_name, column_name, data_type, is_nullable
   FROM columns WHERE table_schema = 'store'  AND data_type = 'Date';
 table_schema |    table_name     |      column_name       | data_type |
is_nullable
--------------+-------------------+------------------------+-----------+------
-------
 store        | store_dimension   | first_open_date        | Date      | f
 store        | store_dimension   | last_remodel_date      | Date      | f
 store        | store_orders_fact | date_ordered           | Date      | f
 store        | store_orders_fact | date_shipped           | Date      | f
 store        | store_orders_fact | expected_delivery_date | Date      | f
 store        | store_orders_fact | date_delivered         | Date      | f
6 rows)
```

NULL results indicate that those columns were not defined. For example, given the following table, the result for the Datetime_precision column is NULL because no precision was declared:

```
=> CREATE TABLE c (c TIMESTAMP);
CREATE TABLE
=> SELECT table_name, column_name, datetime_precision FROM columns WHERE
table_name = 'c';
 table_name | column_name | datetime_precision
------------+-------------+--------------------
 c          | c           |
(1 row)
```

In this example, the datetime_precision column returns 4 because the precision was declared as 4 in the CREATE TABLE statement:

```
=> DROP TABLE c;
=> CREATE TABLE c (c TIMESTAMP(4));
CREATE TABLE
=> SELECT table_name, column_name, datetime_precision FROM columns WHERE
table_name = 'c';
 table_name | column_name | datetime_precision
------------+-------------+--------------------
 c          | c           |                  4
```

DUAL

DUAL is a single-column "dummy" table with one record whose value is X; for example:

```
=> SELECT * FROM DUAL;
 dummy
-------
 X
(1 row)
```

You can now write the following types of queries:

```
mydb=> SELECT 1 FROM dual;
 ?column?
----------
        1
(1 row)
=> SELECT current_timestamp, current_user FROM dual;
           ?column?            | current_user
-------------------------------+--------------
 2010-03-08 12:57:32.065841-05 | release
(1 row)
mydb=> CREATE TABLE t1(col1 VARCHAR(20), col2 VARCHAR(2));
mydb=> INSERT INTO T1(SELECT 'hello' AS col1, 1 AS col2 FROM dual);)
mydb=> SELECT * FROM t1;
 col1  | col2
-------+------
 hello | 1
(1 row
```

Because DUAL is a system table, you cannot create projections for it, nor can you use it in pre-join projections for normal tables. For example, the following is not permitted:

```
=> CREATE TABLE foo (a varchar(20), b varchar(2));
=> CREATE PROJECTION t1_prejoin AS SELECT * FROM t1 JOIN dual ON t1.col1 =
dual.dummy;
       ERROR:  Virtual tables are not allowed in FROM clause of projection
```

The following is also not permitted:

Note: Only the rows where the `PROJECTION_REFRESHES.IS_EXECUTING` column equals false are cleared.

```
=> CREATE PROJECTION dual_proj AS SELECT * FROM dual;
       ERROR:  Virtual tables are not allowed in FROM clause of projection
```

FOREIGN_KEYS

Provides foreign key information.

Column Name	Data Type	Description
CONSTRAINT_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the constraint.
CONSTRAINT_NAME	VARCHAR	The constraint name for which information is listed.
COLUMN_NAME	VARCHAR	The name of the column that is constrained.
ORDINAL_POSITION	VARCHAR	The position of the column respective to other columns in the table.
TABLE_NAME	VARCHAR	The table name for which information is listed.

REFERENCE_TABLE_NAME	VARCHAR	References the TABLE_NAME column in the PRIMARY_KEY table.
CONSTRAINT_TYPE	VARCHAR	The constraint type, `f`, for foreign key.
REFERENCE_COLUMN_NAME	VARCHAR	References the COLUMN_NAME column in the PRIMARY_KEY table.
TABLE_SCHEMA	VARCHAR	The schema name for which information is listed.
REFERENCE_TABLE_SCHEMA	VARCHAR	References the TABLE_SCHEMA column in the PRIMARY_KEY table.

Example

```
mydb=> SELECT constraint_name, table_name, ordinal_position, reference_table_name
       FROM foreign_keys ORDER BY 3;
      constraint_name      |    table_name     | ordinal_position | reference_table_name
---------------------------+-------------------+------------------+----------------------
 fk_store_sales_date       | store_sales_fact  |                1 | date_dimension
 fk_online_sales_saledate  | online_sales_fact |                1 | date_dimension
 fk_store_orders_product   | store_orders_fact |                1 | product_dimension
 fk_inventory_date         | inventory_fact    |                1 | date_dimension
 fk_inventory_product      | inventory_fact    |                2 | product_dimension
 fk_store_sales_product    | store_sales_fact  |                2 | product_dimension
 fk_online_sales_shipdate  | online_sales_fact |                2 | date_dimension
 fk_store_orders_product   | store_orders_fact |                2 | product_dimension
 fk_inventory_product      | inventory_fact    |                3 | product_dimension
 fk_store_sales_product    | store_sales_fact  |                3 | product_dimension
 fk_online_sales_product   | online_sales_fact |                3 | product_dimension
 fk_store_orders_store     | store_orders_fact |                3 | store_dimension
 fk_online_sales_product   | online_sales_fact |                4 | product_dimension
 fk_inventory_warehouse    | inventory_fact    |                4 | warehouse_dimension
 fk_store_orders_vendor    | store_orders_fact |                4 | vendor_dimension
 fk_store_sales_store      | store_sales_fact  |                4 | store_dimension
 fk_store_orders_employee  | store_orders_fact |                5 | employee_dimension
 fk_store_sales_promotion  | store_sales_fact  |                5 | promotion_dimension
 fk_online_sales_customer  | online_sales_fact |                5 | customer_dimension
 fk_store_sales_customer   | store_sales_fact  |                6 | customer_dimension
 fk_online_sales_cc        | online_sales_fact |                6 | call_center_dimension
 fk_store_sales_employee   | store_sales_fact  |                7 | employee_dimension
 fk_online_sales_op        | online_sales_fact |                7 | online_page_dimension
 fk_online_sales_shipping  | online_sales_fact |                8 | shipping_dimension
 fk_online_sales_warehouse | online_sales_fact |                9 | warehouse_dimension
 fk_online_sales_promotion | online_sales_fact |               10 | promotion_dimension
(26 rows)
```

GRANTS

Provides information about privileges granted on various objects, the granting user and grantee user. The order of columns in the table corresponds to the order in which they appear in the GRANT command.

Column Name	Data Type	Description
GRANTOR	VARCHAR	The user granting permission.
PRIVILEGES_DESCRIPTION	VARCHAR	A readable description of the privileges being granted; for example INSERT, SELECT.

OBJECT_SCHEMA	VARCHAR	The name of the schema that is being granted privileges.
OBJECT_NAME	VARCHAR	The name of the object that is being granted privileges. Note that for schema privileges, the schemaname appears in the OBJECT_NAME column rather than the OBJECT_SCHEMA column.
GRANTEE	VARCHAR	The user being granted permission.

Notes

The vsql commands `\dp` and `\z` both include the schema name in the output:

```
=> \dp
         Access privileges for database "vmartdb"
 Grantee | Grantor | Privileges | Schema |      Name
---------+---------+------------+--------+-----------------
         | release | USAGE      |        | public
         | release | USAGE      |        | v_internal
         | release | USAGE      |        | v_catalog
         | release | USAGE      |        | v_monitor
         | release | USAGE      |        | v_internal
         | release | USAGE      |        | v_catalog
         | release | USAGE      |        | v_monitor
         | release | USAGE      |        | v_internal
         | release | USAGE      |        | designer_system
(9 rows)
=> \z
         Access privileges for database "vmartdb"
 Grantee | Grantor | Privileges | Schema |      Name
---------+---------+------------+--------+-----------------
         | release | USAGE      |        | public
         | release | USAGE      |        | v_internal
         | release | USAGE      |        | v_catalog
         | release | USAGE      |        | v_monitor
         | release | USAGE      |        | v_internal
         | release | USAGE      |        | v_catalog
         | release | USAGE      |        | v_monitor
         | release | USAGE      |        | v_internal
         | release | USAGE      |        | designer_system
(9 rows)
```

The vsql command `\dp *.tablename` displays table names in all schemas. This command lets you distinguish the grants for same-named tables in different schemas:

```
=> \dp *.events;
                    Access privileges for database "dbadmin"
 Grantee | Grantor |                 Privileges                 | Schema  | Name
---------+---------+--------------------------------------------+---------+--------
 user2   | dbadmin | INSERT, SELECT, UPDATE, DELETE, REFERENCES | schema1 | events
 user1   | dbadmin | SELECT                                     | schema1 | events
 user2   | dbadmin | INSERT, SELECT, UPDATE, DELETE, REFERENCES | schema2 | events
 user1   | dbadmin | INSERT, SELECT                             | schema2 | events
(4 rows)
```

The vsql command `\dp schemaname.*` displays all tables in the named schema:

```
=> \dp schema1.*
                    Access privileges for database "dbadmin"
grantee | grantor |            privileges_description            | table_schema | table_name
--------+---------+----------------------------------------------+--------------+------------
 user2  | dbadmin | INSERT, SELECT, UPDATE, DELETE, REFERENCES | schema1      | events
 user1  | dbadmin | SELECT                                       | schema1      | events
(2 rows)
```

Example

In the following example, online_sales is the schema that first gets privileges, and then inside that schema the anchor table gets SELECT privileges:

```
=> SELECT grantee, grantor, privileges_description, object_schema, object_name
   FROM grants WHERE grantee='u1' ORDER BY object_name;
 grantee | grantor | privileges_description | object_schema | object_name
---------+---------+------------------------+-------- ------+-----------------
 u1      | release | CREATE                 |               | online_sales
 u1      | release | SELECT                 | online_sales  | online_sales_fact
```

PASSWORDS

Contains user passwords information. This table stores not only current passwords, but also past passwords if any profiles have PASSWORD_REUSE_TIME or PASSWORD_REUSE_MAX parameters set. See ***CREATE PROFILE*** (page 519) for details.

Column Name	Data Type	Description
USER_ID	INTEGER	The ID of the user who owns the password.
USER_NAME	VARCHAR	The name of the user who owns the password.
PASSWORD	VARCHAR	The encrypted password.
PASSWORD_CREATE_TIME	DATETIME	The date and time when the password was created.
IS_CURRENT_PASSWORD	BOOLEAN	Denotes whether this is the user's current password. Non-current passwords are retained to enforce password reuse limitations.
PROFILE_ID	INTEGER	The ID number of the profile to which the user is assigned.
PROFILE_NAME	VARCHAR	The name of the profile to which the user is assigned.
PASSWORD_REUSE_MAX	VARCHAR	The number password changes that must take place before an old password can be reused.
PASSWORD_REUSE_TIME	VARCHAR	The amount of time that must pass before an old password can be reused.

PRIMARY_KEYS

Provides primary key information.

Column Name	Data Type	Description
CONSTRAINT_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the constraint.
CONSTRAINT_NAME	VARCHAR	The constraint name for which information is listed.
COLUMN_NAME	VARCHAR	The column name for which information is listed.
ORDINAL_POSITION	VARCHAR	The position of the column respective to other columns in the table.
TABLE_NAME	VARCHAR	The table name for which information is listed.
CONSTRAINT_TYPE	VARCHAR	The constraint type, p, for primary key.
TABLE_SCHEMA	VARCHAR	The schema name for which information is listed.

Example

Request specific columns from the PRIMARY_KEYS table:

```
=> SELECT constraint_name, table_name, ordinal_position, table_schema
   FROM primary_keys ORDER BY 3;
 constraint_name |      table_name       | ordinal_position | table_schema
-----------------+-----------------------+------------------+--------------
 C_PRIMARY       | customer_dimension    |                1 | public
 C_PRIMARY       | product_dimension     |                1 | public
 C_PRIMARY       | store_dimension       |                1 | store
 C_PRIMARY       | promotion_dimension   |                1 | public
 C_PRIMARY       | date_dimension        |                1 | public
 C_PRIMARY       | vendor_dimension      |                1 | public
 C_PRIMARY       | employee_dimension    |                1 | public
 C_PRIMARY       | shipping_dimension    |                1 | public
 C_PRIMARY       | warehouse_dimension   |                1 | public
 C_PRIMARY       | online_page_dimension |                1 | online_sales
 C_PRIMARY       | call_center_dimension |                1 | online_sales
 C_PRIMARY       | product_dimension     |                2 | public
(12 rows)
```

PROFILE_PARAMETERS

Defines what information is stored in profiles.

Column Name	Data Type	Description
PROFILE_ID	INTEGER	The ID of the profile to which this parameter belongs.
PROFILE_NAME	VARCHAR	The name of the profile to which this parameter belongs.
PARAMETER_TYPE	VARCHAR	The policy type of this parameter (password_complexity, password_security, etc.)
PARAMETER_NAME	VARCHAR	The name of the parameter.
PARAMETER_LIMIT	VARCHAR	The parameter's value.

PROFILES

Provides information about profiles.

Column Name	Data Type	Description
PROFILE_ID	INTEGER	The unique identifier for the profile.
PROFILE_NAME	VARCHAR	The profile's name.
PASSWORD_LIFE_TIME	VARCHAR	The number of days before the user's password expires. After expiration, the user is forced to change passwords during login or warned that their password has expired if password_grace_time is set to a value other than zero or unlimited.
PASSWORD_GRACE_TIME	VARCHAR	The number of days users are allowed to log in after their passwords expire. During the grace time, users are warned about their expired passwords when they log in. After the grace period, the user is forced to change passwords if he or she hasn't already.
PASSWORD_REUSE_MAX	VARCHAR	The number of password changes that must occur before the current password can be reused.
PASSWORD_REUSE_TIME	VARCHAR	The number of days that must pass after setting a password before it can be used again.
FAILED_LOGIN_ATTEMPTS	VARCHAR	The number of consecutive failed login attempts that triggers Vertica to lock the account.
PASSWORD_LOCK_TIME	VARCHAR	The number of days an account is locked after being locked due to too many failed login attempts.
PASSWORD_MAX_LENGTH	VARCHAR	The maximum number of characters allowed in a password.
PASSWORD_MIN_LENGTH	VARCHAR	The minimum number of characters required in a password.
PASSWORD_MIN_LETTERS	VARCHAR	The minimum number of letters (either uppercase or lowercase) required in a password.
PASSWORD_MIN_LOWERCASE_LETTERS	VARCHAR	The minimum number of lowercase.
PASSWORD_MIN_UPPERCASE_LETTERS	VARCHAR	The minimum number of uppercase letters required in a password.
PASSWORD_MIN_DIGITS	VARCHAR	The minimum number of digits required in a

		password.
PASSWORD_MIN_SYMBOLS	VARCHAR	The minimum of symbols (for example, !, #, $, etc.) required in a password.

Notes

Non-superusers querying this table see only the information for the profile to which they are assigned.

PROJECTION_COLUMNS

Provides column information about projections.

Column Name	Data Type	Description
PROJECTION_NAME	VARCHAR	The projection name for which information is listed.
PROJECTION_COLUMN_NAME	VARCHAR	The projection column name.
COLUMN_POSITION	INTEGER	The projection column position used in the CREATE PROJECTION statement.
SORT_POSITION	INTEGER	The projection's column sort specification, as specified in CREATE PROJECTION ORDER BY.
COLUMN_ID	INTEGER	A unique numeric ID (OID) assigned by the Vertica catalog that identifies the projection column.
DATA_TYPE	VARCHAR	The data type of the projection column.
ENCODING_TYPE	VARCHAR	The encoding type of the projection column.
ACCESS_RANK	INTEGER	The access rank of the projection column.
GROUP_ID	INTEGER	A unique numeric ID (OID) assigned by the Vertica catalog that identifies the group.
TABLE_SCHEMA	VARCHAR	The schema name for the projection.
TABLE_NAME	VARCHAR	The schema name for the projection.
TABLE_COLUMN_NAME	VARCHAR	The projection's corresponding table column name.

Example

The following example creates a table named trades and groups the highly correlated columns `bid` and `ask`, storing the `stock` column separately.

```
=> CREATE TABLE trades (stock CHAR(5), bid INT, ask INT);
=> CREATE PROJECTION trades_p (stock ENCODING RLE, GROUPED(bid ENCODING DELTAVAL, ask))
   AS (SELECT * FROM trades) ORDER BY stock, bid;
```

Now query the `PROJECTION_COLUMNS` table for table `trades`:

```
=> SELECT * FROM PROJECTION_COLUMNS where table_name ILIKE 'trades';
```

```
-[ RECORD 1 ]----------+------------------
projection_name        | trades_p
projection_column_name | stock
column_position        | 0
sort_position          | 0
column_id              | 45035996273724456
data_type              | Char
encoding_type          | RLE
access_rank            | 0
group_id               | 0
table_schema           | public
table_name             | trades
table_column_name      | stock
-[ RECORD 2 ]----------+------------------
projection_name        | trades_p
projection_column_name | bid
column_position        | 1
sort_position          | 1
column_id              | 45035996273724458
data_type              | Integer
encoding_type          | DELTAVAL
access_rank            | 0
group_id               | 45035996273724460
table_schema           | public
table_name             | trades
table_column_name      | bid
-[ RECORD 3 ]----------+------------------
projection_name        | trades_p
projection_column_name | ask
column_position        | 2
sort_position          |
column_id              | 45035996273724462
data_type              | Integer
encoding_type          | AUTO
access_rank            | 0
group_id               | 45035996273724460
table_schema           | public
table_name             | trades
table_column_name      | ask
```

PROJECTIONS

Provides information about projections.

Column Name	Data Type	Description
PROJECTION_SCHEMA_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the specific schema that contains the projection.
PROJECTION_SCHEMA	VARCHAR	The name of the schema that contains the projection.

PROJECTION_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the projection.
PROJECTION_NAME	VARCHAR	The projection name for which information is listed.
OWNER_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the projection owner.
OWNER_NAME	VARCHAR	The name of the projection's owner.
ANCHOR_TABLE_ID	INTEGER	The unique numeric identification (OID) of the anchor table for pre-join projections, or the OID of the table from which the projection was created if it is not a pre-join projection. **Note:** A projection has only one anchor (fact) table.
ANCHOR_TABLE_NAME	VARCHAR	The name of the anchor table for pre-join projections, or the name of the table from which the projection was created if it is not a pre-join projection.
NODE_ID	INTEGER	A unique numeric ID (OID) that identifies the node(s) that contain the projection.
NODE_NAME	VARCHAR	The name of the node(s) that contain the projection. **Note:** this column returns information for unsegmented projections only, not for segmented and pinned projections.
IS_PREJOIN	BOOLEAN	Indicates whether the projection is a pre-join projection, where *t* is true and *f* is false.
CREATED_EPOCH	INTEGER	The epoch in which the projection was created.
CREATE_TYPE	VARCHAR	The method in which the projection was created: ▪ CREATE PROJECTION—A custom projection created through the CREATE PROJECTION statement. ▪ CREATE TABLE—A superprojection that was automatically created when its associated table was created through the CREATE TABLE statement. ▪ DELAYED_CREATION—A superprojection that was automatically created when data was loaded into its associated table. ▪ DESIGNER—A projection created through Database Designer ▪ IMPLEMENT_TEMP_DESIGN—A temporary projection. Note that Vertica no longer requires temp designs. ▪ SYSTEM—A projection that was automatically created for a system table.

VERIFIED_FAULT_TOLERANCE	INTEGER	The K-safety value for the projection.
IS_UP_TO_DATE	BOOLEAN	Indicates whether the projection is up to date, where *t* is true and *f* is false. Projections must be up to date to be used in queries.
HAS_STATISTICS	BOOLEAN	Indicates whether there are statistics for any column in the projection, where *t* is true and *f* is false. See ***ANALYZE_STATISTICS*** (page 327).

Example

```
=> SELECT projection_name, anchor_table_name, is_prejoin, is_up_to_date
   FROM projections;
       projection_name        |   anchor_table_name   | is_prejoin | is_up_to_date
------------------------------+-----------------------+------------+---------------
 customer_dimension_site01    | customer_dimension    | f          | t
 customer_dimension_site02    | customer_dimension    | f          | t
 customer_dimension_site03    | customer_dimension    | f          | t
 customer_dimension_site04    | customer_dimension    | f          | t
 product_dimension_site01     | product_dimension     | f          | t
 product_dimension_site02     | product_dimension     | f          | t
 product_dimension_site03     | product_dimension     | f          | t
 product_dimension_site04     | product_dimension     | f          | t
 store_sales_fact_p1          | store_sales_fact      | t          | t
 store_sales_fact_p1_b1       | store_sales_fact      | t          | t
 store_orders_fact_p1         | store_orders_fact     | t          | t
 store_orders_fact_p1_b1      | store_orders_fact     | t          | t
 online_sales_fact_p1         | online_sales_fact     | t          | t
 online_sales_fact_p1_b1      | online_sales_fact     | t          | t
 promotion_dimension_site01   | promotion_dimension   | f          | t
 promotion_dimension_site02   | promotion_dimension   | f          | t
 promotion_dimension_site03   | promotion_dimension   | f          | t
 promotion_dimension_site04   | promotion_dimension   | f          | t
 date_dimension_site01        | date_dimension        | f          | t
 date_dimension_site02        | date_dimension        | f          | t
 date_dimension_site03        | date_dimension        | f          | t
 date_dimension_site04        | date_dimension        | f          | t
 vendor_dimension_site01      | vendor_dimension      | f          | t
 vendor_dimension_site02      | vendor_dimension      | f          | t
 vendor_dimension_site03      | vendor_dimension      | f          | t
 vendor_dimension_site04      | vendor_dimension      | f          | t
 employee_dimension_site01    | employee_dimension    | f          | t
 employee_dimension_site02    | employee_dimension    | f          | t
 employee_dimension_site03    | employee_dimension    | f          | t
 employee_dimension_site04    | employee_dimension    | f          | t
 shipping_dimension_site01    | shipping_dimension    | f          | t
 shipping_dimension_site02    | shipping_dimension    | f          | t
 shipping_dimension_site03    | shipping_dimension    | f          | t
 shipping_dimension_site04    | shipping_dimension    | f          | t
 warehouse_dimension_site01   | warehouse_dimension   | f          | t
 warehouse_dimension_site02   | warehouse_dimension   | f          | t
 warehouse_dimension_site03   | warehouse_dimension   | f          | t
 warehouse_dimension_site04   | warehouse_dimension   | f          | t
 inventory_fact_p1            | inventory_fact        | f          | t
 inventory_fact_p1_b1         | inventory_fact        | f          | t
 store_dimension_site01       | store_dimension       | f          | t
 store_dimension_site02       | store_dimension       | f          | t
 store_dimension_site03       | store_dimension       | f          | t
 store_dimension_site04       | store_dimension       | f          | t
 online_page_dimension_site01 | online_page_dimension | f          | t
 online_page_dimension_site02 | online_page_dimension | f          | t
 online_page_dimension_site03 | online_page_dimension | f          | t
 online_page_dimension_site04 | online_page_dimension | f          | t
```

