iSeries

DB2 Universal Database for iSeries SQL Call Level Interface (ODBC)

Version 5

IBM

@server

iSeries

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Contents

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About DB2 Universal Database for iSeries SQL Call Level Interface (ODBC)

This information provides an overview of a typical DB2 UDB CLI application. This book contains the following information:

- Introduces DB2 UDB CLI and discusses the background of the interface and its relation to embedded SQL.
- Discusses the tasks or steps within a DB2 UDB CLI application, and introduces concepts, the functions and the interaction between them.
- Reference information for the functions that make up DB2 UDB CLI.
- Contains the following appendixes:
  - Appendix A, "DB2 UDB CLI General Diagnostic Information" on page 245, contains tables that are referenced throughout the book.
  - Appendix B, "DB2 UDB CLI Include files" on page 247, lists the header file that is included by all DB2 UDB CLI applications.
  - Appendix C, "Example DB2 UDB CLI application code listing" on page 265, lists the complete source for the example code segments used throughout the book.
  - Appendix D, "Running DB2 UDB CLI in Server Mode" on page 275, contains information on how to use your CLI application to serve mulitple users.

For more information about this guide, see the following topics:

- "Who should read the DB2 UDB for iSeries SQL Call Level Interface (ODBC) book"
- "What's new for V5R2 in DB2 UDB for iSeries SQL Call Level Interface (ODBC)"
- "Code disclaimer information" on page viii

Then, to get started, see Chapter 1, "Introduction to CLI" on page 1.

Who should read the DB2 UDB for iSeries SQL Call Level Interface (ODBC) book

This book is intended for application programmers with a knowledge of SQL and the C programming language who want to use the DB2 UDB CLI functions to call dynamic SQL statements.

What's new for V5R2 in DB2 UDB for iSeries SQL Call Level Interface (ODBC)

The following APIs were added in this release:

- SQLColumnPrivileges - Get Privileges Associated with the Columns of a Table
- SQLNextResult - Process the Next Result Set
- SQLTablePrivileges - Get Privileges Associated with a Table

The following APIs were updated in this release:

- SQLBindParam - Binds a Buffer to a Parameter Marker
- SQLColAttributes - Column Attributes
- SQLEndTran - Commit or Roll Back a Transaction
- SQLGetConnectOption - Returns Current Setting of a Connect Option
- SQLGetInfo - Get General Information
- SQLGetLength - Retrieve Length of a String Value

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- SQLGetStmtOption - Returns Current Setting of a Statement Option
- SQLProcedureColumns - Get Input/Output Parameter Information for a Procedure
- SQLProcedures - Get List of Procedure Names
- SQLSetConnectAttr - Set a Connection Attribute
- SQLSetDescRec - Set a Descriptor Record
- SQLSetEnvAttr - Set Environment Attribute
- SQLSetStmtAttr - Set a Statement Attribute
- SQLTables - Get Table Information

Information in the Introduction to CLI and Writing a DB2® CLI application has also been updated.

Code disclaimer information

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Chapter 1. Introduction to CLI

DB2 UDB Call Level Interface (CLI) is a callable Structured Query Language (SQL) programming interface that is supported in all DB2 environments except for DB2 UDB for zOS and OS/390® and DB2 Server for VSE and VM. A callable SQL interface is a WinSock application program interface (API) for database access that uses function calls to start dynamic SQL statements.

DB2 UDB CLI is an alternative to embedded dynamic SQL. The important difference between embedded dynamic SQL and DB2 UDB CLI is how the SQL statements are started. On the iSeries, this interface is available to any of the ILE languages.

DB2 UDB CLI also provides full Level 1 Microsoft® Open Database Connectivity (ODBC) support, plus many Level 2 functions. For the most part, ODBC is a superset of the ANS and ISO SQL CLI standard.

For more information, see:

- "DB2 UDB CLI Background Information"
- "Call Level Interfaces"
- "Differences Between DB2 UDB CLI and Embedded SQL" on page 3

DB2 UDB CLI Background Information

It is important to understand what DB2 UDB CLI, or any callable SQL interface, is based on, and compare it with existing interfaces.