```
 call_center_dimension_site01 | call_center_dimension | f          | t
 call_center_dimension_site02 | call_center_dimension | f          | t
 call_center_dimension_site03 | call_center_dimension | f          | t
 call_center_dimension_site04 | call_center_dimension | f          | t
(52 rows)
```

RESOURCE_POOLS

Displays information about the parameters specified for the resource pool in the ***CREATE RESOURCE POOL*** (page 531) statement.

Column Name	Data Type	Description
NAME	VARCHAR	The name of the resource pool.
IS_INTERNAL	BOOLEAN	Denotes whether a pool is one of the ***built-in pools*** (page 534).
MEMORYSIZE	VARCHAR	Value of the amount of memory allocated to the resource pool
MAXMEMORYSIZE	VARCHAR	Value assigned as the maximum size the resource pool could grow by borrowing memory from the GENERAL pool.
PRIORITY	INTEGER	Value of PRIORITY parameter specified when defining the pool.
QUEUETIMEOUT	INTEGER	Value in seconds of QUEUETIMEOUT parameter specified when defining the pool. Represents the maximum amount of time the request is allowed to wait for resources to become available before being rejected.
PLANNEDCONCURRENCY	INTEGER	Value of PLANNEDCONCURRENCY parameter specified when defining the pool, which represents number of concurrent queries that are normally expected to be running against the resource pool.
MAXCONCURRENCY	INTEGER	Value of MAXCONCURRENCY parameter specified when defining the pool, which represents the maximum number of concurrent execution slots available to the resource pool.
SINGLEINITIATOR	BOOLEAN	Value that indicates whether all requests using this pool are issued against the same initiator node or whether multiple initiator nodes can be used; for instance in a round-robin configuration.

Notes

Column names in the RESOURCE_POOL table mirror syntax in the CREATE RESOURCE POOL table; therefore, column names do not use underscores.

Example

```
=> SELECT * FROM RESOURCE_POOLS;
   name   | is_internal | memorysize | maxmemorysize | priority | queuetimeout | plannedconcurrency
| maxconcurrency | singleinitiator
----------+-------------+------------+---------------+----------+--------------+--------------------
---+----------------+-----------------
```

```
 general  | t           |            | Special: 95%  |         0 |          300 |                  4
|               | f
 sysquery | t           | 64M        |               |        20 |          300 |                  4
|               | f
 sysdata  | t           | 100M       | 10%           |           |              |
|               |
 wosdata  | t           | 0%         | 25%           |           |              |                  2
|               |
 tm       | t           | 200M       |               |        10 |          300 |                  2
|             3 | t
 refresh  | t           | 0%         |               |       -10 |          300 |                  4
|               | t
 recovery | t           | 0%         |               |        15 |          300 |                 10
|             5 | t
 dbd      | t           | 0%         |               |         0 |            0 |                  4
|               | t
(8 rows)
```

See Also

CREATE RESOURCE POOL (page 531)

Managing Workloads and Monitoring Resource Pools and Resource Usage by Queries in the Administrator's Guide for usage and examples.

SEQUENCES

Displays information about the parameters specified for a sequence using the ***CREATE SEQUENCE*** (page 540) statement.

Column Name	Data Type	Description
SEQUENCE_SCHEMA	VARCHAR	Schema in which the sequence was created.
SEQUENCE_NAME	VARCHAR	Name of the sequence defined in the CREATE SEQUENCE statement.
OWNER_NAME	VARCHAR	Name of the owner; for example, dbadmin.
IDENTITY_TABLE_NAME	VARCHAR	If created by an identity column, the name of the table to which it belongs. See ***column constraints*** (page 556) in the ***CREATE TABLE*** (page 546) statement.
SESSION_CACHE_COUNT	INTEGER	Count of values cached in a session.
ALLOW_CYCLE	BOOLEAN	Values allowed to cycle when max/min is reached. See `CYCLE | NO CYCLE` parameter in ***CREATE SEQUENCE*** (page 540).
OUTPUT_ORDERED	BOOLEAN	Values guaranteed to be ordered (always false).
INCREMENT_BY	INTEGER	Sequence values are incremented by this number (negative for reverse sequences).
MINIMUM	INTEGER	Minimum value the sequence can generate.
MAXIMUM	INTEGER	Maximum value the sequence can generate.
CURRENT_VALUE	INTEGER	Current value of the sequence.
SEQUENCE_SCHEMA_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the schema.

SEQUENCE_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the sequence.
OWNER_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the user who created the sequence.
IDENTITY_TABLE_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the table to which the column belongs (if created by an identity column).

Example

Create a simple sequence:

```
=> CREATE SEQUENCE my_seq MAXVALUE 5000 START 150;
CREATE SEQUENCE
```

Return information about the sequence you just created:

```
=> \x
Expanded display is on.
=> SELECT * FROM sequences;
-[ RECORD 1 ]-------+------------------
sequence_schema     | public
sequence_name       | my_seq
owner_name          | dbadmin
identity_table_name |
session_cache_count | 250000
allow_cycle         | f
output_ordered      | f
increment_by        | 1
minimum             | 1
maximum             | 5000
current_value       | 149
sequence_schema_id  | 45035996273704966
sequence_id         | 45035996273844996
owner_id            | 45035996273704962
identity_table_id   | 0
```

You can also issue the vsql command `\ds` to return a list of sequences. The results below show the sequence created in the previous example. If more sequences existed, they would appear in this table.

```
=> \ds
                                List of Sequences
 Schema | Sequence | CurrentValue | IncrementBy | Minimum | Maximum | AllowCycle
--------+----------+--------------+-------------+---------+---------+---------
---
 public | my_seq   |          149 |           1 |       1 |    5000 | f
(1 row)
```

See Also

CREATE SEQUENCE (page 540)

The \d [PATTERN] meta-commands in the Programmer's Guide

Using Sequences in the Administrator's Guide

SYSTEM_TABLES

Returns a list of all system table names.

Column Name	Data Type	Description
TABLE_SCHEMA	VARCHAR	The schema name in which the system table resides; for example, V_CATALOG (page 664) or V_MONITOR (page 689).
TABLE_NAME	VARCHAR	The name of the system table.
TABLE_DESCRIPTION	VARCHAR	A description of the system table's purpose.

Example

Call all the system tables and order them by schema:

```
=> SELECT * FROM system_tables ORDER BY 1, 2;
```

```
 table_schema |          table_name           |                table_description
--------------+-------------------------------+-------------------------------------------------
-------
 v_catalog    | columns                       | Table column information
 v_catalog    | dual                          | Oracle(TM) compatibility DUAL table
 v_catalog    | foreign_keys                  | Foreign key information
 v_catalog    | grants                        | Grant information
 v_catalog    | passwords                     | User password history and password reuse policy
 v_catalog    | primary_keys                  | Primary key information
 v_catalog    | profile_parameters            | Profile Parameters information
 v_catalog    | profiles                      | Profile information
 v_catalog    | projection_columns            | Projection columns information
 v_catalog    | projections                   | Projection information
 v_catalog    | resource_pools                | Information about defined resource pools
 v_catalog    | system_tables                 | Displays a list of all non-internal system tables
 v_catalog    | table_constraints             | Constraint information
 v_catalog    | tables                        | Table information
 v_catalog    | types                         | Information about supported data types
 v_catalog    | user_functions                | User Defined Function information
 v_catalog    | user_procedures               | User procedure information
 v_catalog    | users                         | User information
 v_catalog    | view_columns                  | View column information
 v_catalog    | views                         | View information
 v_monitor    | active_events                 | Displays all of the active events in the cluster
 v_monitor    | column_storage                | Information on the amount of disk storage in use
 v_monitor    | configuration_parameters      | Configuration Parameters information
 v_monitor    | current_session               | Information on current Session
 v_monitor    | database_snapshots            | Information on stored database snapshots
 v_monitor    | delete_vectors                | Information on delete vectors
 v_monitor    | disk_resource_rejections      | Disk Resource Rejection Summarizations
 v_monitor    | disk_storage                  | Disk usage information
 v_monitor    | event_configurations          | Current Event configuration
 v_monitor    | execution_engine_profiles     | Per EE operator profiling information
 v_monitor    | host_resources                | Per host profiling information
 v_monitor    | load_streams                  | Load metrics for each load stream on each node.
 v_monitor    | locks                         | Lock grants and requests for all nodes
 v_monitor    | node_resources                | Per node profiling information
 v_monitor    | partitions                    | Partition metadata
 v_monitor    | projection_refreshes          | Refresh information on each Projection
 v_monitor    | projection_storage            | Storage information on each Projection
```

```
 v_monitor    | query_metrics                | Summarized query information
 v_monitor    | query_profiles               | Query Profiling
 v_monitor    | resource_acquisitions        | Resources in use by queries
 v_monitor    | resource_acquisitions_history | Resources used by completed queries
 v_monitor    | resource_pool_status         | Resource pool usage Information
 v_monitor    | resource_queues              | Queries waiting to acquire resources
 v_monitor    | resource_rejections          | Resource Rejection Summarizations
 v_monitor    | resource_usage               | Resource usage Information
 v_monitor    | session_profiles             | Per session profiling information
 v_monitor    | sessions                     | Information on each Session
 v_monitor    | storage_containers           | Information on each storage container
 v_monitor    | strata                       | Information of strata used in Tuple Mover
 v_monitor    | strata_structures            | Information of strata structures used in Tuple Mover
 v_monitor    | system                       | System level information
 v_monitor    | tuple_mover_operations       | Information about (automatic) Tuple Mover
 v_monitor    | wos_container_storage        | Storage information on WOS allocator
(53 rows)
```

TABLE_CONSTRAINTS

Provides information about table constraints.

Column Name	Data Type	Description
CONSTRAINT_ID	VARCHAR	A unique numeric ID assigned by the Vertica catalog, which identifies the constraint.
CONSTRAINT_NAME	VARCHAR	The name of the constraint, if specified as UNIQUE, FOREIGN KEY, NOT NULL, or PRIMARY KEY.
CONSTRAINT_SCHEMA_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the schema containing the constraint.
CONSTRAINT_KEY_COUNT	INTEGER	The number of constraint keys.
FOREIGN_KEY_COUNT	INTEGER	The number of foreign keys.
TABLE_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the table.
FOREIGN_TABLE_ID	INTEGER	The unique object ID of the foreign table referenced in a foreign key constraint (zero if not a foreign key constraint).
CONSTRAINT_TYPE	INTEGER	Is one of 'c', 'f', 'p', 'U' or 'd,' which refer to 'check', 'foreign', 'primary', 'unique' and 'determines', respectively.

Example

The following command returns constraint column names and types against the VMart schema.

```
vmartdb=> SELECT constraint_name, constraint_type FROM table_constraints
          ORDER BY constraint_type;
      constraint_name      | constraint_type
---------------------------+-----------------
 fk_online_sales_promotion | f
 fk_online_sales_warehouse | f
 fk_online_sales_shipping  | f
```

```
 fk_online_sales_op        | f
 fk_online_sales_cc        | f
 fk_online_sales_customer  | f
 fk_online_sales_product   | f
 fk_online_sales_shipdate  | f
 fk_online_sales_saledate  | f
 fk_store_orders_employee  | f
 fk_store_orders_vendor    | f
 fk_store_orders_store     | f
 fk_store_orders_product   | f
 fk_store_sales_employee   | f
 fk_store_sales_customer   | f
 fk_store_sales_promotion  | f
 fk_store_sales_store      | f
 fk_store_sales_product    | f
 fk_store_sales_date       | f
 fk_inventory_warehouse    | f
 fk_inventory_product      | f
 fk_inventory_date         | f
 -                         | p
 -                         | p
 -                         | p
 -                         | p
 -                         | p
 -                         | p
 -                         | p
 -                         | p
 -                         | p
 -                         | p
(33 rows)
```

See Also

ANALYZE_CONSTRAINTS (page 321)

Adding Constraints in the Administrator's Guide

TABLES

Provides information about all tables in the database.

Column Name	Data Type	Description
TABLE_SCHEMA_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the schema.
TABLE_SCHEMA	VARCHAR	The schema name for which information is listed.
TABLE_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the table.
TABLE_NAME	VARCHAR	The table name for which information is listed.
OWNER_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the owner.

OWNER_NAME	VARCHAR	The name of the user who created the table.
IS_SYSTEM_TABLE	BOOLEAN	Indicates whether table is a system table, where *t* is true and *f* is false.
SYSTEM_TABLE_CREATOR	VARCHAR	The name of the process that created the table, such as Designer.
PARTITION_EXPRESSION	VARCHAR	The partition expression for the table.

Notes

The TABLE_SCHEMA and TABLE_NAME columns are case sensitive when you run queries that contain the equality (=) predicate. Use the ILIKE predicate instead:

```
=> SELECT table_schema, table_name FROM v_catalog.tables WHERE table_schema ILIKE
'schema1';
```

Example

The following command returns information on all tables in the Vmart schema:

```
vmartdb=> SELECT table_schema, table_name, owner_name, is_system_table FROM
TABLES;
 table_schema |      table_name       | owner_name | is_system_table
--------------+-----------------------+------------+-----------------
 public       | customer_dimension    | release    | f
 public       | product_dimension     | release    | f
 public       | promotion_dimension   | release    | f
 public       | date_dimension        | release    | f
 public       | vendor_dimension      | release    | f
 public       | employee_dimension    | release    | f
 public       | shipping_dimension    | release    | f
 public       | warehouse_dimension   | release    | f
 public       | inventory_fact        | release    | f
 store        | store_dimension       | release    | f
 store        | store_sales_fact      | release    | f
 store        | store_orders_fact     | release    | f
 online_sales | online_page_dimension | release    | f
 online_sales | call_center_dimension | release    | f
 online_sales | online_sales_fact     | release    | f
(15 rows)
```

TYPES

Provides information about supported data types.

Column Name	Data Type	Description
TYPE_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the specific data type.
TYPE_NAME	VARCHAR	The data type name associated with a particular data type ID.

Example

```
=> SELECT * FROM types;
 type_id |  type_name
---------+-------------
       5 | Boolean
       6 | Integer
       7 | Float
       8 | Char
       9 | Varchar
      10 | Date
      11 | Time
      12 | Timestamp
      13 | TimestampTz
      14 | Interval
      15 | TimeTz
      16 | Numeric
      17 | Varbinary
     117 | Binary
(14 rows)
```

USER_FUNCTIONS

Returns metadata about user-defined SQL Macros, which store commonly used SQL expressions as a function in the Vertica catalog.

Column Name	Data Type	Description
FUNCTION_NAME	VARCHAR	The SQL Macro (function) name assigned by the user.
FUNCTION_RETURN_TYPE	VARCHAR	The data type name that the SQL Macro returns.
FUNCTION_DEFINITION	VARCHAR	The SQL expression that the user defined in the SQL Macro's function body.
VOLATILITY	VARCHAR	The SQL Macro's volatility (whether a function returns the same output given the same input). Can be immutable, volatile, or stable.
IS_STRICT	BOOLEAN	Indicates whether the SQL Macro is strict, where *t* is true and *f* is false.

Notes

The volatility and strictness of a SQL Macro are automatically inferred from the function definition in order that Vertica perform constant folding optimization, when possible, and determine the correctness of usage, such as where an immutable function is expected but a volatile function is provided.

Example

Create a SQL Macro called `zeroifnull` in the public schema:

```
=> CREATE FUNCTION zeroifnull(x INT) RETURN INT
   AS BEGIN
```

```
    RETURN (CASE WHEN (x IS NOT NULL) THEN x ELSE 0 END);
  END;
```

Now query the USER_FUNCTIONS table. The query returns just the zeroifnull macro because it is the only one created in this schema:

```
=> SELECT * FROM user_functions;
-[ RECORD 1 ]----------+-----------------------------------------------------
schema_name            | public
function_name          | zeroifnull
function_return_type   | Integer
function_argument_type | x Integer
function_definition    | RETURN CASE WHEN (x IS NOT NULL) THEN x ELSE 0 END
volatility             | immutable
is_strict              | f
```

See Also

CREATE FUNCTION (page 515)

ALTER FUNCTION (page 477)

DROP FUNCTION (page 582)

GRANT (Function) (page 596)

REVOKE (Function) (page 607)

See also Using SQL Macros in the Programmer's Guide

USER_PROCEDURES

Provides information about external procedures that have been defined for Vertica. User see only the procedures they can execute.

Column Name	Data Type	Description
PROCEDURE_NAME	VARCHAR	The name given to the external procedure through the CREATE PROCEDURE statement.
PROCEDURE_ARGUMENTS	VARCHAR	Lists arguments for the external procedure.
SCHEMA_NAME	VARCHAR	Indicates the schema in which the external procedure is defined.

Example

```
=> SELECT * FROM user_procedures;

 procedure_name | procedure_arguments | schema_name
----------------+---------------------+-------------
 helloplanet    | arg1 Varchar        | public
(1 row)
```

USERS

Provides information about all users in the database.

Column Name	Data Type	Description
USER_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the user.
USER_NAME	VARCHAR	The user name for which information is listed.
IS_SUPER_USER	BOOLEAN	Indicates whether the current user is superuser, where *t* is true and *f* is false.
PROFILE_NAME	VARCHAR	The name of the profile to which the user is assigned. The profile controls the user's password policy.
IS_LOCKED	BOOLEAN	Whether the user's account is locked. A locked user cannot log into the system.
LOCK_TIME	DATETIME	When the user's account was locked. Used to determine when to automatically unlock the account, if the user's profile has a PASSWORD_LOCK_TIME parameter set.
RESOURCE_POOL	VARCHAR	The resource pool to which the user is assigned.
MEMORY_CAP_KB	VARCHAR	The maximum amount of memory a query run by the user can consume, in kilobytes.
TEMP_SPACE_CAP_KB	VARCHAR	The maximum amount of temporary disk space a query run by the user can consume, in kilobytes.
RUN_TIME_CAP	VARCHAR	The maximum amount of time any of the user's queries is allowed to run.

Example

```
=> \x
Expanded display is on.
=> SELECT * FROM users;
-[ RECORD 1 ]-----+------------------
user_id           | 45035996273704962
user_name         | dbadmin
is_super_user     | t
profile_name      | default
is_locked         | f
lock_time         |
resource_pool     | general
memory_cap_kb     | unlimited
temp_space_cap_kb | unlimited
run_time_cap      | unlimited
-[ RECORD 2 ]-----+------------------
user_id           | 45035996273708334
user_name         | exampleuser
is_super_user     | f
```

```
profile_name      | default
is_locked         | f
lock_time         |
resource_pool     | general
memory_cap_kb     | unlimited
temp_space_cap_kb | unlimited
run_time_cap      | unlimited
```

VIEW_COLUMNS

Provides view attribute information.

Column Name	Data Type	Description
TABLE_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the view of the table.
TABLE_SCHEMA	VARCHAR	The schema name for which information is listed.
TABLE_NAME	VARCHAR	The table name for which information is listed.
COLUMN_NAME	VARCHAR	The column name for which information is listed.
DATA_TYPE	VARCHAR	The data type of the column for which information is listed; for example, VARCHAR(128).
DATA_TYPE_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the data type.
DATA_TYPE_LENGTH	INTEGER	The maximum allowable length for the data type.
CHARACTER_MAXIMUM_LENGTH	INTEGER	The maximum allowable length for the column, valid for character types.
NUMERIC_PRECISION	INTEGER	The number of significant decimal digits.
NUMERIC_SCALE	INTEGER	The number of fractional digits.
DATETIME_PRECISION	INTEGER	For TIMESTAMP data type, returns the declared precision; returns null if no precision was declared.
INTERVAL_PRECISION	INTEGER	The number of fractional digits retained in the seconds field.
ORDINAL_POSITION	VARCHAR	The position of the column respective to other columns.

Notes

A warning like the following means only that view <t> had its associated table dropped. The view is not returned by the `SELECT * FROM view_columns` command, and the warning is returned merely to notify users about an orphaned view.

```
WARNING:  invalid view v: relation "public.t" does not exist
```

Example

```
=>\pset expanded
Expanded display is on.
=> SELECT * FROM view_columns;
-[ RECORD 3 ]------------+------------------
table_id                 | 45035996273881226
table_schema             | public
table_name               | t_cpp_v
column_name              | c3
data_type                | Char
data_type_id             | 8
data_type_length         | 10
character_maximum_length | 10
numeric_precision        |
numeric_scale            |
datetime_precision       |
interval_precision       |
ordinal_position         | 3
-[ RECORD 4 ]------------+------------------
table_id                 | 45035996273881226
table_schema             | public
table_name               | t_cpp_v
column_name              | c4
data_type                | Date
data_type_id             | 10
data_type_length         | 8
character_maximum_length |
numeric_precision        |
numeric_scale            |
datetime_precision       |
interval_precision       |
ordinal_position         | 4
```

NULL fields in the above results indicate that those columns were not defined. For example, given the following table, the result for the `datetime_precision` column is NULL because no precision was declared:

```
=> CREATE TABLE c (c TIMESTAMP);
CREATE TABLE
=> SELECT table_name, column_name, datetime_precision FROM columns WHERE
table_name = 'c';
 table_name | column_name | datetime_precision
------------+-------------+--------------------
 c          | c           |
(1 row)
```

In this example, the `datetime_precision` column returns 4 because the precision was declared as 4 in the CREATE TABLE statement:

```
=> DROP TABLE c;
=> CREATE TABLE c (c TIMESTAMP(4));
CREATE TABLE
=> SELECT table_name, column_name, datetime_precision FROM columns WHERE
table_name = 'c';
```

```
 table_name | column_name | datetime_precision
------------+-------------+--------------------
 c          | c           |                  4
(1 row)
```

See Also

VIEWS (page 688)

VIEWS

Provides information about all views within the system. See Implementing Views for more information.

Column Name	Data Type	Description
TABLE_SCHEMA_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the table schema.
TABLE_SCHEMA	VARCHAR	The name of the schema that contains the view.
TABLE_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the table.
TABLE_NAME	VARCHAR	The table name for which information is listed.
OWNER_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the owner.
OWNER_NAME	VARCHAR	The name of the view owner.
VIEW_DEFINITION	VARCHAR	The query used to define the view.
IS_SYSTEM_VIEW	BOOLEAN	Indicates whether the table is a system view, where *t* is true and *f* is false.
SYSTEM_VIEW_CREATOR	VARCHAR	The user name who created the view.

Example

Query the VIEWS table:

```
=>\pset expanded
Expanded display is on.
=> SELECT * FROM VIEWS;
-[ RECORD 1 ]-------+-------------------------------------------------------------
table_schema_id     | 45035996273704963
table_schema        | public
table_id            | 45035996273823130
table_name          | temp
owner_id            | 45035996273704961
owner_name          | release
view_definition     | SELECT to_date('F'::character varying, 'dd mm yyyy'::character
                      varying) AS to_date FROM public.customer_dimension
is_system_view      | f
system_view_creator |
```

See Also

Implementing Views

VIEW_COLUMNS (page 686)

V_MONITOR Schema

The system tables in this section reside in the `v_monitor` schema. These tables provide information about the health of the Vertica database.

ACTIVE_EVENTS

Returns all active events in the cluster. See Monitoring Events.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The node name where the event occurred.
EVENT_CODE	INTEGER	A numeric ID that indicates the type of event. See Event Types for a list of event type codes.
EVENT_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the specific event.
EVENT_SEVERITY	VARCHAR	The severity of the event from highest to lowest. These events are based on standard syslog severity types. ▪ 0—Emergency ▪ 1—Alert ▪ 2—Critical ▪ 3—Error ▪ 4—Warning ▪ 5—Notice ▪ 6—Informational ▪ 7—Debug
EVENT_POSTED_TIMESTAMP	TIMESTAMP	The year, month, day, and time the event was reported. The time is posted in military time.
EVENT_EXPIRATION	VARCHAR	The year, month, day, and time the event expire. The time is posted in military time. If the cause of the event is still active, the event is posted again.
EVENT_CODE_DESCRIPTION	VARCHAR	A brief description of the event and details pertinent to the specific situation.
EVENT_PROBLEM_DESCRIPTION	VARCHAR	A generic description of the event.
REPORTING_NODE	VARCHAR	The name of the node within the cluster that reported the event.
EVENT_SENT_TO_CHANNELS	VARCHAR	The event logging mechanisms that are configured for Vertica. These can include `vertica.log`, (configured by default) syslog, and SNMP.
EVENT_POSTED_COUNT	INTEGER	Tracks the number of times an event occurs. Rather than posting the same event multiple

		times, Vertica posts the event once and then counts the number of additional instances in which the event occurs.

Example

Query the ACTIVE_EVENTS table:

```
=>\pset expanded
Expanded display is on.
=> SELECT * FROM active_events;

-[ RECORD 1 ]-------------+----------------------------------------
current_timestamp         | 2009-08-11 14:38:18.083285
node_name                 | site01
event_code                | 6
event_id                  | 6
event_severity            | Informational
is_event_posted           | 2009-08-11 09:38:39.008458
event_expiration          | 2077-08-29 11:52:46.008458
event_code_description    | Node State Change
event_problem_description | Changing node site01 startup state to UP
reporting_node            | site01
event_sent_to_channels    | Vertica Log
event_posted_count        | 1
-[ RECORD 2 ]-------------+----------------------------------------
current_timestamp         | 2009-08-11 14:38:34.226377
node_name                 | site02
event_code                | 6
event_id                  | 6
event_severity            | Informational
is_event_posted           | 2009-08-11 09:38:39.018172
event_expiration          | 2077-08-29 11:52:46.018172
event_code_description    | Node State Change
event_problem_description | Changing node site02 startup state to UP
reporting_node            | site02
event_sent_to_channels    | Vertica Log
event_posted_count        | 1
-[ RECORD 3 ]-------------+----------------------------------------
current_timestamp         | 2009-08-11 14:38:48.859987
node_name                 | site03
event_code                | 6
event_id                  | 6
event_severity            | Informational
is_event_posted           | 2009-08-11 09:38:39.027258
event_expiration          | 2077-08-29 11:52:46.027258
event_code_description    | Node State Change
event_problem_description | Changing node site03 startup state to UP
reporting_node            | site03
event_sent_to_channels    | Vertica Log
event_posted_count        | 1
-[ RECORD 4 ]-------------+----------------------------------------
current_timestamp         | 2009-08-11 14:39:04.226379
node_name                 | site04
event_code                | 6
```

```
event_id                  | 6
event_severity            | Informational
is_event_posted           | 2009-08-11 09:38:39.008288
event_expiration          | 2077-08-29 11:52:46.008288
event_code_description    | Node State Change
event_problem_description | Changing node site04 startup state to UP
reporting_node            | site04
event_sent_to_channels    | Vertica Log
event_posted_count        | 1
...
```

COLUMN_STORAGE

Returns the amount of disk storage used by each column of each projection on each node.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The node name for which information is listed.
COLUMN_NAME	VARCHAR	The column name for which information is listed.
ROW_COUNT	INTEGER	The number of rows in the column.
USED_BYTES	INTEGER	The disk storage allocation of the column in bytes.
ENCODINGS	VARCHAR	The encoding type for the column.
COMPRESSION	VARCHAR	The compression type for the column.
WOS_ROW_COUNT	INTEGER	The number of WOS rows in the column.
ROS_ROW_COUNT	INTEGER	The number of ROS rows in the column.
ROS_USED_BYTES	INTEGER	The number of ROS bytes in the column.
ROS_COUNT	INTEGER	The number of ROS containers.
PROJECTION_NAME	VARCHAR	The associated projection name for the column.
PROJECTION_SCHEMA	VARCHAR	The name of the schema associated with the projection.
ANCHOR_TABLE_NAME	VARCHAR	The associated table name.
ANCHOR_TABLE_SCHEMA	VARCHAR	The associated table's schema name.

Notes

- WOS data is stored by row, so per-column byte counts are not available.
- The ENCODINGS and COMPRESSION columns let you comparing the affect of different encoding types on column storage, when optimizing for compression.

Example

Query the COLUMN_STORAGE table:

```
=> \pset expanded
Expanded display is on.
```

```
=> SELECT * FROM COLUMN_STORAGE;
-[ RECORD 1 ]-------+----------------------------
node_name           | node0001
column_name         | bincol
row_count           | 2
used_bytes          | 0
encodings           | String
compressions        | lzo
wos_row_count       | 0
ros_row_count       | 2
ros_used_bytes      | 0
ros_count           | 1
projection_name     | allTypes_super
projection_schema   | public
anchor_table_name   | allTypes
anchor_table_schema | public
-[ RECORD 12 ]------+---------------------------------
-
node_name           | node0001
column_name         | boolcol
row_count           | 2
used_bytes          | 0
encodings           | Uncompressed
compressions        | lzo
wos_row_count       | 0
ros_row_count       | 2
ros_used_bytes      | 0
ros_count           | 1
projection_name     | allTypes_super
projection_schema   | public
anchor_table_name   | allTypes
anchor_table_schema | public
-[ RECORD 13 ]------+---------------------------------
-
node_name           | node0001
column_name         | charcol
row_count           | 2
used_bytes          | 0
encodings           | String
compressions        | lzo
wos_row_count       | 0
ros_row_count       | 2
ros_used_bytes      | 0
ros_count           | 1
projection_name     | allTypes_super
projection_schema   | public
anchor_table_name   | allTypes
anchor_table_schema | public
-[ RECORD 4 ]-------+----------------------------
...
```

Call specific columns from the `COLUMN_STORAGE` table:

```
SELECT column_name, row_count, projection_name, anchor_table_name
FROM COLUMN_STORAGE
WHERE node_name = 'site02' AND row_count = 1000;
```

```
     column_name      | row_count |       projection_name        |   anchor_table_name
----------------------+-----------+------------------------------+----------------------
 end_date             |      1000 | online_page_dimension_site02 | online_page_dimension
 epoch                |      1000 | online_page_dimension_site02 | online_page_dimension
 online_page_key      |      1000 | online_page_dimension_site02 | online_page_dimension
 page_description     |      1000 | online_page_dimension_site02 | online_page_dimension
 page_number          |      1000 | online_page_dimension_site02 | online_page_dimension
 page_type            |      1000 | online_page_dimension_site02 | online_page_dimension
 start_date           |      1000 | online_page_dimension_site02 | online_page_dimension
 ad_media_name        |      1000 | promotion_dimension_site02   | promotion_dimension
 ad_type              |      1000 | promotion_dimension_site02   | promotion_dimension
 coupon_type          |      1000 | promotion_dimension_site02   | promotion_dimension
 display_provider     |      1000 | promotion_dimension_site02   | promotion_dimension
 display_type         |      1000 | promotion_dimension_site02   | promotion_dimension
 epoch                |      1000 | promotion_dimension_site02   | promotion_dimension
 price_reduction_type |      1000 | promotion_dimension_site02   | promotion_dimension
 promotion_begin_date |      1000 | promotion_dimension_site02   | promotion_dimension
 promotion_cost       |      1000 | promotion_dimension_site02   | promotion_dimension
 promotion_end_date   |      1000 | promotion_dimension_site02   | promotion_dimension
 promotion_key        |      1000 | promotion_dimension_site02   | promotion_dimension
 promotion_media_type |      1000 | promotion_dimension_site02   | promotion_dimension
 promotion_name       |      1000 | promotion_dimension_site02   | promotion_dimension
20 rows)
```

CONFIGURATION_PARAMETERS

Provides information about configuration parameters currently in use by the system.

Caution: Contact ***Technical Support*** (on page 1) before changing any of the parameters that are not explicitly included in the documentation.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The node names on the cluster for which information is listed.
PARAMETER_NAME	VARCHAR	The name of the configurable parameter. See Configuration Parameters in the Administrator's Guide for a detailed list of supported parameters.
CURRENT_VALUE	INTEGER	The value of the current setting for the parameter.
DEFAULT_VALUE	INTEGER	The default value for the parameter.
CHANGE_UNDER_SUPPORT_GUIDANCE	BOOLEAN	A *t* (true) setting indicates that changes to configuration parameters require guidance from Vertica ***Technical Support*** (on page 1).
CHANGE_REQUIRES_RESTART	BOOLEAN	Indicates whether the configuration change requires a restart, where *t* is true and *f* is false.
DESCRIPTION	VARCHAR	A description of the parameter's purpose.

Notes

The CONFIGURATION_PARAMETERS function returns the following error in non-default locales:

```
ERROR:  ORDER BY is not supported with UNION/INTERSECT/EXCEPT in non-default
locales
HINT:  Please move the UNION to a FROM clause subquery.
```

See the ***SET LOCALE*** (page 636) command for details.

Example

The following command returns all current configuration parameters in Vertica:

```
=> SELECT * FROM CONFIGURATION_PARAMETERS;
```

See Also

Configuration Parameters in the Administrator's Guide.

CURRENT_SESSION

Returns information about the current active session. You can use this table to find out the current session's sessionID and get the duration of the previously-run query.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The node name for which information is listed.
USER_NAME	VARCHAR	The name used to log into the database or NULL if the session is internal.
CLIENT_HOSTNAME	VARCHAR	The host name and port of the TCP socket from which the client connection was made; NULL if the session is internal
CLIENT_PID	INTEGER	The process identifier of the client process that issued this connection. **Note:** Remember that the client process could be on a different machine than the server.
LOGIN_TIMESTAMP	TIMESTAMP	The date and time the user logged into the database or when the internal session was created. This column can be useful for identifying sessions that have been left open and could be idle.
SESSION_ID	VARCHAR	The identifier required to close or interrupt a session. This identifier is unique within the cluster at any point in time but can be reused when the session closes.
CLIENT_LABEL	VARCHAR	A user-specified label for the client connection that can be set when using ODBC. See `SessionLabel` in DSN Parameters in Programmer's Guide.
TRANSACTION_START	TIMESTAMP	The date/time the current transaction started or NULL if no transaction is running.
TRANSACTION_ID	VARCHAR	A string containing the hexadecimal representation of the transaction ID, if any;

		otherwise NULL.
TRANSACTION_DESCRIPTION	VARCHAR	A description of the current transaction.
STATEMENT_START	TIMESTAMP	The date/time the current statement started execution, or NULL if no statement is running.
STATEMENT_ID	VARCHAR	An ID for the currently-running statement. NULL indicates that no statement is currently being processed.
LAST_STATEMENT_DURATION_US	INTEGER	The duration of the last completed statement in microseconds.
CURRENT_STATEMENT	VARCHAR	The currently-running statement, if any. NULL indicates that no statement is currently being processed.
LAST_STATEMENT	VARCHAR	NULL if the user has just logged in; otherwise the currently running statement or the most recently completed statement.
EXECUTION_ENGINE_PROFILING_CONFIGURATION	VARCHAR	Returns a value that indicates whether profiling is turned on. Results are: ▪ Empty when no profiling ▪ 'Local' when profiling on for this session ▪ 'Global' when on by default for all sessions ▪ 'Local, Global' when on by default for all sessions and on for current session
QUERY_PROFILING_CONFIGURATION	VARCHAR	Returns a value that indicates whether profiling is turned on. Results are: ▪ Empty when no profiling ▪ 'Local' when profiling on for this session ▪ 'Global' when on by default for all sessions ▪ 'Local, Global' when on by default for all sessions and on for current session
SESSION_PROFILING_CONFIGURATION	VARCHAR	Returns a value that indicates whether profiling is turned on. Results are: ▪ Empty when no profiling ▪ 'Local' when profiling on for this session ▪ 'Global' when on by default for all sessions ▪ 'Local, Global' when on by default for all sessions and on for current session

Notes

- The default for profiling is ON ('1') for all sessions. Each session can turn profiling ON or OFF.

- Profiling parameters (such as `GlobalEEProfiling` in the examples below) are set in the Vertica configuration file (`vertica.conf`). To turn profiling off, set the parameter to '0'. To turn profiling on, set the parameter to '1'.

Examples

Query the CURRENT_SESSION table:

```
=> SELECT * FROM CURRENT_SESSION;
-[ RECORD 1 ]----------------------------+---------------------------------------
node_name                               | v_vmartdb_node01
user_name                               | release
client_hostname                         | xxx.x.x.x:xxxxx
client_pid                              | 18082
login_timestamp                         | 2010-10-07 10:10:03.114863-04
session_id                              | myhost-17956:0x1d
client_label                            |
transaction_start                       | 2010-10-07 11:52:32.43386
transaction_id                          | 45035996273727909
transaction_description                 | user release (select * from passwords;)
statement_start                         | 2010-10-07 12:30:42.444459
statement_id                            | 11
last_statement_duration_us              | 85241
current_statement                       | SELECT * FROM CURRENT_SESSION;
last_statement                          | SELECT * FROM CONFIGURATION_PARAMETERS;
execution_engine_profiling_configuration | Local
query_profiling_configuration           |
session_profiling_configuration         |
```

Request specific columns from the table:

```
=> SELECT node_name, session_id, execution_engine_profiling_configuration
   FROM CURRENT_SESSION;
 node_name |     session_id      | execution_engine_profiling_configuration
-----------+---------------------+-----------------------------------------
 site01    | myhost-17956:0x1d   | Global
(1 row)
```

The sequence of commands in this example shows the use of disabling and enabling profiling for local and global sessions.

This command disables EE profiling for query execution runs:

```
=> SELECT disable_profiling('EE');
disable_profiling
-----------------------
EE Profiling Disabled
(1 row)
```

The following command sets the `GlobalEEProfiling` configuration parameter to 0, which turns off profiling:

```
=> SELECT set_config_parameter('GlobalEEProfiling', '0'); set_config_parameter
----------------------------
Parameter set successfully
(1 row)
```

The following command tells you whether profiling is set to 'Local' or 'Global' or none:

```
=> SELECT execution_engine_profiling_configuration FROM CURRENT_SESSION;
ee_profiling_config
```

```
--------------------

(1 row)
```

Note: The result set is empty because profiling was turned off in the preceding example.

This command now enables EE profiling for query execution runs:

```
=> SELECT enable_profiling('EE');
enable_profiling
----------------------
EE Profiling Enabled
(1 row)
```

Now when you run a select on the CURRENT_SESSION table, you can see profiling is ON for the local session:

```
=> SELECT execution_engine_profiling_configuration FROM CURRENT_SESSION;
ee_profiling_config
--------------------
Local
(1 row)
```

Now turn profiling on for all sessions by setting the GlobalEEProfiling configuration parameter to 1:

```
=> SELECT set_config_parameter('GlobalEEProfiling', '1'); set_config_parameter
---------------------------
Parameter set successfully
(1 row)
```

Now when you run a select on the CURRENT_SESSION table, you can see profiling is ON for the local sessions, as well as for all sessions:

```
=> SELECT execution_engine_profiling_configuration FROM CURRENT_SESSION;
ee_profiling_config
--------------------
Local, Global
(1 row)
```

See Also

CLOSE_SESSION (page 330), ***CLOSE_ALL_SESSIONS*** (page 333), ***EXECUTION_ENGINE_PROFILES*** (page 704), ***QUERY_PROFILES*** (page 722), ***SESSION_PROFILES*** (page 739), and ***SESSIONS*** (page 741)

Managing Sessions and Configuration Parameters in the Administrator's Guide

DELETE_VECTORS

Holds information on deleted rows to speed up the delete process.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The name of the node storing the deleted rows.
SCHEMA_NAME	VARCHAR	The name of the schema where the deleted rows are located.

PROJECTION_NAME	VARCHAR	The name of the projection where the deleted rows are located.
STORAGE_TYPE	VARCHAR	The type of storage containing the delete vector (WOS or ROS).
DV_OID	INTEGER	The unique numeric ID (OID) that identifies this delete vector.
STORAGE_OID	INTEGER	The unique numeric ID (OID) that identifies the storage container that holds the delete vector.
DELETED_ROW_COUNT	INTEGER	The number of rows deleted.
USED_BYTES	INTEGER	The number of bytes used to store the deletion.
START_EPOCH	INTEGER	The start epoch of the data in the delete vector.
END_EPOCH	INTEGER	The end epoch of the data in the delete vector.

DISK_RESOURCE_REJECTIONS

Returns requests for resources that are rejected due to disk space shortages.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The node name for which information is listed.
RESOURCE_TYPE	VARCHAR	The resource request requester (example: Temp files).
REJECTED_REASON	VARCHAR	One of 'Insufficient disk space' or 'Failed volume'.
REJECTED_COUNT	INTEGER	Number of times this REJECTED_REASON has been given for this RESOURCE_TYPE.
FIRST_REJECTED_TIMESTAMP	TIMESTAMP	The time of the first rejection for this REJECTED_REASON and RESOURCE_TYPE.
LAST_REJECTED_TIMESTAMP	TIMESTAMP	The time of the most recent rejection for this REJECTED_REASON and RESOURCE_TYPE.
LAST_REJECTED_VALUE	INTEGER	The value of the most recent rejection for this REJECTED_REASON and RESOURCE_TYPE.

Notes

Output is aggregated by both RESOURCE_TYPE and REJECTED_REASON to provide more comprehensive information.

Example

```
=>\pset expanded
```

```
Expanded display on.
=> SELECT * FROM disk_resource_rejections;
-[ RECORD 1 ]------------+--------------------------
node_name                | e0
resource_type            | Table Data
rejected_reason          | Insufficient disk space
rejected_count           | 2
first_rejected_timestamp | 2009-10-16 15:55:16.336246
last_rejected_timestamp  | 2009-10-16 15:55:16.336391
last_rejected_value      | 1048576
-[ RECORD 2 ]------------+--------------------------
node_name                | e1
resource_type            | Table Data
rejected_reason          | Insufficient disk space
rejected_count           | 2
first_rejected_timestamp | 2009-10-16 15:55:16.37908
last_rejected_timestamp  | 2009-10-16 15:55:16.379207
last_rejected_value      | 1048576
```

See Also

RESOURCE_REJECTIONS (page 735)

CLEAR_RESOURCE_REJECTIONS (page 330)

Managing Workloads and Managing System Resource Usage in the Administrator's Guide

DISK_STORAGE

Returns the amount of disk storage used by the database on each node.

Column Name	Date Type	Description
NODE_NAME	VARCHAR	The node name for which information is listed.
STORAGE_PATH	VARCHAR	The path where the storage location is mounted.
STORAGE_USAGE	VARCHAR	The type of information stored in the location: ▪ DATA: Only data is stored in the location. ▪ TEMP: Only temporary files that are created during loads or queries are stored in the location. ▪ DATA,TEMP: Both types of files are stored in the location. ▪ CATALOG
RANK	INTEGER	The rank assigned to the storage location based on its performance. Ranks are used to create a tiered disk architecture in which projections, columns, and partitions are stored on different disks based on predicted or measured access patterns. See Creating and Configuring Storage Locations in the Administrator's Guide.

THROUGHPUT	INTEGER	The measure of a storage location's performance in MB/sec. 1/throughput is the time taken to read 1MB of data.
LATENCY	INTEGER	The measure of a storage location's performance in seeks/sec. 1/latency is the time taken to seek to the data.
STORAGE_STATUS	VARCHAR	The status of the storage location: active or retired.
DISK_BLOCK_SIZE_BYTES	INTEGER	The block size of the disk in bytes.
DISK_SPACE_USED_BLOCKS	INTEGER	The number of disk blocks in use.
DISK_SPACE_USED_MB	INTEGER	The number of megabytes of disk storage in use.
DISK_SPACE_FREE_BLOCKS	INTEGER	The number of free disk blocks available.
DISK_SPACE_FREE_MB	INTEGER	The number of megabytes of free storage available.
DISK_SPACE_FREE_PERCENT	INTEGER	The percentage of free disk space remaining.

Notes

- The storage usage annotation called CATALOG indicates the location is used to store the catalog. However, CATALOG location can only be specified when Creating a new database and no new locations can be added as CATALOG locations using ***ADD_LOCATION*** (page 318). Existing CATALOG annotations cannot be removed.
- A storage location's performance is measured in throughput in MB/sec and latency in seeks/sec. These two values are converted to single number(Speed) with the following formula:
- ReadTime (time to read 1MB) = 1/throughput + 1 / latency
  - 1/throughput is the time taken to read 1MB of data
  - 1/latency is the time taken to seek to the data.
  - ReadTime is the time taken to read 1MB of data.
- A disk is faster than another disk if its ReadTime is less.
- There can be multiple storage locations per node, and these locations can be on different disks with different free/used space, block size, etc. This information is useful in letting you know where the data files reside.

Example

Query the DISK_STORAGE table:

```
=>\pset expanded
Expanded display is on.
=> SELECT * FROM DISK_STORAGE;