ISO standard 9075:1999 – Database Language SQL Part 3: Call-Level Interface provides the standard definition of CLI. . The goal of this interface is to increase the portability of applications by enabling them to become independent of any one database server.

ODBC provides a Driver Manager for Windows®, which offers a central point of control for each ODBC driver (a dynamic link library (DLL) that implements ODBC function calls and interacts with a specific DBMS).

Call Level Interfaces

The following call level interface APIs are available for database access on iSeries:

- **Connecting**
  - "SQLConnect - Connect to a Data Source" on page 69
  - "SQLDataSources - Get List of Data Sources" on page 73
  - "SQLDisconnect - Disconnect from a Data Source" on page 83
  - "SQLDriverConnect - (Expanded) Connect to a Data Source" on page 85
- **Diagnostics**
  - "SQLError - Retrieve Error Information" on page 91
  - "SQLGetDiagField - Return Diagnostic Information (extensible)" on page 136
  - "SQLGetDiagRec - Return Diagnostic Information (concise)" on page 139
- **MetaData**
  - "SQLColumns - Get Column Information for a Table" on page 66
  - "SQLColumnPrivileges - Get privileges associated with the columns of a table" on page 63
  - "SQLForeignKeys - Get the List of Foreign Key Columns" on page 109
  - "SQLGetInfo - Get General Information" on page 146
  - "SQLGetTypeInfo - Get Data Type Information" on page 169

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Differences Between DB2 UDB CLI and Embedded SQL

An application that uses an embedded SQL interface requires a precompiler to convert the SQL statements into code. Code is compiled, bound to the database, and executed. In contrast, a DB2 UDB CLI application does not require precompilation or binding, but instead uses a standard set of functions to execute SQL statements and related services at runtime.

This difference is important because, traditionally, precompilers have been specific to a database product, which effectively ties your applications to that product. DB2 UDB CLI enables you to write portable applications that are independent of any particular database product. This independence means that a DB2 UDB CLI application does not have to be recompiled or rebound to access-different database products. An application selects the appropriate database products at runtime.

DB2 UDB CLI and embedded SQL also differ in the following ways:

- DB2 UDB CLI does not require the explicit declaration of cursors. DB2 UDB CLI generates them as needed. The application can then use the generated cursor in the normal cursor fetch model for multiple row `SELECT` statements and positioned `UPDATE` and `DELETE` statements.
- The `OPEN` statement is not necessary in DB2 UDB CLI. Instead, the execution of a `SELECT` automatically causes a cursor to be opened.

- Unlike embedded SQL, DB2 UDB CLI allows the use of parameter markers on the equivalent of the `EXECUTE IMMEDIATE` statement (the `SQLExecDirect()` function).
- A `COMMIT` or `ROLLBACK` in DB2 UDB CLI is issued through the `SQLTransact()` or `SQLEndTran()` function call rather than by passing it as an SQL statement.
- DB2 UDB CLI manages statement-related information on behalf of the application, and provides a ***statement handle*** to refer to it as an abstract object. This handle avoids the need for the application to use product-specific data structures.
- Similar to the statement handle, the ***environment handle*** and ***connection handle*** provide a means to refer to all global variables and connection specific information.
- DB2 UDB CLI uses the SQLSTATE values defined by the X/Open SQL CAE specification. Although the format and many of the values are consistent with values that are used by the IBM relational database products, there are differences.

Despite these differences, there is an important common concept between embedded SQL and DB2 UDB CLI:

> DB2 UDB CLI can execute any SQL statement that can be prepared dynamically in embedded SQL. This is guaranteed because DB2 UDB CLI does not actually *execute* the SQL statement itself, but passes it to the DBMS for dynamic execution.

Table 1 lists each SQL statement, and if it can be executed using DB2 UDB CLI.