-[ RECORD 1 ]-----------+----------------------------
current_timestamp       | 2009-08-11 14:48:35.932541
node_name               | site01
storage_path            | /mydb/node01_catalog/Catalog
storage_usage           | CATALOG
rank                    | 0
```

```
throughput              | 0
latency                 | 0
storage_status          | Active
disk_block_size_bytes   | 4096
disk_space_used_blocks  | 34708721
disk_space_used_mb      | 135581
disk_space_free_blocks  | 178816678
disk_space_free_mb      | 698502
disk_space_free_percent | 83%
-[ RECORD 2 ]-----------+-----------------------------
current_timestamp       | 2009-08-11 14:48:53.884255
node_name               | site01
storage_path            | /mydb/node01_data
storage_usage           | DATA,TEMP
rank                    | 0
throughput              | 0
latency                 | 0
storage_status          | Active
disk_block_size_bytes   | 4096
disk_space_used_blocks  | 34708721
disk_space_used_mb      | 135581
disk_space_free_blocks  | 178816678
disk_space_free_mb      | 698502
disk_space_free_percent | 83%
-[ RECORD 3 ]-----------+-----------------------------
current_timestamp       | 2009-08-11 14:49:08.299012
node_name               | site02
storage_path            | /mydb/node02_catalog/Catalog
storage_usage           | CATALOG
rank                    | 0
throughput              | 0
latency                 | 0
storage_status          | Active
disk_block_size_bytes   | 4096
disk_space_used_blocks  | 19968349
disk_space_used_mb      | 78001
disk_space_free_blocks  | 193557050
disk_space_free_mb      | 756082
disk_space_free_percent | 90%
-[ RECORD 4 ]-----------+-----------------------------
current_timestamp       | 2009-08-11 14:49:22.696772
node_name               | site02
storage_path            | /mydb/node02_data
storage_usage           | DATA,TEMP
rank                    | 0
throughput              | 0
latency                 | 0
storage_status          | Active
disk_block_size_bytes   | 4096
disk_space_used_blocks  | 19968349
disk_space_used_mb      | 78001
disk_space_free_blocks  | 193557050
disk_space_free_mb      | 756082
disk_space_free_percent | 90%
```

```
-[ RECORD 5 ]-----------+-----------------------------
current_timestamp       | 2009-08-11 14:50:03.960157
node_name               | site03
storage_path            | /mydb/node03_catalog/Catalog
storage_usage           | CATALOG
rank                    | 0
throughput              | 0
latency                 | 0
storage_status          | Active
disk_block_size_bytes   | 4096
disk_space_used_blocks  | 19902595
disk_space_used_mb      | 77744
disk_space_free_blocks  | 193622804
disk_space_free_mb      | 756339
disk_space_free_percent | 90%
-[ RECORD 6 ]-----------+-----------------------------
current_timestamp       | 2009-08-11 14:50:27.415735
node_name               | site03
storage_path            | /mydb/node03_data
storage_usage           | DATA,TEMP
rank                    | 0
throughput              | 0
latency                 | 0
storage_status          | Active
disk_block_size_bytes   | 4096
disk_space_used_blocks  | 19902595
disk_space_used_mb      | 77744
disk_space_free_blocks  | 193622804
disk_space_free_mb      | 756339
disk_space_free_percent | 90%
-[ RECORD 7 ]-----------+-----------------------------
current_timestamp       | 2009-08-11 14:50:39.398879
node_name               | site04
storage_path            | /mydb/node04_catalog/Catalog
storage_usage           | CATALOG
rank                    | 0
throughput              | 0
latency                 | 0
storage_status          | Active
disk_block_size_bytes   | 4096
disk_space_used_blocks  | 19972309
disk_space_used_mb      | 78017
disk_space_free_blocks  | 193553090
disk_space_free_mb      | 756066
disk_space_free_percent | 90%
-[ RECORD 8 ]-----------+-----------------------------
current_timestamp       | 2009-08-11 14:50:57.879302
node_name               | site04
storage_path            | /mydb/node04_data
storage_usage           | DATA,TEMP
rank                    | 0
throughput              | 0
latency                 | 0
storage_status          | Active
```

```
disk_block_size_bytes   | 4096
disk_space_used_blocks  | 19972309
disk_space_used_mb      | 78017
disk_space_free_blocks  | 193553090
disk_space_free_mb      | 756066
disk_space_free_percent | 90%
```

Request only specific columns from the table:

```
=> SELECT node_name, storage_path, storage_status, disk_space_free_percent FROM disk_storage;

 node_name |         storage_path         | storage_status | disk_space_free_percent
-----------+------------------------------+----------------+-------------------------
 site01    | /mydb/node01_catalog/Catalog | Active         | 83%
 site01    | /mydb/node01_data            | Active         | 83%
 site02    | /mydb/node02_catalog/Catalog | Active         | 90%
 site02    | /mydb/node02_data            | Active         | 90%
 site03    | /mydb/node03_catalog/Catalog | Active         | 90%
 site03    | /mydb/node03_data            | Active         | 90%
 site04    | /mydb/node04_catalog/Catalog | Active         | 90%
 site04    | /mydb/node04_data            | Active         | 90%
(8 rows)
```

EVENT_CONFIGURATIONS

Monitors the configuration of events.

Column Name	Date Type	Description
EVENT_ID	VARCHAR	The name of the event.
EVENT_DELIVERY_CHANNELS	VARCHAR	The delivery channel on which the event occurred.

Example

```
=> SELECT * FROM event_configurations;

                event_id                  | event_delivery_channels
------------------------------------------+-------------------------
 Low Disk Space                           | Vertica Log, SNMP Trap
 Read Only File System                    | Vertica Log, SNMP Trap
 Loss Of K Safety                         | Vertica Log, SNMP Trap
 Current Fault Tolerance at Critical Level | Vertica Log, SNMP Trap
 Too Many ROS Containers                  | Vertica Log, SNMP Trap
 WOS Over Flow                            | Vertica Log, SNMP Trap
 Node State Change                        | Vertica Log, SNMP Trap
 Recovery Failure                         | Vertica Log, SNMP Trap
 Recovery Error                           | Vertica Log
 Recovery Lock Error                      | Vertica Log
 Recovery Projection Retrieval Error      | Vertica Log
 Refresh Error                            | Vertica Log
 Refresh Lock Error                       | Vertica Log
 Tuple Mover Error                        | Vertica Log
 Timer Service Task Error                 | Vertica Log
 Stale Checkpoint                         | Vertica Log, SNMP Trap
(16 rows)
```

EXECUTION_ENGINE_PROFILES

Provides information regarding query execution runs.

For additional details about profiling and debugging, see Profiling Database Performance in the Troubleshooting Guide.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The node name for which information is listed.
SESSION_ID	VARCHAR	The identification of the session for which profiling information is captured. This identifier is unique within the cluster at any point in time but can be reused when the session closes.
TRANSACTION_ID	INTEGER	An identifier for the transaction within the session if any; otherwise NULL.
STATEMENT_ID	INTEGER	An ID for the currently-running statement. NULL indicates that no statement is currently being processed.
USER_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the user.
USER_NAME	VARCHAR	The user name for which query profile information is listed.
OPERATOR_NAME	VARCHAR	The name of the Execution Engine component; for example, NetworkSend.
OPERATOR_ID	INTEGER	The ID of the Execution Engine component.
BASEPLAN_ID	INTEGER	The ID in the original plan by the optimizer (EXPLAIN plan).
LOCALPLAN_ID	INTEGER	The ID in the plan that was actually executed (EXPLAIN LOCAL plan).
COUNTER_NAME	VARCHAR	The name of the counter. See the "COUNTER_NAME Values" section below this table.
COUNTER_TAG	VARCHAR	A string that uniquely identifies the counter for operators that might need to distinguish between different instances. For example, COUNTER_TAG is used to identify to which of the node bytes are being sent to or received from for the NetworkSend operator.
COUNTER_VALUE	INTEGER	The value of the counter.
IS_EXECUTING	VARCHAR	Distinguishes between active and completed profiles.

COUNTER_NAME Values

The value of COUNTER_NAME can be any of the following:

COUNTER_NAME	Description
buffers spilled	[NetworkSend] Buffers spilled to disk by NetworkSend.
bytes received	[NetworkRecv] The number of bytes received over the network for query execution.
bytes sent	[NetworkSend] Size of data after encoding and compression sent over the network (actual network bytes).
bytes spilled	[NetworkSend] Bytes spilled to disk by NetworkSend.
bytes total	Only relevant to SendFiles operator (that is, recover-by-container plan) total number of bytes to send / receive.
clock time (µs)	Real-time clock in microseconds. **Note:** This counter was called execution time (us) in previous Vertica releases.
completed merge phases	Number of merge phases already completed by an LSort or DataTarget operator. Compare to the total merge phases. Variants on this value include "join inner completed merge phases."
cumulative size of raw temp data (bytes)	Compare to cumulative size of temp files (bytes) to understand impact of encoding and compression in an externalizing operator. Variants on this value include join inner cumulative size of raw temp files (bytes).
cumulative size of temp files (bytes)	For externalizing operators only, the total number of bytes the operator has written to temp files. A sort operator might go through multiple merge phases, where at each pass sorted chunks of data are merged into fewer chunks. This counter remembers the cumulative size of all temp files past and present. Variants on this value include join inner cumulative size of temp files (bytes).
current size of temp files (bytes)	For externalizing operators only, the current size of the operator's temp files in bytes. Variants on this value include join inner current size of temp files (bytes).
encoded bytes received	[NetworkRecv] Size of received data after decompressed (but still encoded) received over the network.
encoded bytes sent	[NetworkSend] Size of data sent over the network after encoding.
executable time (ms)	Thread CPU clock time in milliseconds.
files completed	Relevant only to SendFiles/RecvFiles operators (that is, recover-by-container plan) number of files sent / received.
file handles	Number of file handles used by the operator.
files total	Relevant only to SendFiles/RecvFiles operators (that is, recover-by-container plan) total number of files to send / receive.
input queue wait (µs)	Time in microseconds that an operator spends waiting for upstream operators.

input size (bytes)	Total number of bytes of the Load operator's input source, where NULL is unknown (read from FIFO).
memory allocated (bytes)	Actual memory in bytes that the operator allocated at run time.
memory reserved (bytes)	Memory reserved by the operator in the ResourceManager operator. **Note:** An allocation slightly more than the reservation (a few MB) is not a cause for concern and is built into ResourceManager calculations.
network wait (µs)	[NetworkSend, NetworkRecv] Time in microseconds spent waiting on the network.
output queue wait (µs)	Time in microseconds that an operator spends waiting for the output buffer to be consumed by a downstream operator.
phj sort cumulative size of raw temp files (bytes)	Less common counter for partitioned hash join. **Note:** Used only for joins of dynamically-redistributed data.
phj inner cumulative size of raw temp files (bytes)	
phj outer cumulative size of raw temp files (bytes)	
phj sort cumulative size of temp files (bytes)	
phj inner cumulative size of temp files (bytes)	
phj outer cumulative size of temp files (bytes)	
phj sort current size of temp files (bytes)	
phj inner current size of temp files (bytes)	
phj outer current size of temp files (bytes)	
phj total partitions	Total number of partitions created. This counter is null until all input is consumed and the number of partitions is known.
phj completed partitions	Number of partitions that have been processed.
producer stall (µs)	[NetworkSend] Time in microseconds spent by NetworkSend when stalled waiting for network buffers to clear.
producer wait (µs)	[NetworkSend] Time in microseconds spent by the input operator making rows to send.
rle rows produced	Number of physical tuples produced by an operator. Complements the rows produced counter, which shows the number of logical rows produced by an operator. For example, if a value occurs 1000 rows consecutively and is RLE encoded, it counts as 1000 rows

	`produced` not only 1 `rle rows produced`.
`read (bytes)`	Number of bytes read from the input source by the `Load` operator.
`receive time (µs)`	Time in microseconds that a `Recv` operator spends reading data from its socket.
`rows produced`	Number of logical rows produced by an operator. See also the `rle rows produced` counter.
`rows received`	[`NetworkRecv`] Number of received sent over the network.
`rows rejected`	The number of rows rejected by the `Load` operator.
`rows sent`	[`NetworkSend`] Number of rows sent over the network.
`send time (µs)`	Time in microseconds that a `Send` operator spends writing data to its socket.
`total merge phases`	Number of merge phases an `LSort` or `DataTarget` operator must complete to finish sorting its data. NULL until the operator can compute this value (all data must first be ingested by the operator). Variants on this value include `join inner total merge phases`.
`WOS bytes acquired`	Number of bytes acquired from the WOS by a `DataTarget` operator. **Note:** This is usually more but can be less than `WOS bytes written` if an earlier statement in the transaction acquired some WOS memory.
`WOS bytes written`	Number of bytes written to the WOS by a `DataTarget` operator.

Example

```
=> SELECT  operator_name, operator_id, counter_name, counter_value
   FROM EXECUTION_ENGINE_PROFILES WHERE operator_name = 'Scan'
   ORDER BY counter_value DESC;
 operator_name | operator_id |       counter_name       | counter_value
---------------+-------------+--------------------------+---------------
 Scan          |           6 | memory allocated (bytes) |         15688
 Scan          |           6 | estimated rows produced  |          9999
 Scan          |           6 | estimated rows produced  |          9999
 Scan          |           6 | memory allocated (bytes) |          2152
 Scan          |           6 | clock time (us)          |           572
 Scan          |           6 | execution time (us)      |           187
 Scan          |           6 | clock time (us)          |             0
 Scan          |           6 | memory reserved (bytes)  |             0
 Scan          |           6 | file handles             |             0
 Scan          |           6 | rows produced            |             0
 Scan          |           6 | memory reserved (bytes)  |             0
 Scan          |           6 | rows produced            |             0
 Scan          |           6 | file handles             |             0
 Scan          |           6 | execution time (us)      |             0
(14 rows)
=> SELECT DISTINCT counter_name FROM execution_engine_profiles; counter_name
--------------------------
```

```
 file handles
 estimated rows produced
 memory reserved (bytes)
 clock time (us)
 output queue wait (us)
 input queue wait (us)
 wait clock time (us)
 wait execution time (us)
 execution time (us)
 memory allocated (bytes)
 rows produced
(11 rows)
```

See Also

Profiling Database Performance in the Troubleshooting Guide, particularly Viewing Profiling Data

HOST_RESOURCES

Provides a snapshot of the node. This is useful for regularly polling the node with automated tools or scripts.

Column Name	Data Type	Description
HOST_NAME	VARCHAR	The host name for which information is listed.
OPEN_FILES_LIMIT	INTEGER	The maximum number of files that can be open at one time on the node.
THREADS_LIMIT	INTEGER	The maximum number of threads that can coexist on the node.
CORE_FILE_LIMIT_MAX_SIZE_BYTES	INTEGER	The maximum core file size allowed on the node.
PROCESSOR_COUNT	INTEGER	The number of system processors.
PROCESSOR_CORE_COUNT	INTEGER	The number of processor cores in the system.
PROCESSOR_DESCRIPTION	VARCHAR	A description of the processor. For example: Inter(R) Core(TM)2 Duo CPU T8100 @2.10GHz (1 row)
OPENED_FILE_COUNT	INTEGER	The total number of open files on the node.
OPENED_SOCKET_COUNT	INTEGER	The total number of open sockets on the node.
OPENED_NONFILE_NONSOCKET_COUNT	INTEGER	The total number of *other* file descriptions open in which 'other' could be a directory or FIFO. It is not an open file or socket.
TOTAL_MEMORY_BYTES	INTEGER	The total amount of physical RAM, in bytes, available on the system.
TOTAL_MEMORY_FREE_BYTES	INTEGER	The amount of physical RAM, in bytes, left unused by the system.
TOTAL_BUFFER_MEMORY_BYTES	INTEGER	The amount of physical RAM, in bytes, used for file buffers on the system

TOTAL_MEMORY_CACHE_BYTES	INTEGER	The amount of physical RAM, in bytes, used as cache memory on the system.
TOTAL_SWAP_MEMORY_BYTES	INTEGER	The total amount of swap memory available, in bytes, on the system.
TOTAL_SWAP_MEMORY_FREE_BYTES	INTEGER	The total amount of swap memory free, in bytes, on the system.
DISK_SPACE_FREE_MB	INTEGER	The free disk space available, in megabytes, for all storage location file systems (data directories).
DISK_SPACE_USED_MB	INTEGER	The disk space used, in megabytes, for all storage location file systems.
DISK_SPACE_TOTAL_MB	INTEGER	The total free disk space available, in megabytes, for all storage location file systems.

Examples

Query the HOST_RESOURCES table:

```
=>\pset expanded
Expanded display is on.
=> SELECT * FROM HOST_RESOURCES;

-[ RECORD 1 ]------------------+-------------------------------------
host_name                      | myhost-s1
open_files_limit               | 65536
threads_limit                  | 15914
core_file_limit_max_size_bytes | 1649680384
processor_count                | 2
processor_core_count           | 8
processor_description          | Intel(R) Xeon(R) CPU E5504  @ 2.00GHz
opened_file_count              | 5
opened_socket_count            | 4
opened_nonfile_nonsocket_count | 3
total_memory_bytes             | 16687161344
total_memory_free_bytes        | 4492627968
total_buffer_memory_bytes      | 1613922304
total_memory_cache_bytes       | 9349111808
total_swap_memory_bytes        | 36502126592
total_swap_memory_free_bytes   | 36411580416
disk_space_free_mb             | 121972
disk_space_used_mb             | 329235
disk_space_total_mb            | 451207
-[ RECORD 2 ]------------------+-------------------------------------
host_name                      | myhost-s2
open_files_limit               | 65536
threads_limit                  | 15914
core_file_limit_max_size_bytes | 3772891136
processor_count                | 2
processor_core_count           | 4
processor_description          | Intel(R) Xeon(R) CPU E5504  @ 2.00GHz
opened_file_count              | 5
opened_socket_count            | 3
opened_nonfile_nonsocket_count | 3
total_memory_bytes             | 16687161344
total_memory_free_bytes        | 9525706752
total_buffer_memory_bytes      | 2840420352
total_memory_cache_bytes       | 3060588544
```

```
total_swap_memory_bytes        | 34330370048
total_swap_memory_free_bytes   | 34184642560
disk_space_free_mb             | 822190
disk_space_used_mb             | 84255
disk_space_total_mb            | 906445
-[ RECORD 3 ]------------------+-------------------------------------
host_name                      | myhost-s3
open_files_limit               | 65536
threads_limit                  | 15914
core_file_limit_max_size_bytes | 3758211072
processor_count                | 2
processor_core_count           | 4
processor_description          | Intel(R) Xeon(R) CPU E5504  @ 2.00GHz
opened_file_count              | 5
opened_socket_count            | 3
opened_nonfile_nonsocket_count | 3
total_memory_bytes             | 16687161344
total_memory_free_bytes        | 9718706176
total_buffer_memory_bytes      | 2928369664
total_memory_cache_bytes       | 2757115904
total_swap_memory_bytes        | 34315689984
total_swap_memory_free_bytes   | 34205523968
disk_space_free_mb             | 820789
disk_space_used_mb             | 85640
disk_space_total_mb            | 906429
-[ RECORD 4 ]------------------+-------------------------------------
host_name                      | myhost-s4
open_files_limit               | 65536
threads_limit                  | 15914
core_file_limit_max_size_bytes | 3799433216
processor_count                | 2
processor_core_count           | 8
processor_description          | Intel(R) Xeon(R) CPU E5504  @ 2.00GHz
opened_file_count              | 5
opened_socket_count            | 3
opened_nonfile_nonsocket_count | 3
total_memory_bytes             | 16687161344
total_memory_free_bytes        | 8772620288
total_buffer_memory_bytes      | 3792273408
total_memory_cache_bytes       | 2831040512
total_swap_memory_bytes        | 34356912128
total_swap_memory_free_bytes   | 34282590208
disk_space_free_mb             | 818896
disk_space_used_mb             | 55291
disk_space_total_mb            | 874187
```

LOAD_STREAMS

Monitors load metrics for each load stream on each node.

Column Name	Date Type	Description
STREAM_NAME	VARCHAR	The optional identifier that names a stream, if specified.
TABLE_NAME	VARCHAR	The name of the table being loaded.
LOAD_START	VARCHAR	The Linux system time when the load started.
ACCEPTED_ROW_COUNT	INTEGER	The number of rows loaded.
REJECTED_ROW_COUNT	INTEGER	The number of rows rejected.

READ_BYTES	INTEGER	The number of bytes read from the input file.
INPUT_FILE_SIZE_BYTES	INTEGER	The size of the input file in bytes. **Note:** When using STDIN as input size of input file size is zero (0).
PARSE_COMPLETE_PERCENT	INTEGER	The percent of the rows in the input file that have been loaded.
UNSORTED_ROW_COUNT	INTEGER	The cumulative number rows not sorted across all projections. **Note:** UNSORTED_ROW_COUNT could be greater than ACCEPTED_ROW_COUNT because data is copied and sorted for every projection in the target table.
SORTED_ROW_COUNT	INTEGER	The cumulative number of rows sorted across all projections.
SORT_COMPLETE_PERCENT	INTEGER	The percent of the rows in the input file that have been sorted.

Notes

If a COPY ... DIRECT operation is in progress, the ACCEPTED_ROW_COUNT field could increase up to the maximum number of rows in the input file as the rows are being parsed. If COPY reads from many named pipes, PARSE_COMPLETE_PERCENT shows 0 until it receives an EOF from *all* named pipes. This can take a significant amount of time, and it is easy to mistake this state as a hang. Check your system CPU and disk accesses to determine if any activity is in progress before canceling COPY or reporting a hang.

In a typical load, you might notice PARSE_COMPLETE_PERCENT creep up to 100% or jump to 100% if loading from named pipes or STDIN, while SORT_COMPLETE_PERCENT is at 0. Once PARSE_COMPLETE_PERCENT reaches 100%, SORT_COMPLETE_PERCENT creeps up to 100%. Depending on the data sizes, there could be significant lag between the time PARSE_COMPLETE_PERCENT reaches 100% and the time SORT_COMPLETE_PERCENT begins to increase.

Example

```
=> \pset expanded
Expanded display is on.
=> SELECT * FROM load_streams;

-[ RECORD 1 ]----------+---------------------------
stream_name            | fact-13
table_name             | fact
load_start             | 2010-09-28 15:07:41.132053
accepted_row_count     | 900
rejected_row_count     | 100
read_bytes             | 11975
input_file_size_bytes  | 0
parse_complete_percent | 0
unsorted_row_count     | 3600
```