Table 1. SQL Statements

SQL Statement	**Dyn** [a]	**CLI** [c]
ALTER TABLE	X	X
BEGIN DECLARE SECTION [b]		
CALL	X	X
CLOSE		`SQLFreeStmt()`
COMMENT ON	X	X
COMMIT	X	`SQLTransact()`, `SQLEndTran()`
CONNECT (Type 1)		`SQLConnect()`
CONNECT (Type 2)		`SQLConnect()`
CREATE INDEX	X	X
CREATE TABLE	X	X
CREATE VIEW	X	X
DECLARE CURSOR [b]		`SQLAllocStmt()`
DELETE	X	X
DESCRIBE		`SQLDescribeCol()`, `SQLColAttributes()`
DISCONNECT		`SQLDisconnect()`
DROP	X	X
END DECLARE SECTION [b]		
EXECUTE		`SQLExecute()`
EXECUTE IMMEDIATE		`SQLExecDirect()`
FETCH		`SQLFetch()`
GRANT	X	X
INCLUDE [b]		
INSERT	X	X

Table 1. SQL Statements (continued)

SQL Statement	Dyn [a]	CLI [c]
LOCK TABLE	X	X
OPEN		`SQLExecute()`, `SQLExecDirect()`
PREPARE		`SQLPrepare()`
RELEASE		`SQLDisconnect()`
REVOKE	X	X
ROLLBACK	X	`SQLTransact()`, `SQLEndTran()`
SELECT	X	X
SET CONNECTION		
UPDATE	X	X
WHENEVER [b]		

Note:

[a] **Dyn** stands for dynamic. All statements in this list can be coded as static SQL, but only those marked with **X** can be coded as dynamic SQL.

[b] This is a non-executable statement.

[c] An X indicates that this statement can be executed using either `SQLExecDirect()` or `SQLPrepare()` and `SQLExecute()`. If there is an equivalent DB2 UDB CLI function, the function name is listed.

Each DBMS may have additional statements that can be dynamically prepared, in which case DB2 UDB CLI passes them to the DBMS. There is one exception, COMMIT and ROLLBACK can be dynamically prepared by some DBMSs but are not passed. Instead, the `SQLTransact()` or `SQLEndTran()` should be used to specify either COMMIT or ROLLBACK.

For additional information, see:

- “Advantages of using DB2 UDB CLI instead of embedded SQL”
- “Deciding between DB2 UDB CLI, dynamic SQL, and static SQL”

Advantages of using DB2 UDB CLI instead of embedded SQL

The DB2 UDB CLI interface has several key advantages over embedded SQL.

- It is ideally suited for a client-server environment, in which the target database is not known when the application is built. It provides a consistent interface for executing SQL statements, regardless of which database server to which the application is connected .
- It increases the portability of applications by removing the dependence on precompilers. Applications are distributed not as compiled applications or runtime libraries but as source code which are preprocessed for each database product.
- DB2 UDB CLI applications do not have to be bound to each database to which they connect .
- DB2 UDB CLI applications can connect to multiple databases simultaneously.
- DB2 UDB CLI applications are not responsible for controlling global data areas, such as SQLCA and SQLDA, as they are with embedded SQL applications. Instead, DB2 UDB CLI allocates and controls the necessary data structures, and provides a *handle* for the application to reference them.

Deciding between DB2 UDB CLI, dynamic SQL, and static SQL

Which interfaces you choose depend on your application.

DB2 UDB CLI is ideally suited for query-based applications requiring portability, and not requiring the APIs or utilities offered by a particular DBMS (for example, catalog database, backup, restore). This does not mean that using DB2 UDB CLI calls DBMS specific APIs from an application. It means that the application will no longer be as portable.

Another important consideration is the performance comparison between dynamic and static SQL. Dynamic SQL is prepared at runtime, while static SQL is prepared at the precompile stage. Since preparing statements requires additional processing time, static SQL may be more efficient. If you choose static over dynamic SQL, then DB2 UDB CLI is not an option.

In most cases the choice between either interface is open to personal preference. Your previous experience may make one alternative seem more intuitive than the other.

Chapter 2. Writing a DB2 UDB CLI application

A DB2 UDB CLI application consists of a set of tasks, each comprised of a set of discrete steps. Other tasks may occur throughout the application as it runs. The application calls one or more DB2 UDB CLI functions to carry out each of these tasks.

Every DB2 UDB CLI application contains the three main tasks that are shown in Figure 1. If the functions are not called in the sequence that is shown in the figure, an error results.

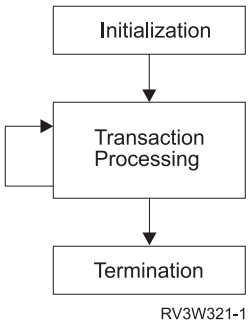

Figure 1. Conceptual View of a DB2 UDB CLI Application

Initialization
This task allocates and initializes some resources in preparation for the main *Transaction Processing* task. Refer to "Initialization and termination tasks in a DB2 UDB CLI application" on page 8 for details.

Transaction Processing
This is the main task of the application. To query and modify the SQL, statements are passed to DB2 UDB CLI. Refer to "Transaction processing task in a DB2 UDB CLI application" on page 10 for details.

Termination
This task frees allocated resources. The resources generally consist of data areas that are identified by unique handles. After freeing the resources, other tasks can use these handles. Refer to "Initialization and termination tasks in a DB2 UDB CLI application" on page 8 for details.

As well as the three tasks that are listed above, there are general tasks, such as handling diagnostic messages, which occur throughout an application.

In this topic, examples have been provided to illustrate how these functions are used in a DB2 UDB CLI application.

For additional information, see:

- "Initialization and termination tasks in a DB2 UDB CLI application" on page 8
- "Transaction processing task in a DB2 UDB CLI application" on page 10
- "Diagnostics in a DB2 UDB CLI application" on page 15
- "Data types and data conversion in DB2 UDB CLI functions" on page 17
- "Working with string arguments in DB2 UDB CLI functions" on page 19

Refer to Chapter 3, "DB2 UDB CLI Functions" on page 21 for complete descriptions and usage information for each of the functions.

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Initialization and termination tasks in a DB2 UDB CLI application

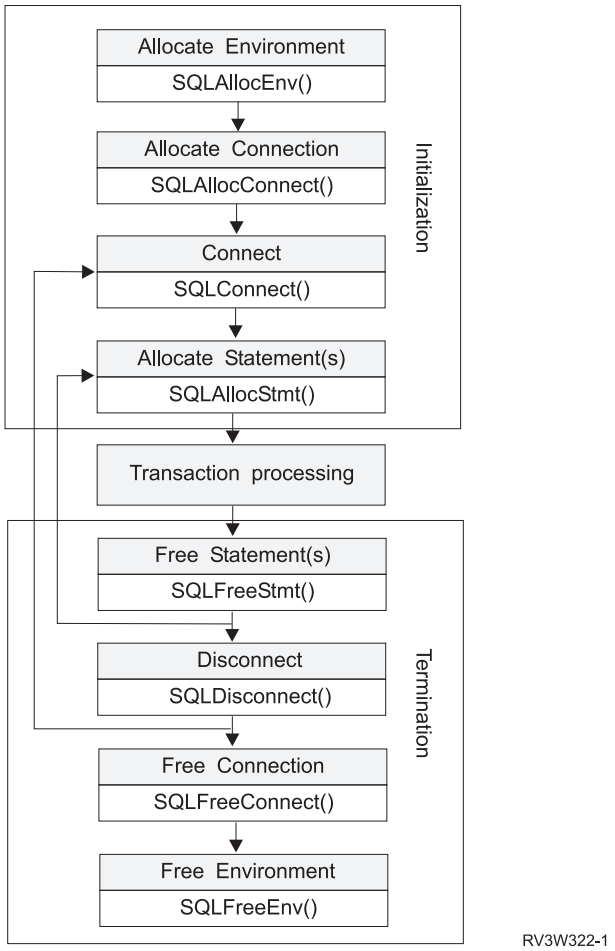

Figure 2. Conceptual View of Initialization and Termination Tasks

Figure 2 shows the function call sequences for both the initialization and termination tasks. The transaction processing task in the middle of the diagram is shown in Figure 3 on page 11.