```
sorted_row_count       | 3600
sort_complete_percent  | 100
```

LOCKS

Monitors lock grants and requests for all nodes.

Column Name	Date Type	Description
NODE_NAMES	VARCHAR	The nodes on which lock interaction occurs. **Note on node rollup:** If a transaction has the same lock in the same mode in the same scope on multiple nodes, it gets one (1) line in the table. NODE_NAMES are separated by commas.
OBJECT_NAME	VARCHAR	Name of object being locked; can be a table or an internal structure (projection, global catalog, or local catalog).
OBJECT_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the object being locked.
TRANSACTION_DESCRIPTION	VARCHAR	ID of transaction and associated description, typically the query that caused the transaction's creation.
LOCK_MODE	VARCHAR	Describes the intended operations of the transaction: ▪ S — Share lock needed for select operations ▪ I — Insert lock needed for insert operations ▪ X — Exclusive lock is always needed for delete operations. X lock is also the result of lock promotion (see Table 2) ▪ T — Tuple Mover lock used by the Tuple Mover and also used for COPY into pre-join projections ▪ U — Usage lock needed for moveout and mergeout operations in the first phase; they then upgrade their U lock to a T lock for the second phase. U locks conflicts with no other locks but O. ▪ O — Owner lock needed for DROP_PARTITION, TRUNCATE TABLE, and ADD COLUMN. O locks conflict with all locks. O locks never promote.
LOCK_SCOPE	VARCHAR	The expected duration of the lock once it is granted. Before the lock is granted, the scope is listed as REQUESTED. Once a lock has been granted, the following scopes are possible: ▪ STATEMENT_LOCALPLAN

		▪ STATEMENT_COMPILE ▪ STATEMENT_EXECUTE ▪ TRANSACTION_POSTCOMMIT ▪ TRANSACTION All scopes, other than TRANSACTION, are transient and are used only as part of normal query processing.

Notes

- Locks acquired on tables that were subsequently dropped by another transaction can result in the message, `Unknown or deleted object`, appearing in the output's `OBJECT` column.
- If a `SELECT..FROM LOCKS` query times out after five minutes, it is possible the cluster has failed. Run the Diagnostics Utility and contact ***Technical Support*** (on page 1).

The following two tables are from *Transaction Processing: Concepts and Techniques http://www.amazon.com/gp/product/1558601902/ref=s9sdps_c1_14_at1-rfc_p-frt_p-3237_g1_si1?pf_rd_m=ATVPDKIKX0DER&pf_rd_s=center-1&pf_rd_r=1QHH6V589JEV0DR3DQ1D&pf_rd_t=101&pf_rd_p=463383351&pf_rd_i=507846* by Jim Gray (Figure 7.11, p. 408 and Figure 8.6, p. 467).

Table 1: Compatibility matrix for granular locks

This table is for compatibility with other users. The table is symmetric.

	Granted Mode					
Requested Mode	**S**	**I**	**X**	**T**	**U**	**O**
S	Yes	No	No	Yes	Yes	No
I	**No**	**Yes**	No	Yes	Yes	No
X	No	No	No	No	Yes	No
T	Yes	Yes	No	Yes	Yes	No
U	Yes	Yes	Yes	Yes	Yes	No
O	No	No	No	No	No	No

The following two examples refer to Table 1 above:

- **Example 1:** If someone else has an S lock, you cannot get an I lock.
- **Example 2:** If someone has an I lock, you can get an I lock.

Table 2: Lock conversion matrix

This table is used for upgrading locks you already have. For example, If you have an S lock and you want an I lock, you request an **X** lock. If you have an S lock and you want an S lock, no lock requests is required.

	Granted Mode					
Requested Mode	**S**	**I**	**X**	**T**	**U**	**O**
S	S	X	X	S	S	0
I	**X**	I	X	I	I	0
X	X	X	X	X	X	0
T	S	I	X	T	T	0
U	S	I	X	T	U	O
O	O	O	O	O	O	O

Example

The following table call shows that there are no current locks in use:

```
=> SELECT * FROM LOCKS;
 node_names | object_name | object_id | transaction_description | lock_mode |
lock_scope
------------+-------------+-----------+-------------------------+-----------+-
-----------
(0 rows)
```

The next example shows an insert lock in use:

```
=>\pset expanded
Expanded display is on.
vmartdb=> SELECT * FROM LOCKS;
-[ RECORD 1
]----------+-----------------------------------------------------------
node_names              | node01,node02,node03,node04
object_name             | Table:fact
object_id               | 45035996273772278
transaction_description | Txn: a000000000112b 'COPY fact FROM '/data_dg/fact.dat'
                          DELIMITER '|' NULL '\\N';'
lock_mode               | I
lock_scope              | TRANSACTION
start_timestamp         | 2010-09-17 14:01:07.662325-04
```

See Also

DUMP_LOCKTABLE (page 346)

PROJECTION_REFRESHES (page 717)

SELECT (page 617) FOR UPDATE clause

SESSION_PROFILES (page 739)

NODE_RESOURCES

Provides a snapshot of the node. This is useful for regularly polling the node with automated tools or scripts.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The node name for which information is listed.
HOST_NAME	VARCHAR	The hostname associated with a particular node.
PROCESS_SIZE_BYTES	INTEGER	The total size of the program.
PROCESS_RESIDENT_SET_SIZE_BYTES	INTEGER	The total number of pages that the process has in memory.
PROCESS_SHARED_MEMORY_SIZE_BYTES	INTEGER	The amount of shared memory used.
PROCESS_TEXT_MEMORY_SIZE_BYTES	INTEGER	The total number of text pages that the process has in physical memory. This does not include any shared libraries.
PROCESS_DATA_MEMORY_SIZE_BYTES	INTEGER	The amount of physical memory, in pages, used for performing processes. This does not include the executable code.
PROCESS_LIBRARY_MEMORY_SIZE_BYTES	INTEGER	The total number of library pages that the process has in physical memory.
PROCESS_DIRTY_MEMORY_SIZE_BYTES	INTEGER	The number of pages that have been modified since they were last written to disk.

Example

Query the NODE_RESOURCES table:

```
=>\pset expanded
Expanded display is on.
=> SELECT * FROM NODE_RESOURCES;

-[ RECORD 1 ]----------------------+-------------------
node_name                          | v_vmartdb_node01
host_name                          | myhost-s1
process_size_bytes                 | 2001829888
process_resident_set_size_bytes    | 40964096
process_shared_memory_size_bytes   | 16543744
process_text_memory_size_bytes     | 46649344
process_data_memory_size_bytes     | 0
process_library_memory_size_bytes  | 1885351936
process_dirty_memory_size_bytes    | 0
-[ RECORD 2 ]----------------------+-------------------
node_name                          | v_vmartdb_node02
host_name                          | myhost-s2
process_size_bytes                 | 399822848
process_resident_set_size_bytes    | 31453184
process_shared_memory_size_bytes   | 10862592
process_text_memory_size_bytes     | 46649344
process_data_memory_size_bytes     | 0
process_library_memory_size_bytes  | 299356160
process_dirty_memory_size_bytes    | 0
```

```
-[ RECORD 3 ]----------------------+------------------
node_name                          | v_vmartdb_node03
host_name                          | myhost-s3
process_size_bytes                 | 399822848
process_resident_set_size_bytes    | 31100928
process_shared_memory_size_bytes   | 10735616
process_text_memory_size_bytes     | 46649344
process_data_memory_size_bytes     | 0
process_library_memory_size_bytes  | 299356160
process_dirty_memory_size_bytes    | 0
-[ RECORD 4 ]----------------------+------------------
node_name                          | v_vmartdb_node04
host_name                          | myhost-s4
process_size_bytes                 | 466923520
process_resident_set_size_bytes    | 31309824
process_shared_memory_size_bytes   | 10735616
process_text_memory_size_bytes     | 46649344
process_data_memory_size_bytes     | 0
process_library_memory_size_bytes  | 366456832
process_dirty_memory_size_bytes    | 0
```

PARTITIONS

Displays partition metadata, one row per partition key, per ROS container.

Column Name	Data Type	Description
PARTITION_KEY	VARCHAR	The partition value(s).
TABLE_SCHEMA	VARCHAR	The schema name for which information is listed.
PROJECTION_NAME	VARCHAR	The projection name for which information is listed.
ROS_ID	VARCHAR	A unique numeric ID assigned by the Vertica catalog, which identifies the ROS container.
ROS_SIZE_BYTES	INTEGER	The ROS container size in bytes.
ROS_ROW_COUNT	INTEGER	Number of rows in the ROS container.
NODE_NAME	VARCHAR	Node where the ROS container resides.

Notes

- A many-to-many relationship exists between partitions and ROS containers. PARTITIONS displays information in a denormalized fashion.
- To find the number of ROS containers having data of a specific partition, aggregate PARTITIONS over the `partition_key` column.
- To find the number of partitions stored in a ROS container, aggregate PARTITIONS over the `ros_id` column.

Example

Given a projection named `p1` with three ROS containerS (RC1, RC2 and RC3), the values are defined as follow:

```
 COLUMN NAME             RC1                  RC2                RC3
----------------+--------------------+--------------------+--------------------
 PARTITION_KEY  |  (20,30,40)        |  (20)              |  (30,60)
 ROS_ID         |  45035986273705000 |  45035986273705001 |  45035986273705002
 SIZE           |  1000              |  20000             |  30000
 ROW_ROW_COUNT  |  100               |  200               |  300
 NODE_NAME      |  node01            |  node01            |  node01
```

The PARTITIONS function returns six rows:

```
=> SELECT PARTITION_KEY, PROJECTION_NAME, ROS_ID, ROS_SIZE_BYTES, ROS_ROW_COUNT,NODE_NAME
   FROM PARTITIONS;
PARTITION_KEY | PROJECTION_NAME |      ROS_ID        | ROS_SIZE_BYTES | ROS_ROW_COUNT | NODE_NAME
-------------+-----------------+--------------------+----------------+---------------+-----------
 20          | p1              | 45035986273705000  | 10000          | 100           | node01
 30          | p1              | 45035986273705000  | 10000          | 100           | node01
 40          | p1              | 45035986273705000  | 10000          | 100           | node01
 20          | p1              | 45035986273705001  | 20000          | 200           | node01
 30          | p1              | 45035986273705002  | 30000          | 300           | node01
 60          | p1              | 45035986273705002  | 30000          | 300           | node01
```

PROJECTION_REFRESHES

Provides information about refresh operations for projections.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The node where the refresh was initiated.
PROJECTION_SCHEMA	VARCHAR	The name of the schema associated with the projection.
PROJECTION_NAME	VARCHAR	The name of the projection that is targeted for refresh.
ANCHOR_TABLE_NAME	VARCHAR	The name of the projection's associated anchor table.
REFRESH_STATUS	VARCHAR	The status of the projection: ▪ Queued — Indicates that a projection is queued for refresh. ▪ Refreshing — Indicates that a refresh for a projection is in process. ▪ Refreshed — Indicates that a refresh for a projection has successfully completed. ▪ Failed — Indicates that a refresh for a projection did not successfully complete.
REFRESH_PHASE	VARCHAR	Indicates how far the refresh has progressed: ▪ Historical – Indicates that the refresh has reached the first phase and is refreshing data from historical data. This refresh phase requires the most amount of time. ▪ Current – Indicates that the refresh has reached the final phase and is attempting to refresh data

		from the current epoch. To complete this phase, refresh must be able to obtain a lock on the table. If the table is locked by some other transaction, refresh is put on hold until that transaction completes. ▪ The ***LOCKS*** (page 712) system table is useful for determining if a refresh has been blocked on a table lock. To determine if a refresh has been blocked, locate the term "refresh" in the transaction description. A refresh has been blocked when the scope for the refresh is REQUESTED and one or more other transactions have acquired a lock on the table. **Note:** The REFRESH_PHASE field is NULL until the projection starts to refresh and is NULL after the refresh completes.
REFRESH_METHOD	VARCHAR	The method used to refresh the projection: ▪ Buddy – Uses the contents of a buddy to refresh the projection. This method maintains historical data. This enables the projection to be used for historical queries. ▪ Scratch – Refreshes the projection without using a buddy. This method does not generate historical data. This means that the projection cannot participate in historical queries from any point before the projection was refreshed.
REFRESH_FAILURE_COUNT	INTEGER	The number of times a refresh failed for the projection. FAILURE_COUNT does not indicate whether the projection was eventually refreshed. See REFRESH_STATUS to determine how the refresh operation is progressing.
SESSION_ID	VARCHAR	A unique numeric ID assigned by the Vertica catalog, which identifies the refresh session.
REFRESH_START	TIMESTAMP	The time the projection refresh started (provided as a timestamp).
REFRESH_DURATION_SEC	INTEGER	The length of time that the projection refresh ran in seconds.
IS_EXECUTING	BOOLEAN	Indicates if the refresh is currently running (t) or if the refresh occurred in the past (f).

Notes

- Information about a refresh operation—whether successful or unsuccessful—is maintained in the PROJECTION_REFRESHES system table until either the ***CLEAR_PROJECTION_REFRESHES()*** (page 329) function is executed or the storage quota for the table is exceeded.

- Tables and projections can be dropped while a query runs against them. The query continues to run, even after the drop occurs. Only when the query finishes does it notice the drop, which could cause a rollback. The same is true for refresh queries. PROJECTION_REFRESHES, therefore, could report that a projection failed to be refreshed before the refresh query completes. In this case, the REFRESH_DURATION_SEC column continues to increase until the refresh query completes.

Example

Query the PROJECTION_REFRESHES table:

```
=>\pset expanded
Expanded display on.
=> SELECT * FROM projection_refreshes;
-[ RECORD 1 ]---------+-----------------------------------
node_name             | node02
projection_schema     | public
projection_name       | fact_p1_b1
anchor_table_name     | fact
refresh_status        | refreshed
refresh_phase         |
refresh_method        | buddy
refresh_failure_count | 0
session_id            | myhost.verticacorp-15750:0x6b38
refresh_start         | 2010-09-28 15:09:12.411551
refresh_duration_sec  | 2
is_executing          | f
```

The following command purges projection refresh history from the PROJECTION_REFRESHES table:

```
=> SELECT clear_projection_refreshes();
 clear_projection_refreshes
----------------------------
 CLEAR
(1 row)
```

Only the rows where the IS_EXECUTING column equals false are cleared.

See Also

CLEAR_PROJECTION_REFRESHES (page 329)

Clearing PROJECTION_REFRESHES History in the Administrator's Guide

PROJECTION_STORAGE

Monitors the amount of disk storage used by each projection on each node.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The node name for which information is listed.
PROJECTION_NAME	VARCHAR	The projection name for which information is listed.
PROJECTION_SCHEMA	VARCHAR	The name of the schema associated with the

		projection.
PROJECTION_COLUMN_COUNT	INTEGER	The number of columns in the projection.
ROW_COUNT	INTEGER	The number of rows in the table's projections, excluding any rows marked for deletion.
USED_BYTES	INTEGER	The number of bytes of disk storage used by the projection.
WOS_ROW_COUNT	INTEGER	The number of WOS rows in the projection.
WOS_USED_BYTES	INTEGER	The number of WOS bytes in the projection.
ROS_ROW_COUNT	INTEGER	The number of ROS rows in the projection.
ROS_USED_BYTES	INTEGER	The number of ROS bytes in the projection.
ROS_COUNT	INTEGER	The number of ROS containers in the projection.
ANCHOR_TABLE_NAME	VARCHAR	The associated table name for which information is listed.
ANCHOR_TABLE_SCHEMA	VARCHAR	The associated table schema for which information is listed.

Example

```
=> SELECT projection_name, row_count, ros_used_bytes, used_bytes
   FROM PROJECTION_STORAGE WHERE projection_schema = 'store' ORDER BY used_bytes;
                     projection_name                      | row_count | ros_used_bytes |
used_bytes
----------------------------------------------------------+-----------+----------------+-------
-----
 store_dimension_DBD_4_seg_vmartdb_design_vmartdb_design    |        53 |           2791 |
2791
 store_dimension_DBD_29_seg_vmartdb_design_vmartdb_design   |        53 |           2791 |
2791
 store_dimension_DBD_29_seg_vmartdb_design_vmartdb_design   |        56 |           2936 |
2936
 store_dimension_DBD_4_seg_vmartdb_design_vmartdb_design    |        56 |           2936 |
2936
 store_dimension_DBD_4_seg_vmartdb_design_vmartdb_design    |        68 |           3360 |
3360
 store_dimension_DBD_29_seg_vmartdb_design_vmartdb_design   |        68 |           3360 |
3360
 store_dimension_DBD_29_seg_vmartdb_design_vmartdb_design   |        73 |           3579 |
3579
 store_dimension_DBD_4_seg_vmartdb_design_vmartdb_design    |        73 |           3579 |
3579
 store_orders_fact_DBD_31_seg_vmartdb_design_vmartdb_design |     53974 |        1047782 |
1047782
 store_orders_fact_DBD_6_seg_vmartdb_design_vmartdb_design  |     53974 |        1047782 |
1047782
 store_orders_fact_DBD_6_seg_vmartdb_design_vmartdb_design  |     66246 |        1285786 |
1285786
 store_orders_fact_DBD_31_seg_vmartdb_design_vmartdb_design |     66246 |        1285786 |
1285786
 store_orders_fact_DBD_31_seg_vmartdb_design_vmartdb_design |     71909 |        1395258 |
1395258
 store_orders_fact_DBD_6_seg_vmartdb_design_vmartdb_design  |     71909 |        1395258 |
1395258
 store_orders_fact_DBD_6_seg_vmartdb_design_vmartdb_design  |    107871 |        2090941 |
2090941
 store_orders_fact_DBD_31_seg_vmartdb_design_vmartdb_design |    107871 |        2090941 |
```

```
2090941
 store_sales_fact_DBD_5_seg_vmartdb_design_vmartdb_design   |   1235825 |       24285740 |
24285740
 store_sales_fact_DBD_30_seg_vmartdb_design_vmartdb_design  |   1235825 |       24285740 |
24285740
 store_sales_fact_DBD_30_seg_vmartdb_design_vmartdb_design  |   1245865 |       24480819 |
24480819
 store_sales_fact_DBD_5_seg_vmartdb_design_vmartdb_design   |   1245865 |       24480819 |
24480819
 store_sales_fact_DBD_5_seg_vmartdb_design_vmartdb_design   |   1249547 |       24551817 |
24551817
 store_sales_fact_DBD_30_seg_vmartdb_design_vmartdb_design  |   1249547 |       24551817 |
24551817
 store_sales_fact_DBD_30_seg_vmartdb_design_vmartdb_design  |   1268763 |       24930549 |
24930549
 store_sales_fact_DBD_5_seg_vmartdb_design_vmartdb_design   |   1268763 |       24930549 |
24930549
(24 rows)
```

QUERY_METRICS

Monitors the sessions and queries running on each node.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The node name for which information is listed.
ACTIVE_USER_SESSION_COUNT	INTEGER	The number of active user sessions (connections).
ACTIVE_SYSTEM_SESSION_COUNT	INTEGER	The number of active system sessions.
TOTAL_USER_SESSION_COUNT	INTEGER	The total number of user sessions.
TOTAL_SYSTEM_SESSION_COUNT	INTEGER	The total number of system sessions.
TOTAL_ACTIVE_SESSION_COUNT	INTEGER	The total number of active user and system sessions.
TOTAL_SESSION_COUNT	INTEGER	The total number of user and system sessions.
RUNNING_QUERY_COUNT	INTEGER	The number of queries currently running.
EXECUTED_QUERY_COUNT	INTEGER	The total number of queries that ran.

Notes

Totals get reset each time you restart the database.

Example

```
=>\pset expanded
Expanded display is on.
=> SELECT * FROM QUERY_METRICS;

-[ RECORD 1 ]---------------+-------------------
node_name                   | v_vmartdb_node01
active_user_session_count   | 1
active_system_session_count | 2
```

```
total_user_session_count    | 2
total_system_session_count  | 6248
total_active_session_count  | 3
total_session_count         | 6250
running_query_count         | 1
executed_query_count        | 42
-[ RECORD 2 ]---------------+-------------------
node_name                   | v_vmartdb_node02
active_user_session_count   | 1
active_system_session_count | 2
total_user_session_count    | 2
total_system_session_count  | 6487
total_active_session_count  | 3
total_session_count         | 6489
running_query_count         | 0
executed_query_count        | 0
-[ RECORD 3 ]---------------+-------------------
node_name                   | v_vmartdb_node03
active_user_session_count   | 1
active_system_session_count | 2
total_user_session_count    | 2
total_system_session_count  | 6489
total_active_session_count  | 3
total_session_count         | 6491
running_query_count         | 0
executed_query_count        | 0
-[ RECORD 4 ]---------------+-------------------
node_name                   | v_vmartdb_node04
active_user_session_count   | 1
active_system_session_count | 2
total_user_session_count    | 2
total_system_session_count  | 6489
total_active_session_count  | 3
total_session_count         | 6491
running_query_count         | 0
executed_query_count        | 0
```

QUERY_PROFILES

Provides information about queries that have run. To obtain information about query profiling, see Collecting Query Information in the Troubleshooting Guide.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The node name for which information is listed.
SESSION_ID	VARCHAR	The identification of the session for which profiling information is captured. This identifier is unique within the cluster at any point in time but can be reused when the session closes.
TRANSACTION_ID	INTEGER	An identifier for the transaction within the session if any; otherwise NULL.

STATEMENT_ID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the currently-executing statement. **Note:** NULL indicates that no statement is currently being processed.
IDENTIFIER	VARCHAR	A string to identify the query in virtual tables.
QUERY	VARCHAR	The query string used for the query.
QUERY_SEARCH_PATH	VARCHAR	A list of schemas in which to look for tables.
SCHEMA_NAME	VARCHAR	The schema name in which the query is being profiled.
TABLE_NAME	VARCHAR	The table name in the query being profiled.
PROJECTIONS_USED	VARCHAR	The projections used in the query.
QUERY_DURATION_US	INTEGER	The duration of the query in microseconds.
QUERY_START_EPOCH	VARCHAR	The epoch number at the start of the given query.
QUERY_START	VARCHAR	The Linux system time of query execution in a format that can be used as a DATE/TIME expression.
QUERY_TYPE	VARCHAR	Is one of INSERT, SELECT, UPDATE, DELETE, UTILITY, or UNKNOWN.
ERROR_CODE	INTEGER	The return error code for the query.
USER_NAME	VARCHAR	The name of the user who ran the query.
PROCESSED_ROW_COUNT	INTEGER	The number of rows returned by the query.
RESERVED_EXTRA_MEMORY	INTEGER	The amount of extra memory reserved for the query. Extra memory is the amount of memory reserved for the plan but not assigned to a particular operator. This is the memory from which unbounded operators pull first. If they acquire all of the extra memory, then the plan must go back to the Resource Manager for more memory. See **Notes** section below this table.
IS_EXECUTING	BOOLEAN	Displays information about actively running queries, regardless of whether profiling is enabled.

Notes

- The total memory reserved by the query is available in RESOURCE_ACQUISITIONS.MEMORY_INUSE_KB (page 724). The difference between RESOURCE_ACQUISITIONS.MEMORY_INUSE_KB and QUERY_PROFILES.EXTRA_MEMORY is the "essential memory."
  - RESOURCE_ACQUISITIONS.MEMORY_INUSE_KB is the total memory acquired.
  - QUERY_PROFILES.EXTRA_MEMORY is the unused portion of the acquired memory.
  - The difference gives you the memory in use.
- If the query has finished executing, query the RESOURCE_ACQUISITIONS_HISTORY (page 727) table.

Example

Query the QUERY_PROFILES table:

```
=>\pset expanded
Expanded display is on.
=> SELECT * FROM QUERY_PROFILES;

-[ RECORD 1 ]-------+----------------------------------------------------------
...
-[ RECORD 18 ]------+----------------------------------------------------------
node_name           | v_vmartdb_node0001
session_id          | raster-s1-17956:0x1d
transaction_id      | 45035996273728061
statement_id        | 6
identifier          |
query               | SELECT * FROM event_configurations;
query_search_path   | "$user", public, v_catalog, v_monitor, v_internal
schema_name         |
table_name          |
projections_used    | v_monitor.event_configurations_p
query_duration_us   | 9647
query_start_epoch   | 429
query_start         | 2010-10-07 12:46:24.370044-04
query_type          | SELECT
error_code          | 0
user_name           | release
processed_row_count | 16
reserved_extra_memory | 0
is_executing        | f
-[ RECORD ...]------+----------------------------------------------------------
...
```

See Also

RESOURCE_ACQUISITIONS (page 724)

RESOURCE_ACQUISITIONS_HISTORY (page 727)

Profiling Database Performance, Collecting Query Information, and Monitoring the QUERY_REPO Table in the Troubleshooting Guide

Managing Workloads in the Administrator's Guide

RESOURCE_ACQUISITIONS

Provides information about resources (memory, open file handles, threads) acquired by each running request for each resource pool in the system.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The node name for which information is listed.
TRANSACTION_ID	INTEGER	Transaction identifier for this request.
STATEMENT_ID	INTEGER	Statement identifier for this request.
POOL_NAME	VARCHAR	The name of the resource pool.
THREAD_COUNT	INTEGER	Number of threads in use by this request.

OPEN_FILE_HANDLE_COUNT	INTEGER	Number of open file handles in use by this request.
MEMORY_INUSE_KB	INTEGER	Amount of memory in Kilobytes acquired by this request. See Notes section below this table.
QUEUE_ENTRY_TIMESTAMP	TIMESTAMP	Timestamp when the request was queued.
ACQUISITION_TIMESTAMP	TIMESTAMP	Timestamp when the request was admitted to run.

Notes

- The total memory reserved by the query is available in RESOURCE_ACQUISITIONS.MEMORY_INUSE_KB. The difference between RESOURCE_ACQUISITIONS.MEMORY_INUSE_KB and QUERY_PROFILES.EXTRA_MEMORY (page 722) is the "essential memory."
  - RESOURCE_ACQUISITIONS.MEMORY_INUSE_KB is the total memory acquired.
  - QUERY_PROFILES.EXTRA_MEMORY is the unused portion of the acquired memory.
  - The difference gives you the memory in use.
- If the query has finished executing, query the RESOURCE_ACQUISITIONS_HISTORY (page 727) table.

Example

```
vmartdb=> \x
Expanded display is on.

vmartdb=> SELECT * FROM resource_acquisitions;
-[ RECORD 1 ]----------+-----------------------------
node_name              | v_vmartdb_node01
transaction_id         | 45035996273744830
statement_number       | 3
pool_name              | sysquery
thread_count           | 4
open_file_handle_count | 0
memory_inuse_kb        | 4110
queue_entry_timestamp  | 2010-05-05 16:22:43.272117-04
acquisition_timestamp  | 2010-05-05 16:22:43.272123-04
-[ RECORD 2 ]----------+-----------------------------
node_name              | v_vmartdb_node01
transaction_id         | -1
statement_number       | 45035996273708350
pool_name              | sysdata
thread_count           | 0
open_file_handle_count | 0
memory_inuse_kb        | 4096
queue_entry_timestamp  | 2010-05-05 14:22:52.863803-04
acquisition_timestamp  | 2010-05-05 14:22:52.863828-04
-[ RECORD 3 ]----------+-----------------------------
node_name              | v_vmartdb_node01
transaction_id         | -1
statement_number       | 45035996273708352
pool_name              | wosdata
thread_count           | 0
```

```
open_file_handle_count | 0
memory_inuse_kb        | 0
queue_entry_timestamp  | 2010-05-05 14:32:46.997389-04
acquisition_timestamp  | 2010-05-05 15:21:38.447699-04
-[ RECORD 4 ]----------+------------------------------
node_name              | v_vmartdb_node02
transaction_id         | -1
statement_number       | 45035996273708352
pool_name              | wosdata
thread_count           | 0
open_file_handle_count | 0
memory_inuse_kb        | 0
queue_entry_timestamp  | 2010-05-05 14:32:47.00394-04
acquisition_timestamp  | 2010-05-05 15:21:38.448964-04
-[ RECORD 5 ]----------+------------------------------
node_name              | v_vmartdb_node03
transaction_id         | -1
statement_number       | 45035996273708352
pool_name              | wosdata
thread_count           | 0
open_file_handle_count | 0
memory_inuse_kb        | 0
queue_entry_timestamp  | 2010-05-05 14:32:47.005306-04
acquisition_timestamp  | 2010-05-05 15:21:38.454139-04
-[ RECORD 6 ]----------+------------------------------
node_name              | v_vmartdb_node04
transaction_id         | -1
statement_number       | 45035996273708352
pool_name              | wosdata
thread_count           | 0
open_file_handle_count | 0
memory_inuse_kb        | 0
queue_entry_timestamp  | 2010-05-05 14:32:47.003121-04
acquisition_timestamp  | 2010-05-05 15:21:38.452377-04
```

See Also

QUERY_PROFILES (page 722)

RESOURCE_ACQUISITIONS_HISTORY (page 727)

RESOURCE_POOL_STATUS (page 730)

RESOURCE_POOLS (page 676)

RESOURCE_QUEUES (page 734)

RESOURCE_REJECTIONS (page 735)

Managing Workloads and Scenario: Setting a Hard Limit on Concurrency For An Application in the Administrator's Guide

RESOURCE_ACQUISITIONS_HISTORY

Provides information about resources (memory, open file handles, threads) acquired by any profiled query for each resource pool in the system. The data in this table is retained as long as the equivalent data is stored in the ***QUERY_PROFILES*** (page 722) table. This means that the data may be cleared from this table when the CLEAR_PROFILING function is called, or when data from QUERY_PROFILES is moved to the query repository.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The node name for which information is listed.
TRANSACTION_ID	INTEGER	Transaction identifier for this request.
STATEMENT_ID	INTEGER	Statement identifier for this request.
POOL_NAME	VARCHAR	The name of the resource pool.
THREAD_COUNT	INTEGER	Number of threads in use by this request.
OPEN_FILE_HANDLE_COUNT	INTEGER	Number of open file handles in use by this request.
MEMORY_INUSE_KB	INTEGER	Amount of memory in kilobytes acquired by this request.
QUEUE_ENTRY_TIMESTAMP	TIMESTAMP	TIMESTAMP when the request was queued.
ACQUISITION_TIMESTAMP	TIMESTAMP	TIMESTAMP when the request was admitted to run.

Example

```
vmartdb=> \x
Expanded display is on.
vmartdb=> SELECT * FROM resource_acquisitions_history;

-[ RECORD 1 ]----------+-----------------------------
node_name              | v_vmartdb_node01
transaction_id         | 45035996273734167
statement_id           | 1
pool_name              | sysquery
thread_count           | 4
open_file_handle_count | 0
memory_inuse_kb        | 4110
queue_entry_timestamp  | 2010-10-19 17:57:32.830559-04
acquisition_timestamp  | 2010-10-19 17:57:32.830566-04
-[ RECORD 2 ]----------+-----------------------------
node_name              | v_vmartdb_node01
transaction_id         | 45035996273733629
statement_id           | 1
pool_name              | sysquery
thread_count           | 4
open_file_handle_count | 0
memory_inuse_kb        | 4232
queue_entry_timestamp  | 2010-10-19 15:06:38.568905-04
acquisition_timestamp  | 2010-10-19 15:06:38.568914-04
```

```
-[ RECORD 3 ]----------+-----------------------------
node_name              | v_vmartdb_node01
transaction_id         | 45035996273733629
statement_id           | 2
pool_name              | sysquery
thread_count           | 4
open_file_handle_count | 0
memory_inuse_kb        | 4232
queue_entry_timestamp  | 2010-10-19 15:12:23.296074-04
acquisition_timestamp  | 2010-10-19 15:12:23.296082-04
-[ RECORD 4 ]----------+-----------------------------
node_name              | v_vmartdb_node01
transaction_id         | 45035996273733629
statement_id           | 3
pool_name              | sysquery
thread_count           | 4
open_file_handle_count | 0
memory_inuse_kb        | 4232
queue_entry_timestamp  | 2010-10-19 15:51:44.131538-04
acquisition_timestamp  | 2010-10-19 15:51:44.131545-04
-[ RECORD 5 ]----------+-----------------------------
node_name              | v_vmartdb_node01
transaction_id         | 45035996273733629
statement_id           | 4
pool_name              | sysquery
thread_count           | 4
open_file_handle_count | 0
memory_inuse_kb        | 4232
queue_entry_timestamp  | 2010-10-19 15:52:06.91811-04
acquisition_timestamp  | 2010-10-19 15:52:06.918117-04
-[ RECORD 6 ]----------+-----------------------------
node_name              | v_vmartdb_node01
transaction_id         | 45035996273733629
statement_id           | 5
pool_name              | sysquery
thread_count           | 4
open_file_handle_count | 0
memory_inuse_kb        | 4232
queue_entry_timestamp  | 2010-10-19 15:52:56.427166-04
acquisition_timestamp  | 2010-10-19 15:52:56.427174-04
-[ RECORD 7 ]----------+-----------------------------
node_name              | v_vmartdb_node01
transaction_id         | 45035996273733629
statement_id           | 6
pool_name              | sysquery
thread_count           | 4
open_file_handle_count | 0
memory_inuse_kb        | 4229
queue_entry_timestamp  | 2010-10-19 15:54:04.529661-04
acquisition_timestamp  | 2010-10-19 15:54:04.529668-04
-[ RECORD 8 ]----------+-----------------------------
node_name              | v_vmartdb_node01
transaction_id         | 45035996273733629
statement_id           | 7
```

```
pool_name              | sysquery
thread_count           | 4
open_file_handle_count | 0
memory_inuse_kb        | 4232
queue_entry_timestamp  | 2010-10-19 16:00:34.279086-04
acquisition_timestamp  | 2010-10-19 16:00:34.279093-04
-[ RECORD 9 ]----------+------------------------------
node_name              | v_vmartdb_node01
transaction_id         | 45035996273733629
statement_id           | 8
pool_name              | sysquery
thread_count           | 4
open_file_handle_count | 0
memory_inuse_kb        | 4232
queue_entry_timestamp  | 2010-10-19 16:01:01.112476-04
acquisition_timestamp  | 2010-10-19 16:01:01.112484-04
-[ RECORD 10 ]---------+------------------------------
node_name              | v_vmartdb_node01
transaction_id         | 45035996273733629
statement_id           | 9
pool_name              | sysquery
thread_count           | 4
open_file_handle_count | 0
memory_inuse_kb        | 4232
queue_entry_timestamp  | 2010-10-19 16:02:38.263142-04
acquisition_timestamp  | 2010-10-19 16:02:38.26315-04
-[ RECORD 11 ]---------+------------------------------
node_name              | v_vmartdb_node01
transaction_id         | 45035996273733629
statement_id           | 10
pool_name              | sysquery
thread_count           | 4
open_file_handle_count | 0
memory_inuse_kb        | 4232
queue_entry_timestamp  | 2010-10-19 16:02:44.278322-04
acquisition_timestamp  | 2010-10-19 16:02:44.278329-04
-[ RECORD 12 ]---------+------------------------------
node_name              | v_vmartdb_node01
transaction_id         | 45035996273733629
statement_id           | 11
pool_name              | sysquery
thread_count           | 4
open_file_handle_count | 0
memory_inuse_kb        | 4232
queue_entry_timestamp  | 2010-10-19 16:04:05.409825-04
acquisition_timestamp  | 2010-10-19 16:04:05.409832-04
-[ RECORD 13 ]---------+------------------------------
node_name              | v_vmartdb_node01
transaction_id         | 0
statement_id           | 0
pool_name              |
thread_count           | 0
open_file_handle_count | 0
memory_inuse_kb        | 0
```

```
queue_entry_timestamp  | 1999-12-31 19:00:00-05
acquisition_timestamp  | 1999-12-31 19:00:00-05
```

See Also

QUERY_PROFILES (page 722)

RESOURCE_ACQUISITIONS (page 724)

RESOURCE_POOL_STATUS (page 730)

RESOURCE_POOLS (page 676)

RESOURCE_QUEUES (page 734)

RESOURCE_REJECTIONS (page 735)

Managing Workloads in the Administrator's Guide

RESOURCE_POOL_STATUS

Provides configuration settings of the various resource pools in the system, including internal pools.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The name of the node for which information is provided.
POOL_OID	INTEGER	A unique numeric ID assigned by the Vertica catalog that identifies the pool.
POOL_NAME	VARCHAR	The name of the resource pool.
IS_INTERNAL	BOOLEAN	Denotes whether a pool is one of the ***built-in pools*** (page 534).
MEMORY_SIZE_KB	INTEGER	Value of `MemorySize` setting of the pool in kilobytes
MEMORY_SIZE_ACTUAL_KB	INTEGER	Current amount of memory in kilobytes allocated to the pool by the resource manager. Note that the actual size can be less than specified in the DDL, if the pool has been recently altered in a running system and the request to shuffle memory is pending. See ***ALTER RESOURCE POOL*** (page 481).
MEMORY_INUSE_KB	INTEGER	Amount of memory in Kilobytes acquired by requests running against this pool.
GENERAL_MEMORY_BORROWED_KB	INTEGER	Amount of memory in Kilobytes borrowed from the General pool by requests running against this pool. The sum of `MEMORY_INUSE_KB` and `GENERAL_MEMORY_BORROWED_KB` should be less than `MAX_MEMORY_SIZE_KB` (see below).

QUEUEING_THRESHOLD_KB	INTEGER	Calculated as MAX_MEMORY_SIZE_KB * 75%. When the amount of memory used by all requests against this queue exceed the QUEUEING_THRESHOLD_KB (but less than MAX_MEMORY_SIZE_KB), new requests against the pool will be queued until memory becomes available.
MAX_MEMORY_SIZE_KB	INTEGER	Value of MAXMEMORYSIZE size parameter specified when defining the pool. Provides an upper limit on the amount of memory that can be taken up by requests running against this pool. Once this threshold is reached, new requests against this pool are rejected until memory becomes available.
RUNNING_QUERY_COUNT	INTEGER	Number of queries actually running using this pool.
PLANNED_CONCURRENCY	INTEGER	Value of PLANNEDCONCURRENCY parameter specified when defining the pool.
MAX_CONCURRENCY	INTEGER	Value of MAXCONCURRENCY parameter specified when defining the pool.
IS_STANDALONE	BOOLEAN	If the pool is configured to have MEMORYSIZE equal to MAXMEMORYSIZE, it does not borrow any memory from the General pool and hence said to be standalone.
QUEUE_TIMEOUT_SECONDS	INTEGER	Value of QUEUETIMEOUT parameter specified when defining the pool.
PRIORITY	INTEGER	Value of PRIORITY parameter specified when defining the pool.
SINGLE_INITIATOR	INTEGER	Value of SINGLEINITIATOR parameter specified when defining the pool.
QUERY_BUDGET_KB	INTEGER	The current amount of memory that queries are tuned to use.

Example

The following command finds all the configuration settings of the various resource pools on node01:

```
vmartdb=> SELECT * FROM RESOURCE_POOL_STATUS WHERE node_name ILIKE 'node02';
-[ RECORD 1 ]--------------+------------------
node_name                  | v_vmartdb_node02
pool_oid                   | 45035996273708346
pool_name                  | general
is_internal                | t
memory_size_kb             | 7562919
memory_size_actual_kb      | 7562919
```

```
memory_inuse_kb             | 0
general_memory_borrowed_kb | 0
queueing_threshold_kb       | 5672189
max_memory_size_kb          | 7562919
running_query_count         | 0
planned_concurrency         | 4
max_concurrency             |
is_standalone               | t
queue_timeout_in_seconds    | 300
priority                    | 0
single_initiator            | false
query_budget_kb             | 1398847
-[ RECORD 2 ]---------------+------------------
node_name                   | v_vmartdb_node02
pool_oid                    | 45035996273708348
pool_name                   | sysquery
is_internal                 | t
memory_size_kb              | 65536
memory_size_actual_kb       | 65536
memory_inuse_kb             | 0
general_memory_borrowed_kb | 0
queueing_threshold_kb       | 5721341
max_memory_size_kb          | 7628455
running_query_count         | 0
planned_concurrency         | 4
max_concurrency             |
is_standalone               | f
queue_timeout_in_seconds    | 300
priority                    | 20
single_initiator            | false
query_budget_kb             | 16384
-[ RECORD 3 ]---------------+------------------
node_name                   | v_vmartdb_node02
pool_oid                    | 45035996273708350
pool_name                   | sysdata
is_internal                 | t
memory_size_kb              | 102400
memory_size_actual_kb       | 102400
memory_inuse_kb             | 0
general_memory_borrowed_kb | 0
queueing_threshold_kb       | 587493
max_memory_size_kb          | 783325
running_query_count         | 0
planned_concurrency         | 1
max_concurrency             | 0
is_standalone               | f
queue_timeout_in_seconds    | 0
priority                    | 0
single_initiator            | false
query_budget_kb             |
-[ RECORD 4 ]---------------+------------------
node_name                   | v_vmartdb_node02
pool_oid                    | 45035996273708352
pool_name                   | wosdata
```

```
is_internal                | t
memory_size_kb             | 0
memory_size_actual_kb      | 0
memory_inuse_kb            | 0
general_memory_borrowed_kb | 0
queueing_threshold_kb      | 1468734
max_memory_size_kb         | 1958313
running_query_count        | 0
planned_concurrency        | 2
max_concurrency            | 0
is_standalone              | f
queue_timeout_in_seconds   | 0
priority                   | 0
single_initiator           | false
query_budget_kb            |
-[ RECORD 5 ]--------------+------------------
node_name                  | v_vmartdb_node02
pool_oid                   | 45035996273708354
pool_name                  | tm
is_internal                | t
memory_size_kb             | 102400
memory_size_actual_kb      | 102400
memory_inuse_kb            | 0
general_memory_borrowed_kb | 0
queueing_threshold_kb      | 5748989
max_memory_size_kb         | 7665319
running_query_count        | 0
planned_concurrency        | 1
max_concurrency            | 2
is_standalone              | f
queue_timeout_in_seconds   | 300
priority                   | 10
single_initiator           | true
query_budget_kb            | 102400
-[ RECORD 6 ]--------------+------------------
node_name                  | v_vmartdb_node02
pool_oid                   | 45035996273708356
pool_name                  | refresh
is_internal                | t
memory_size_kb             | 0
memory_size_actual_kb      | 0
memory_inuse_kb            | 0
general_memory_borrowed_kb | 0
queueing_threshold_kb      | 5672189
max_memory_size_kb         | 7562919
running_query_count        | 0
planned_concurrency        | 4
max_concurrency            |
is_standalone              | f
queue_timeout_in_seconds   | 300
priority                   | -10
single_initiator           | true
query_budget_kb            | 1398847
-[ RECORD 7 ]--------------+------------------
```

```
node_name                   | v_vmartdb_node02
pool_oid                    | 45035996273708358
pool_name                   | recovery
is_internal                 | t
memory_size_kb              | 0
memory_size_actual_kb       | 0
memory_inuse_kb             | 0
general_memory_borrowed_kb | 0
queueing_threshold_kb       | 5672189
max_memory_size_kb          | 7562919
running_query_count         | 0
planned_concurrency         | 3
max_concurrency             | 3
is_standalone               | f
queue_timeout_in_seconds    | 300
priority                    | 15
single_initiator            | true
query_budget_kb             | 932564
-[ RECORD 8 ]---------------+------------------
node_name                   | v_vmartdb_node02
pool_oid                    | 49539595901158692
pool_name                   | dbd
is_internal                 | t
memory_size_kb              | 0
memory_size_actual_kb       | 0
memory_inuse_kb             | 0
general_memory_borrowed_kb | 0
queueing_threshold_kb       | 5672189
max_memory_size_kb          | 7562919
running_query_count         | 0
planned_concurrency         | 4
max_concurrency             |
is_standalone               | f
queue_timeout_in_seconds    | 0
priority                    | 0
single_initiator            | true
query_budget_kb             | 1398847
```

See Also

RESOURCE_ACQUISITIONS (page 724)

RESOURCE_ACQUISITIONS_HISTORY (page 727)

RESOURCE_POOLS (page 676)

RESOURCE_QUEUES (page 734)

RESOURCE_REJECTIONS (page 735)

Managing Workloads, Monitoring Resource Pools and Resource Usage by Queries, Scenario: Restricting Resource Usage of Ad-hoc Query Application in the Administrator's Guide

RESOURCE_QUEUES

Provides information about requests pending for various resource pools.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The name of the node for which information is listed.
TRANSACTION_ID	INTEGER	Transaction identifier for this request
STATEMENT_ID	INTEGER	Statement identifier for this request
POOL_NAME	VARCHAR	The name of the resource pool
MEMORY_REQUESTED_KB	INTEGER	Amount of memory in kilobytes requested by this request
PRIORITY	INTEGER	Value of PRIORITY parameter specified when defining the pool.
POSITION_IN_QUEUE	INTEGER	Position of this request within the pool's queue
QUEUE_ENTRY_TIMESTAMP	TIMESTAMP	Timestamp when the request was queued

See Also

RESOURCE_ACQUISITIONS (page 724)

RESOURCE_ACQUISITIONS_HISTORY (page 727)

RESOURCE_POOLS (page 676)

RESOURCE_REJECTIONS (page 735)

Managing Workloads in the Administrator's Guide

RESOURCE_REJECTIONS

Monitors requests for resources that are rejected by the Resource Manager.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The node name for which information is listed.
POOL_NAME	VARCHAR	The name of the resource pool.
REASON	VARCHAR	The reason for rejecting this request; for example: ▪ Usage of single request exceeds high limit ▪ Timed out waiting for resource reservation ▪ Canceled waiting for resource reservation
RESOURCE_TYPE	VARCHAR	Memory, threads, file handles or execution slots. The following list shows the resources that are limited by the resource manager. A query might need some amount of each resource, and if the amount needed is not available, the query is queued and could eventually time out of the queue and be rejected. ▪ Number of running plans

		▪ Number of running plans on initiator node (local) ▪ Number of requested threads ▪ Number of requested file handles ▪ Number of requested KB of memory ▪ Number of requested KB of address space **Note:** Execution slots are determined by MAXCONCURRENCY parameter.
REJECTION_COUNT	INTEGER	Number of requests rejected due to specified reason and RESOURCE_TYPE.
FIRST_REJECTED_TIMESTAMP	TIMESTAMP	The time of the first rejection for this pool
LAST_REJECTED_TIMESTAMP	TIMESTAMP	The time of the last rejection for this pool
LAST_REJECTED_VALUE	INTEGER	The amount of the specific resource requested by the last rejection

Notes

Information is valid only as long as the node is up and the counters reset to 0 upon node restart.

Example

The following command returns the type of queries currently running on the node:

```
=> SELECT resource_type FROM resource_rejections;
 request_type
--------------
 UPDATE_QUERY
 UPDATE_QUERY
 UPDATE_QUERY
(3 rows)
```

See Also

CLEAR_RESOURCE_REJECTIONS (page 330)

DISK_RESOURCE_REJECTIONS (page 698)

Managing Workloads and Managing System Resource Usage in the Administrator's Guide

Managing and Viewing Query Repository in the Administrator's Guide

RESOURCE_USAGE

Monitors system resource management on each node.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The node name for which information is listed.
REQUEST_COUNT	INTEGER	The cumulative number of requests for threads, file handles, and memory (in kilobytes).
LOCAL_REQUEST_COUNT	INTEGER	The cumulative number of local requests.
REQUEST_QUEUE_DEPTH	INTEGER	The current request queue depth.
ACTIVE_THREAD_COUNT	INTEGER	The current number of active threads.
OPEN_FILE_HANDLE_COUNT	INTEGER	The current number of open file handles.
MEMORY_REQUESTED_KB	INTEGER	The memory requested in kilobytes.
ADDRESS_SPACE_REQUESTED_KB	INTEGER	The address space requested in kilobytes.
WOS_USED_BYTES	INTEGER	The size of the WOS in bytes.
WOS_ROW_COUNT	INTEGER	The number of rows in the WOS.
ROS_USED_BYTES	INTEGER	The size of the ROS in bytes.
ROS_ROW_COUNT	INTEGER	The number of rows in the ROS.
TOTAL_USED_BYTES	INTEGER	The total size of storage (WOS + ROS) in bytes.
TOTAL_ROW_COUNT	INTEGER	The total number of rows in storage (WOS + ROS).
RESOURCE_REQUEST_REJECT_COUNT	INTEGER	The number of rejected plan requests.
RESOURCE_REQUEST_TIMEOUT_COUNT	INTEGER	The number of resource request timeouts.
RESOURCE_REQUEST_CANCEL_COUNT	INTEGER	The number of resource request cancelations.
DISK_SPACE_REQUEST_REJECT_COUNT	INTEGER	The number of rejected disk write requests.
FAILED_VOLUME_REJECT_COUNT	INTEGER	The number of rejections due to a failed volume.
TOKENS_USED	INTEGER	For internal use only.
TOKENS_AVAILABLE	INTEGER	For internal use only.

Example

```
=>\pset expanded
Expanded display is on.
=> SELECT * FROM RESOURCE_USAGE;

-[ RECORD 1 ]-------------------+--------------------------
node_name                      | node01
request_count                  | 1
local_request_count            | 1
```

```
request_queue_depth             | 0
active_thread_count             | 4
open_file_handle_count          | 2
memory_requested_kb             | 4352
address_space_requested_kb      | 106752
wos_used_bytes                  | 0
wos_row_count                   | 0
ros_used_bytes                  | 10390319
ros_row_count                   | 324699
total_used_bytes                | 10390319
total_row_count                 | 324699
resource_request_reject_count   | 0
resource_request_timeout_count  | 0
resource_request_cancel_count   | 0
disk_space_request_reject_count | 0
failed_volume_reject_count      | 0
tokens_used                     | 1
tokens_available                | 7999999
-[ RECORD 2 ]-------------------+---------------------------
node_name                       | node02
request_count                   | 0
local_request_count             | 0
request_queue_depth             | 0
active_thread_count             | 0
open_file_handle_count          | 0
memory_requested_kb             | 0
address_space_requested_kb      | 0
wos_used_bytes                  | 0
wos_row_count                   | 0
ros_used_bytes                  | 10359489
ros_row_count                   | 324182
total_used_bytes                | 10359489
total_row_count                 | 324182
resource_request_reject_count   | 0
resource_request_timeout_count  | 0
resource_request_cancel_count   | 0
disk_space_request_reject_count | 0
failed_volume_reject_count      | 0
tokens_used                     | 0
tokens_available                | 8000000
-[ RECORD 3 ]-------------------+---------------------------
node_name                       | node03
request_count                   | 0
local_request_count             | 0
request_queue_depth             | 0
active_thread_count             | 0
open_file_handle_count          | 0
memory_requested_kb             | 0
address_space_requested_kb      | 0
wos_used_bytes                  | 0
wos_row_count                   | 0
ros_used_bytes                  | 10355231
ros_row_count                   | 324353
total_used_bytes                | 10355231
```

```
total_row_count                  | 324353
resource_request_reject_count    | 0
resource_request_timeout_count   | 0
resource_request_cancel_count    | 0
disk_space_request_reject_count  | 0
failed_volume_reject_count       | 0
tokens_used                      | 0
tokens_available                 | 8000000
-[ RECORD 4 ]--------------------+---------------------------
node_name                        | node04
request_count                    | 0
local_request_count              | 0
request_queue_depth              | 0
active_thread_count              | 0
open_file_handle_count           | 0
memory_requested_kb              | 0
address_space_requested_kb       | 0
wos_used_bytes                   | 0
wos_row_count                    | 0
ros_used_bytes                   | 10385744
ros_row_count                    | 324870
total_used_bytes                 | 10385744
total_row_count                  | 324870
resource_request_reject_count    | 0
resource_request_timeout_count   | 0
resource_request_cancel_count    | 0
disk_space_request_reject_count  | 0
failed_volume_reject_count       | 0
tokens_used                      | 0
tokens_available                 | 8000000
```

SESSION_PROFILES

Provides basic session parameters and lock time out data. To obtain information about sessions, see Profiling Database Performance.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The node name for which information is listed.
USER_NAME	VARCHAR	The name used to log in to the database or NULL if the session is internal.
CLIENT_HOSTNAME	VARCHAR	The host name and port of the TCP socket from which the client connection was made; NULL if the session is internal.
LOGIN_TIMESTAMP	TIMESTAMP	The date and time the user logged into the database or when the internal session was created. This field is useful for identifying sessions that have been left open for a period of time and could be idle.

LOGOUT_TIMESTAMP	TIMESTAMP	The date and time the user logged out of the database or when the internal session was closed.
SESSION_ID	VARCHAR	A unique numeric ID assigned by the Vertica catalog, which identifies the session for which profiling information is captured. This identifier is unique within the cluster at any point in time but can be reused when the session closes.
EXECUTED_STATEMENT_SUCCESS_COUNT	INTEGER	The number of successfully run statements.
EXECUTED_STATEMENT_FAILURE_COUNT	INTEGER	The number of unsuccessfully run statements.
LOCK_GRANT_COUNT	INTEGER	The number of locks granted during the session.
DEADLOCK_COUNT	INTEGER	The number of deadlocks encountered during the session.
LOCK_TIMEOUT_COUNT	INTEGER	The number of times a lock timed out during the session.
LOCK_CANCELLATION_COUNT	INTEGER	The number of times a lock was canceled during the session.
LOCK_REJECTION_COUNT	INTEGER	The number of times a lock was rejected during a session.
LOCK_ERROR_COUNT	INTEGER	The number of lock errors encountered during the session.

Example

Query the SESSION_PROFILES table:

```
=>\pset expanded
Expanded display on.
=> SELECT * FROM SESSION_PROFILES;
-[ RECORD 1 ]-------------------+---------------------------------
node_name                      | node04
user_name                      | dbadmin
client_hostname                | 192.168.1.1:46816
login_timestamp                | 2009-09-28 11:40:34.01518
logout_timestamp               | 2009-09-28 11:41:01.811484
session_id                     | myhost.verticacorp-20790:0x32f
executed_statement_success_count | 51
executed_statement_failure_count | 1
lock_grant_count               | 579
deadlock_count                 | 0
lock_timeout_count             | 0
lock_cancellation_count        | 0
lock_rejection_count           | 0
lock_error_count               | 0
```

See Also

LOCKS (page 712)

SESSIONS

Monitors external sessions. You can use this table to:

- Identify users who are running long queries
- Identify users who are holding locks due to an idle but uncommitted transaction
- Disconnect users in order to shut down the database
- Determine the details behind the type of database security (Secure Socket Layer (SSL) or client authentication) used for a particular session.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The node name for which information is listed.
USER_NAME	VARCHAR	The name used to log into the database or NULL if the session is internal.
CLIENT_HOSTNAME	VARCHAR	The host name and port of the TCP socket from which the client connection was made; NULL if the session is internal.
CLIENT_PID	INTEGER	The process identifier of the client process that issued this connection. Remember that the client process could be on a different machine than the server.
LOGIN_TIMESTAMP	TIMESTAMP	The date and time the user logged into the database or when the internal session was created. This can be useful for identifying sessions that have been left open for a period of time and could be idle.
SESSION_ID	VARCHAR	The identifier required to close or interrupt a session. This identifier is unique within the cluster at any point in time but can be reused when the session closes.
CLIENT_LABEL	VARCHAR	A user-specified label for the client connection that can be set when using ODBC. See `SessionLabel` in DSN Parameters in Programmer's Guide.
TRANSACTION_START	DATE	The date/time the current transaction started or NULL if no transaction is running.
TRANSACTION_ID	VARCHAR	A string containing the hexadecimal representation of the transaction ID, if any; otherwise NULL.
TRANSACTION_DESCRIPTION	VARCHAR	A description of the current transaction.
STATEMENT_START	DATE	The date/time the current statement started execution, or NULL if no statement is running.

STATEMENT_ID	VARCHAR	A unique numeric ID assigned by the Vertica catalog, which identifies the currently-executing statement. **Note:** NULL indicates that no statement is currently being processed.
LAST_STATEMENT_DURATION_US	INTEGER	The duration of the last completed statement in microseconds.
CURRENT_STATEMENT	VARCHAR	The currently executing statement, if any. NULL indicates that no statement is currently being processed.
SSL_STATE	VARCHAR	Indicates if Vertica used Secure Socket Layer (SSL) for a particular session. Possible values are: ▪ None – Vertica did not use SSL. ▪ Server – Sever authentication was used, so the client could authenticate the server. ▪ Mutual – Both the server and the client authenticated one another through mutual authentication. See Implementing Security and Implementing SSL.
AUTHENTICATION_METHOD	VARCHAR	The type of client authentication used for a particular session, if known. Possible values are: ▪ Unknown ▪ Trust ▪ Reject ▪ Kerberos ▪ Password ▪ MD5 ▪ LDAP ▪ Kerberos-GSS See Implementing Security and Implementing Client Authentication.

Notes

- The superuser has unrestricted access to all session information, but users can only view information about their own, current sessions.
- During session initialization and termination, you might see sessions running only on nodes other than the node on which you ran the virtual table query. This is a temporary situation that corrects itself as soon as session initialization and termination completes.

Example

```
=>\pset expanded
Expanded display is on.
=> SELECT * FROM SESSIONS;
```

```
-[ RECORD 1 ]--------------+-----------------------------------------------
node_name                  | v_vmartdb_node01
user_name                  | dbadmin
client_hostname            | xxx.x.x.x:xxxxx
client_pid                 | 18082
login_timestamp            | 2010-10-07 10:10:03.114863-04
session_id                 | myhost-17956:0x1d
client_label               |
transaction_start          | 2010-10-07 12:40:15.243772
transaction_id             | 45035996273728061
transaction_description    | user dbadmin(SELECT * FROM database_snapshots;)
statement_start            | 2010-10-07 13:33:56.542804
statement_id               | 34
last_statement_duration_us | 19194
current_statement          | SELECT * FROM SESSIONS;
ssl_state                  | None
authentication_method      | Trust
```

See Also

CLOSE_SESSION (page 330) and ***CLOSE_ALL_SESSIONS*** (page 333)

Managing Sessions and Configuration Parameters in the Administrator's Guide

STORAGE_CONTAINERS

Monitors information about WOS and ROS storage containers in the database.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The node name for which information is listed.
SCHEMA_NAME	VARCHAR	The schema name for which information is listed.
PROJECTION_NAME	VARCHAR	The projection name for which information is listed on that node.
STORAGE_TYPE	VARCHAR	Type of storage container: ROS or WOS.
STORAGE_OID	INTEGER	A unique numeric ID assigned by the Vertica catalog, which identifies the storage.
TOTAL_ROW_COUNT	VARCHAR	Total rows in the storage container listed for that projection.
DELETED_ROW_COUNT	INTEGER	Total rows in the storage container deleted for that projection.
USED_BYTES	INTEGER	Total bytes in the storage container listed for that projection.
START_EPOCH	INTEGER	The number of the start epoch in the storage container for which information is listed.
END_EPOCH	INTEGER	The number of the end epoch in the storage container for which information is listed.
GROUPING	VARCHAR	The group by which columns are stored:

		▪ ALL – All columns are grouped ▪ PROJECTION – Columns grouped according to projection definition ▪ NONE – No columns grouped, despite grouping in the projection definition ▪ OTHER – Some grouping but neither all nor according to projection (e.g., results from add column)

Example

The following command returns all the nodes on which a segmented projection has data on the TickStore database:

```
TickStore=> SELECT node_name, projection_name, total_row_count
FROM storage_containers ORDER BY projection_name;
     node_name   |      projection_name    | total_row_count
-----------------+-------------------------+-----------------
 v_tick_node0001 | Quotes_Fact_tmp_node0001 |             512
 v_tick_node0001 | Quotes_Fact_tmp_node0001 |          480176
 v_tick_node0002 | Quotes_Fact_tmp_node0002 |             512
 v_tick_node0002 | Quotes_Fact_tmp_node0002 |          480176
 v_tick_node0003 | Quotes_Fact_tmp_node0003 |          480176
 v_tick_node0003 | Quotes_Fact_tmp_node0003 |             512
 v_tick_node0004 | Quotes_Fact_tmp_node0004 |          480176
 v_tick_node0004 | Quotes_Fact_tmp_node0004 |             512
 v_tick_node0001 | Trades_Fact_tmp_node0001 |             512
 v_tick_node0001 | Trades_Fact_tmp_node0001 |          500334
 v_tick_node0002 | Trades_Fact_tmp_node0002 |          500334
 v_tick_node0002 | Trades_Fact_tmp_node0002 |             512
 v_tick_node0003 | Trades_Fact_tmp_node0003 |          500334
 v_tick_node0003 | Trades_Fact_tmp_node0003 |             512
 v_tick_node0004 | Trades_Fact_tmp_node0004 |          500334
 v_tick_node0004 | Trades_Fact_tmp_node0004 |             512
(16 rows)
```

The following command returns information on inventory_fact projections on all nodes on the Vmart schema:

```
=> SELECT * FROM storage_containers WHERE projection_name LIKE
'inventory_fact_p%';
-[ RECORD 1 ]-----+-------------------------
node_name         | node01
schema_name       | public
projection_name   | inventory_fact_p_node0001
storage_type      | WOS
storage_oid       | 45035996273720173
total_row_count   | 3000
deleted_row_count | 100
used_bytes        | 196608
start_epoch       | 1
end_epoch         | 2
grouping          | ALL
-[ RECORD 2 ]-----+-------------------------
node_name         | node01
schema_name       | public
projection_name   | inventory_fact_p_node0001
```

```
storage_type      | ROS
storage_oid       | 45035996273722211
total_row_count   | 500
deleted_row_count | 25
used_bytes        | 5838
start_epoch       | 1
end_epoch         | 1
grouping          | ALL
-[ RECORD 3 ]-----+--------------------------
node_name         | node01
schema_name       | public
projection_name   | inventory_fact_p_node0001
storage_type      | ROS
storage_oid       | 45035996273722283
total_row_count   | 500
deleted_row_count | 25
used_bytes        | 5794
start_epoch       | 1
end_epoch         | 1
grouping          | ALL
-[ RECORD 4 ]-----+--------------------------
node_name         | node01
schema_name       | public
projection_name   | inventory_fact_p_node0001
storage_type      | ROS
storage_oid       | 45035996273723379
total_row_count   | 500
deleted_row_count | 25
used_bytes        | 5838
start_epoch       | 1
end_epoch         | 1
grouping          | ALL
-[ RECORD 5 ]-----+--------------------------
node_name         | node01
schema_name       | public
projection_name   | inventory_fact_p_node0001
storage_type      | ROS
storage_oid       | 45035996273723451
total_row_count   | 500
deleted_row_count | 25
used_bytes        | 5794
start_epoch       | 1
end_epoch         | 1
grouping          | ALL
-[ RECORD 6 ]-----+--------------------------
node_name         | node01
schema_name       | public
projection_name   | inventory_fact_p_node0001
storage_type      | ROS
storage_oid       | 45035996273724547
total_row_count   | 500
deleted_row_count | 0
used_bytes        | 5838
start_epoch       | 2
```

```
end_epoch          | 2
grouping           | ALL
-[ RECORD 7 ]------+-------------------------
node_name          | node01
schema_name        | public
projection_name    | inventory_fact_p_node0001
storage_type       | ROS
storage_oid        | 45035996273724619
total_row_count    | 500
deleted_row_count  | 0
used_bytes         | 5794
start_epoch        | 2
end_epoch          | 2
grouping           | ALL
-[ RECORD 8 ]------+-------------------------
...
```

See Also

Column Store Architecture with FlexStore in the Concepts Guide

STRATA

This table contains internal details of how the Tuple Mover combines ROSs in each projection, broken down by stratum. For a brief overview of how the Tuple Mover combines ROSs, see Tuple Mover topic in Administrator's Guide. The STRATA table contains detailed information on how the ROS containers are classified by size and partition. The related ***STRATA_STRUCTURES*** (page 749) virtual table provides a summary of the strata values.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The node name for which information is listed
SCHEMA_NAME	VARCHAR	The schema name for which information is listed
PROJECTION_NAME	VARCHAR	The projection name for which information is listed on that node
PARTITION_KEY	VARCHAR	The data partition for which information is listed
STRATA_COUNT	INTEGER	The total number of strata for this projection partition
STRATUM_CAPACITY	INTEGER	The maximum number of ROS containers for the stratum before they must be merged.
STRATUM_HEIGHT	FLOAT	The size ratio between the smallest and largest ROS container in this stratum
STRATUM_NO	INTEGER	The stratum number. Strata are numbered starting at 0, for the stratum containing the smallest ROS containers
STRATUM_LOWER_SIZE	INTEGER	The smallest ROS container size allowed in this stratum
STRATUM_UPPER_SIZE	INTEGER	The largest ROS container size allowed in this stratum
ROS_CONTAINER_COUNT	INTEGER	The current number of ROS containers in the projection

		partition

Example

```
vmartdb=> \pset expanded
Expanded display is on.
vmartdb=> SELECT * from STRATA WHERE node_name ILIKE 'node01'
          AND stratum_upper_size < '15MB';
-[ RECORD 1
]-------+-----------------------------------------------------------
node_name           | v_vmartdb_node01
schema_name         | online_sales
projection_name     |
call_center_dimension_DBD_32_seg_vmart_design_vmart_design
partition_key       |
strata_count        | 5
stratum_capacity    | 19
stratum_height      | 8.97589786696783
stratum_no          | 0
stratum_lower_size  | 0B
stratum_upper_size  | 13MB
ROS_container_count | 1
-[ RECORD 2
]-------+-----------------------------------------------------------
node_name           | v_vmartdb_node01
schema_name         | online_sales
projection_name     |
call_center_dimension_DBD_8_seg_vmart_design_vmart_design
partition_key       |
strata_count        | 5
stratum_capacity    | 19
stratum_height      | 8.97589786696783
stratum_no          | 0
stratum_lower_size  | 0B
stratum_upper_size  | 13MB
ROS_container_count | 1
-[ RECORD 3
]-------+-----------------------------------------------------------
node_name           | v_vmartdb_node01
schema_name         | online_sales
projection_name     | online_sales_fact_DBD_33_seg_vmart_design_vmart_design
partition_key       |
strata_count        | 5
stratum_capacity    | 13
stratum_height      | 8.16338338718601
stratum_no          | 1
stratum_lower_size  | 19MB
stratum_upper_size  | 155.104MB
ROS_container_count | 1
-[ RECORD 4
]-------+-----------------------------------------------------------
node_name           | v_vmartdb_node01
schema_name         | online_sales
projection_name     | online_sales_fact_DBD_9_seg_vmart_design_vmart_design
```

```
partition_key       |
strata_count        | 5
stratum_capacity    | 13
stratum_height      | 8.16338338718601
stratum_no          | 1
stratum_lower_size  | 19MB
stratum_upper_size  | 155.104MB
ROS_container_count | 1
-[ RECORD 5
]-------+-------------------------------------------------------------
node_name           | v_vmartdb_node01
schema_name         | public
projection_name     | promotion_dimension_DBD_16_seg_vmart_design_vmart_design
partition_key       |
strata_count        | 5
stratum_capacity    | 19
stratum_height      | 8.97589786696783
stratum_no          | 0
stratum_lower_size  | 0B
stratum_upper_size  | 13MB
ROS_container_count | 1
-[ RECORD 6
]-------+-------------------------------------------------------------
node_name           | v_vmartdb_node01
schema_name         | public
projection_name     | promotion_dimension_DBD_17_seg_vmart_design_vmart_design
partition_key       |
strata_count        | 5
stratum_capacity    | 19
stratum_height      | 8.97589786696783
stratum_no          | 0
stratum_lower_size  | 0B
stratum_upper_size  | 13MB
ROS_container_count | 1
-[ RECORD 7
]-------+-------------------------------------------------------------
node_name           | v_vmartdb_node01
schema_name         | store
projection_name     | store_sales_fact_DBD_29_seg_vmart_design_vmart_design
partition_key       |
strata_count        | 5
stratum_capacity    | 16
stratum_height      | 8.52187248329035
stratum_no          | 1
stratum_lower_size  | 16MB
stratum_upper_size  | 136.35MB
ROS_container_count | 1
-[ RECORD 8
]-------+-------------------------------------------------------------
node_name           | v_vmartdb_node01
schema_name         | store
projection_name     | store_sales_fact_DBD_5_seg_vmart_design_vmart_design
partition_key       |
strata_count        | 5
```

```
stratum_capacity    | 16
stratum_height      | 8.52187248329035
stratum_no          | 1
stratum_lower_size  | 16MB
stratum_upper_size  | 136.35MB
ROS_container_count | 1
```

STRATA_STRUCTURES

This table provides an overview of the Tuple Mover's internal details. It summarizes how the ROS containers are classified by size. A more detailed view can be found in the ***STRATA*** (page 746) virtual table.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The node name for which information is listed
SCHEMA_NAME	VARCHAR	The schema name for which information is listed
PROJECTION_NAME	VARCHAR	The projection name for which information is listed on that node
PARTITION_KEY	VARCHAR	The data partition for which the information is listed
STRATA_COUNT	INTEGER	The total number of strata for this projection partition
STRATUM_CAPACITY	INTEGER	The maximum number of ROS containers that the strata can contained before it must merge them
STRATUM_HEIGHT	FLOAT	The size ratio between the smallest and largest ROS container in a stratum.
ACTIVE_STRATA_COUNT	INTEGER	The total number of strata that have ROS containers in them

Example

```
vmartdb=> \pset expanded
Expanded display is on.
vmartdb=> SELECT * FROM strata_structures WHERE stratum_capacity > 60;
-[ RECORD 1 ]-------+----------------------------------------------------
node_name           | v_vmartdb_node01
schema_name         | public
projection_name     | shipping_dimension_DBD_22_seg_vmart_design_vmart_design
partition_key       |
strata_count        | 4
stratum_capacity    | 62
stratum_height      | 25.6511590887058
active_strata_count | 1
-[ RECORD 2 ]-------+----------------------------------------------------
node_name           | v_vmartdb_node01
schema_name         | public
projection_name     | shipping_dimension_DBD_23_seg_vmart_design_vmart_design
partition_key       |
strata_count        | 4
stratum_capacity    | 62
stratum_height      | 25.6511590887058
```

```
active_strata_count | 1
-[ RECORD 3 ]-------+-----------------------------------------------------
node_name           | v_vmartdb_node02
schema_name         | public
projection_name     | shipping_dimension_DBD_22_seg_vmart_design_vmart_design
partition_key       |
strata_count        | 4
stratum_capacity    | 62
stratum_height      | 25.6511590887058
active_strata_count | 1
-[ RECORD 4 ]-------+-----------------------------------------------------
node_name           | v_vmartdb_node02
schema_name         | public
projection_name     | shipping_dimension_DBD_23_seg_vmart_design_vmart_design
partition_key       |
strata_count        | 4
stratum_capacity    | 62
stratum_height      | 25.6511590887058
active_strata_count | 1
-[ RECORD 5 ]-------+-----------------------------------------------------
node_name           | v_vmartdb_node03
schema_name         | public
projection_name     | shipping_dimension_DBD_22_seg_vmart_design_vmart_design
partition_key       |
strata_count        | 4
stratum_capacity    | 62
stratum_height      | 25.6511590887058
active_strata_count | 1
-[ RECORD 6 ]-------+-----------------------------------------------------
node_name           | v_vmartdb_node03
schema_name         | public
projection_name     | shipping_dimension_DBD_23_seg_vmart_design_vmart_design
partition_key       |
strata_count        | 4
stratum_capacity    | 62
stratum_height      | 25.6511590887058
active_strata_count | 1
-[ RECORD 7 ]-------+-----------------------------------------------------
node_name           | v_vmartdb_node04
schema_name         | public
projection_name     | shipping_dimension_DBD_22_seg_vmart_design_vmart_design
partition_key       |
strata_count        | 4
stratum_capacity    | 62
stratum_height      | 25.6511590887058
active_strata_count | 1
-[ RECORD 8 ]-------+-----------------------------------------------------
node_name           | v_vmartdb_node04
schema_name         | public
projection_name     | shipping_dimension_DBD_23_seg_vmart_design_vmart_design
partition_key       |
strata_count        | 4
stratum_capacity    | 62
stratum_height      | 25.6511590887058
```

```
active_strata_count | 1
```

SYSTEM

Monitors the overall state of the database.

Column Name	Data Type	Description
CURRENT_EPOCH	INTEGER	The current epoch number.
AHM_EPOCH	INTEGER	The AHM epoch number.
LAST_GOOD_EPOCH	INTEGER	The smallest (min) of all the checkpoint epochs on the cluster.
REFRESH_EPOCH	INTEGER	The oldest of the refresh epochs of all the nodes in the cluster
DESIGNED_FAULT_TOLERANCE	INTEGER	The designed or intended K-Safety level.
NODE_COUNT	INTEGER	The number of nodes in the cluster.
NODE_DOWN_COUNT	INTEGER	The number of nodes in the cluster that are currently down.
CURRENT_FAULT_TOLERANCE	INTEGER	The number of node failures the cluster can tolerate before it shuts down automatically.
CATALOG_REVISION_NUMBER	INTEGER	The catalog version number.
WOS_USED_BYTES	INTEGER	The WOS size in bytes (cluster-wide).
WOS_ROW_COUNT	INTEGER	The number of rows in WOS (cluster-wide).
ROS_USED_BYTES	INTEGER	The ROS size in bytes (cluster-wide).
ROS_ROW_COUNT	INTEGER	The number of rows in ROS (cluster-wide).
TOTAL_USED_BYTES	INTEGER	The total storage in bytes (WOS + ROS) (cluster-wide).
TOTAL_ROW_COUNT	INTEGER	The total number of rows (WOS + ROS) (cluster-wide).

Example

Query the SYSTEM table:

```
=>\pset expanded
Expanded display is on.
=> SELECT * FROM SYSTEM;
-[ RECORD 1 ]------------+----------
current_epoch            | 429
ahm_epoch                | 428
last_good_epoch          | 428
refresh_epoch            | -1
designed_fault_tolerance | 1
node_count               | 4
node_down_count          | 0
current_fault_tolerance  | 1
```

```
catalog_revision_number  | 1590
wos_used_bytes           | 0
wos_row_count            | 0
ros_used_bytes           | 443131537
ros_row_count            | 21809072
total_used_bytes         | 443131537
total_row_count          | 21809072
```

If there are no projections in the system, `LAST_GOOD_EPOCH` returns the following:

```
=> SELECT get_last_good_epoch();
ERROR:  Last good epoch not set
```

And if there are projections in the system:

```
=> SELECT get_last_good_epoch();
 get_last_good_epoch
---------------------
                 428
(1 row)
```

TUPLE_MOVER_OPERATIONS

Monitors the status of the Tuple Mover (ATM) on each node.

Column Name	Data Type	Description
OPERATION_START_TIMESTAMP	TIMESTAMP	The start time of a Tuple Mover operation.
NODE_NAME	VARCHAR	The node name for which information is listed.

OPERATION_NAME	VARCHAR	One of the following operations:
		`Moveout`
		`Mergeout`
		`Analyze Statistics`

OPERATION_STATUS	VARCHAR	Returns `Running` or an empty string to indicate 'not running.'
TABLE_SCHEMA	VARCHAR	The schema name for the specified projection.
TABLE_NAME	VARCHAR	The table name for the specified projection
PROJECTION_NAME	VARCHAR	The name of the projection being processed.
EARLIEST_CONTAINER_START_EPOCH	INTEGER	Populated for mergeout, purge and merge_partitions operations only. For an ATM-invoked mergeout, for example, the returned value represents the lowest epoch of containers involved in the mergeout.
LATEST_CONTAINER_END_EPOCH	INTEGER	Populated for mergeout, purge and merge_partitions operations only. For an ATM-invoked mergeout, for example, the returned value represents the highest epoch

		of containers involved in the mergeout.
ROS_COUNT	INTEGER	The number of ROS containers.
TOTAL_ROS_USED_BYTES	INTEGER	The size in bytes of all ROS containers in the mergeout operation. (Not applicable for other operations.)
PLAN_TYPE	VARCHAR	One of the following values: Moveout Mergeout Analyze Replay Delete

Notes

Manual mergeouts are invoked using one of the following APIs:

- ***DO_TM_TASK*** (page 339)()
- ***PURGE*** (page 371)
- ***MERGE_PARTITIONS*** (page 367)

Note: No output from TUPLE_MOVER_OPERATIONS means that the Tuple Mover is not performing an operation.

Example

```
=> SELECT node_name, operation_status, projection_name, plan_type
   FROM TUPLE_MOVER_OPERATIONS;
 node_name | operation_status | projection_name  | plan_type
-----------+------------------+------------------+-----------
 node0001  | Running          | p1_b2            | Mergeout
 node0002  | Running          | p1               | Mergeout
 node0001  | Running          | p1_b2            | Replay Delete
 node0001  | Running          | p1_b2            | Mergeout
 node0002  | Running          | p1_b2            | Mergeout
 node0001  | Running          | p1_b2            | Replay Delete
 node0002  | Running          | p1               | Mergeout
 node0003  | Running          | p1_b2            | Replay Delete
 node0001  | Running          | p1               | Mergeout
 node0002  | Running          | p1_b1            | Mergeout
```

See Also

DO_TM_TASK (page 339), ***MERGE_PARTITIONS*** (page 367), and ***PURGE*** (page 371)

Understanding the Tuple Mover and Partitioning Tables in the Administrator's Guide

WOS_CONTAINER_STORAGE

Monitors information about WOS storage, which is divided into regions. Each region allocates blocks of a specific size to store rows.

Column Name	Data Type	Description
NODE_NAME	VARCHAR	The node name for which information is listed.

WOS_TYPE	VARCHAR	Returns one of the following: ▪ system – for system table queries ▪ user – for other user queries
WOS_ALLOCATION_REGION	VARCHAR	The block size allocated by region in KB. The summary line sums the amount of memory used by all regions.
REGION_VIRTUAL_SIZE_KB	INTEGER	The amount of virtual memory in use by region in KB. Virtual size is greater than or equal to allocated size, which is greater than or equal to in-use size.
REGION_ALLOCATED_SIZE_KB	INTEGER	The amount of physical memory in use by a particular region in KB.
REGION_IN_USE_SIZE_KB	INTEGER	The actual number of bytes of data stored by the region in KB.
REGION_SMALL_RELEASE_COUNT	INTEGER	Internal use only.
REGION_BIG_RELEASE_COUNT	INTEGER	Internal use only.

Notes

- The WOS allocator can use large amounts of virtual memory without assigning physical memory.
- To see the difference between virtual size and allocated size, look at the REGION_IN_USE_SIZE column to see if the WOS is full. The summary line tells you the amount of memory used by the WOS, which is typically capped at one quarter of physical memory per node.

Examples

```
=>\pset expanded
Expanded display is on.
=> SELECT * FROM WOS_CONTAINER_STORAGE;

-[ RECORD 1 ]--------------+--------------------------
node_name                  | host01
wos_type                   | user
wos_allocation_region      | 16 KB Region
region_virtual_size_kb     | 2045408
region_allocated_size_kb   | 0
region_in_use_size_kb      | 0
region_small_release_count | 656
region_big_release_count   | 124
-[ RECORD 2 ]--------------+--------------------------
node_name                  | host01
wos_type                   | system
wos_allocation_region      | 16 KB Region
region_virtual_size_kb     | 1024
region_allocated_size_kb   | 960
region_in_use_size_kb      | 0
region_small_release_count | 78
```

```
region_big_release_count   | 9
-[ RECORD 3 ]--------------+--------------------------
node_name                  | host01
wos_type                   | system
wos_allocation_region      | 64 KB Region
region_virtual_size_kb     | 1024
region_allocated_size_kb   | 64
region_in_use_size_kb      | 0
region_small_release_count | 19
region_big_release_count   | 0
-[ RECORD 4 ]--------------+--------------------------
node_name                  | host01
wos_type                   | system
wos_allocation_region      | Summary
region_virtual_size_kb     | 2048
region_allocated_size_kb   | 1024
region_in_use_size_kb      | 0
region_small_release_count | 97
region_big_release_count   | 9
-[ RECORD 5 ]--------------+--------------------------
node_name                  | host01
wos_type                   | user
wos_allocation_region      | Summary
region_virtual_size_kb     | 2045408
region_allocated_size_kb   | 0
region_in_use_size_kb      | 0
region_small_release_count | 656
region_big_release_count   | 124
-[ RECORD 6 ]--------------+--------------------------
node_name                  | host02
wos_type                   | user
wos_allocation_region      | 16 KB Region
region_virtual_size_kb     | 2045408
region_allocated_size_kb   | 0
region_in_use_size_kb      | 0
region_small_release_count | 666
region_big_release_count   | 121
-[ RECORD 7 ]--------------+--------------------------
node_name                  | host02
wos_type                   | system
wos_allocation_region      | 16 KB Region
region_virtual_size_kb     | 1024
region_allocated_size_kb   | 960
region_in_use_size_kb      | 0
region_small_release_count | 38
region_big_release_count   | 2
-[ RECORD 8 ]--------------+--------------------------
node_name                  | host02
wos_type                   | system
wos_allocation_region      | 64 KB Region
region_virtual_size_kb     | 1024
region_allocated_size_kb   | 64
region_in_use_size_kb      | 0
region_small_release_count | 10
```

```
region_big_release_count   | 0
-[ RECORD 9 ]--------------+--------------------------
...
```

Appendix: Compatibility with Other RDBMS

This section describes compatibility of Vertica with other relational database management systems.

Information in this appendix is intended to simplify database migration to Vertica.

Data Type Mappings Between Vertica and Oracle

Oracle uses proprietary data types for all main data types (for example, VARCHAR, INTEGER, FLOAT, DATE), if you plan to migrate your database from Oracle to Vertica, Vertica strongly recommends that you convert the schema—a simple and important exercise that can minimize errors and time lost spent fixing erroneous data issues.

The following table compares the behavior of Oracle data types to Vertica data types.

Oracle	Vertica	Notes
`NUMBER` (no explicit precision)	`INT, NUMERIC` or `FLOAT`	In Oracle, the NUMBER data type with no explicit precision stores each number N as an integer M, together with a scale S. The scale can range from -84 to 127, while the precision of M is limited to 38 digits. So N = M * 10^S. When precision is specified, precision/scale applies to all entries in the column. If omitted, the scale defaults to 0. For the common case where Oracle's NUMBER with no explicit precision data type is used to store only integer values, INT is the best suited and the fastest Vertica data type. However, INT (the same as BIGINT) is limited to a little less than 19 digits, with a scale of 0; if the Oracle column contains integer values outside of the range [-9223372036854775807, +9223372036854775807], use the Vertica data type NUMERIC(p,0) where p is the maximum number of digits required to represent the values of N. Even though no explicit scale is specified for an Oracle NUMBER column, Oracle allows non-integer values, each with its own scale. If the data stored in the column is approximate, Vertica recommends using the Vertica data type FLOAT, which is standard IEEE floating point, like ORACLE BINARY_DOUBLE. If the data is exact with fractional places, for example dollar amounts, Vertica recommends NUMERIC(p,s) where `p` is the precision (total number of digits) and `s` is the maximum scale (number of decimal places). Vertica conforms to standard SQL, which requires that p >= s and s >= 0. Vertica's NUMERIC data type is most effective for p=18, and increasingly expensive for p=37, 58, 67, etc., where p <= 1024. Vertica recommends against using the data type NUMERIC(38,s) as a default "failsafe" mapping to guarantee no loss of precision. NUMERIC(18,s) is better, and INT or FLOAT are better yet, if one of these data types will do the job.

NUMBER (P,0), P <= 18	INT	In Oracle, when precision is specified the precision/scale applies to all entries in the column. If omitted the scale defaults to 0. For the Oracle NUMBER data type with 0 scale, and a precision less than or equal to 18, use INT in Vertica.
NUMBER (P,0), P > 18	NUMERIC (p,0)	An Oracle column precision greater than 18 is often more than an application really needs. If all values in the Oracle column are within the INT range [-9223372036854775807,+9223372036854775807], use INT for best performance. Otherwise, use the Vertica data type NUMERIC(p, 0), where p = P.
NUMBER (P,S) all cases other than previous 3 rows	NUMERIC (p,s) or FLOAT	When P >= S and S >= 0, use p = P and s = S, unless the data allows reducing P or using FLOAT as discussed above. If S > P, use p = S, s = S. If S < 0, use p = P – S, s = 0.
NUMERIC (P,S)	See notes -->	Rarely used in Oracle. See notes for the NUMBER type.
DECIMAL (P,S)	See notes -->	DECIMAL is a synonym for NUMERIC. See notes for the NUMBER type.
BINARY_FLOAT	FLOAT	Same as FLOAT(53) or DOUBLE PRECISION.
BINARY_DOUBLE	FLOAT	Same as FLOAT(53) or DOUBLE PRECISION.
RAW	VARBINARY(RAW)	The maximum size of RAW in Oracle is 2,000 bytes. The maximum size of CHAR/BINARY in Vertica is 65000 bytes. In Vertica, RAW is a synonym for VARBINARY.
LONG RAW	VARBINARY(RAW)	The maximum size of Oracle's LONG RAW is 2GB. The maximum size of Vertica's VARBINARY is 65000 bytes. Vertica user should exercise caution to avoid truncation during data migration from Oracle.
CHAR(n)	CHAR(n)	The maximum size of CHAR in Oracle is 2,000 bytes. The maximum size of CHAR in Vertica is 65000 bytes.
NCHAR(n)	CHAR(n*3)	Vertica supports national characters with CHAR(n) as variable-length UTF8-encoded UNICODE character string. UTF-8 represents ASCII in 1 byte, most European characters in 2 bytes, and most oriental and Middle Eastern characters in 3 bytes.
VARCHAR2(n)	VARCHAR(n)	The maximum size of VARCHAR2 in Oracle is 4,000 bytes. The maximum size of VARCHAR in Vertica is 65000 . **Note:** The behavior of Oracle's VARCHAR2 and Vertica's VARCHAR is semantically different. Vertica's VARCHAR exhibits standard SQL behavior, whereas Oracle's VARCHAR2 is not completely consistent with standard behavior – it treats an empty string as NULL value and uses non-padded comparison if one operand is VARCHAR2.
NVARCHAR2 (n)	VARCHAR(n*3)	See notes for NCHAR().
DATE	TIMESTAMP or possibly DATE	Oracle's DATE is different from the SQL standard DATE data type implemented by Vertica. Oracle's DATE includes the time (no

		fractional seconds), while Vertica DATE type includes only date per SQL specification.
TIMESTAMP	TIMESTAMP	TIMESTAMP defaults to six places, that is, to microseconds
TIMESTAMP WITH TIME ZONE	TIMESTAMP WITH TIME ZONE	TIME ZONE defaults to the currently SET or system time zone.
INTERVAL YEAR TO MONTH	INTERVAL YEAR TO MONTH	Per the SQL standard, INTERVAL can be qualified with YEAR TO MONTH sub-type in Vertica.
INTERVAL DAY TO SECOND	INTERVAL DAY TO SECOND	In Vertica, DAY TO SECOND is the default sub-type for INTERVAL.

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bzip2/libbzip2 version 1.0 of 21 March 2000

This program is based on (at least) the work of:

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Daemonize

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- lib/gssapi/generic/gssapi_err_generic.et
- lib/gssapi/mechglue/g_accept_sec_context.c
- lib/gssapi/mechglue/g_acquire_cred.c
- lib/gssapi/mechglue/g_canon_name.c
- lib/gssapi/mechglue/g_compare_name.c
- lib/gssapi/mechglue/g_context_time.c
- lib/gssapi/mechglue/g_delete_sec_context.c
- lib/gssapi/mechglue/g_dsp_name.c
- lib/gssapi/mechglue/g_dsp_status.c
- lib/gssapi/mechglue/g_dup_name.c
- lib/gssapi/mechglue/g_exp_sec_context.c
- lib/gssapi/mechglue/g_export_name.c
- lib/gssapi/mechglue/g_glue.c
- lib/gssapi/mechglue/g_imp_name.c

- lib/gssapi/mechglue/g_imp_sec_context.c
- lib/gssapi/mechglue/g_init_sec_context.c
- lib/gssapi/mechglue/g_initialize.c
- lib/gssapi/mechglue/g_inquire_context.c
- lib/gssapi/mechglue/g_inquire_cred.c
- lib/gssapi/mechglue/g_inquire_names.c
- lib/gssapi/mechglue/g_process_context.c
- lib/gssapi/mechglue/g_rel_buffer.c
- lib/gssapi/mechglue/g_rel_cred.c
- lib/gssapi/mechglue/g_rel_name.c
- lib/gssapi/mechglue/g_rel_oid_set.c
- lib/gssapi/mechglue/g_seal.c
- lib/gssapi/mechglue/g_sign.c
- lib/gssapi/mechglue/g_store_cred.c
- lib/gssapi/mechglue/g_unseal.c
- lib/gssapi/mechglue/g_userok.c
- lib/gssapi/mechglue/g_utils.c
- lib/gssapi/mechglue/g_verify.c
- lib/gssapi/mechglue/gssd_pname_to_uid.c
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- lib/gssapi/spnego/gssapiP_spnego.h
- lib/gssapi/spnego/spnego_mech.c

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Python Dialog

The Administration Tools part of this product uses Python Dialog, a Python module for doing console-mode user interaction.

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The complete source code of the Python dialog package and complete text of the GNU Lesser General Public License can be found on the Vertica Systems Web site at http://www.vertica.com/licenses/pythondialog-2.7.tar.bz2
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RRDTool Open Source License

Note: rrdtool is a dependency of using the ganglia-web third-party tool. RRDTool allows the graphs displayed by ganglia-web to be produced.

RRDTOOL - Round Robin Database Tool

A tool for fast logging of numerical data graphical display of this data.

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zlib

This is used by the project to load zipped files directly by COPY command. www.zlib.net/

zlib.h -- interface of the 'zlib' general purpose compression library version 1.2.3, July 18th, 2005

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