The initialization task allocates and initializes environment handles and connection handles. The termination task frees them. A handle is a variable that refers to a data object that is controlled by DB2 UDB CLI. Using handles frees the application from having to allocate and manage global variables or data structures, such as the SQLDA, or SQLCA used in embedded SQL interfaces for IBM DBMSs. An application then passes the appropriate handle when it calls other DB2 UDB CLI functions. There are three types of handles:

Environment Handle

The environment handle refers to the data object that contains global information regarding the state of the application. This handle is allocated by calling `SQLAllocEnv()`, and freed by calling `SQLFreeEnv()`. An environment handle must be allocated before a connection handle can be allocated. Only one environment handle can be allocated per application.

Connection Handle

A connection handle refers to a data object that contains information that is associated with a connection that is managed by DB2 UDB CLI. This includes general status information, transaction status, and diagnostic information. Each connection handle is allocated by calling

SQLAllocConnect() and freed by calling SQLFreeConnect(). An application must allocate a connection handle for each connection to a database server.

Statement Handle(s)
Statement handles are discussed in the next task.

See “Example: Initialization and connection in a DB2 UDB CLI application”.

Example: Initialization and connection in a DB2 UDB CLI application

See “Code disclaimer information” on page viii for information pertaining to code examples.

```
/*************************************************
** file = basiccon.c
**    - demonstrate basic connection to two datasources.
**    - error handling  ignored for simplicity
**
**  Functions used:
**
**    SQLAllocConnect  SQLDisconnect
**    SQLAllocEnv      SQLFreeConnect
**    SQLConnect       SQLFreeEnv
**
**
*************************************************/

#include <stdio.h>
#include <stdlib.h>
#include "sqlcli.h"

int
connect(SQLHENV henv,
        SQLHDBC * hdbc);

#define MAX_DSN_LENGTH    18
#define MAX_UID_LENGTH    10
#define MAX_PWD_LENGTH    10
#define MAX_CONNECTIONS   5

int
main()
{
    SQLHENV         henv;
    SQLHDBC         hdbc[MAX_CONNECTIONS];

    /* allocate an environment handle   */
    SQLAllocEnv(&henv);

    /* Connect to first data source */
    connect(henv, &hdbc[0];);

    /* Connect to second data source */
    connect(henv, &hdbc[1];);

    /*********   Start Processing Step  ************************/
    /* allocate statement handle, execute statement, and so forth       */
    /*********   End Processing Step  *************************/

    printf("\nDisconnecting .....\n");
    SQLDisconnect(hdbc[0]);     /* disconnect first connection   */
    SQLDisconnect(hdbc[1]);     /* disconnect second connection  */
    SQLFreeConnect(hdbc[0]);    /* free first connection handle  */
    SQLFreeConnect(hdbc[1]);    /* free second connection handle */
    SQLFreeEnv(henv);           /* free environment handle       */

    return (SQL_SUCCESS);
}
```

```
/*********************************************************************
**   connect - Prompt for connect options and connect              **
*********************************************************************/

int
connect(SQLHENV henv,
        SQLHDBC * hdbc)
{
    SQLRETURN       rc;
    SQLCHAR         server[MAX_DSN_LENGTH + 1], uid[MAX_UID_LENGTH + 1],
pwd[MAX_PWD_LENGTH
+ 1];
    SQLCHAR         buffer[255];
    SQLSMALLINT     outlen;

    printf("Enter Server Name:\n");
    gets((char *) server);
    printf("Enter User Name:\n");
    gets((char *) uid);
    printf("Enter Password Name:\n");
    gets((char *) pwd);

    SQLAllocConnect(henv, hdbc);/* allocate a connection handle     */

    rc = SQLConnect(*hdbc, server, SQL_NTS, uid, SQL_NTS, pwd, SQL_NTS);
    if (rc != SQL_SUCCESS) {
        printf("Error while connecting to database\n");
        return (SQL_ERROR);
    } else {
        printf("Successful Connect\n");
        return (SQL_SUCCESS);
    }
}
```

Transaction processing task in a DB2 UDB CLI application

The following figure shows the typical order of function calls in a DB2 UDB CLI application. This does not show all functions or possible paths.

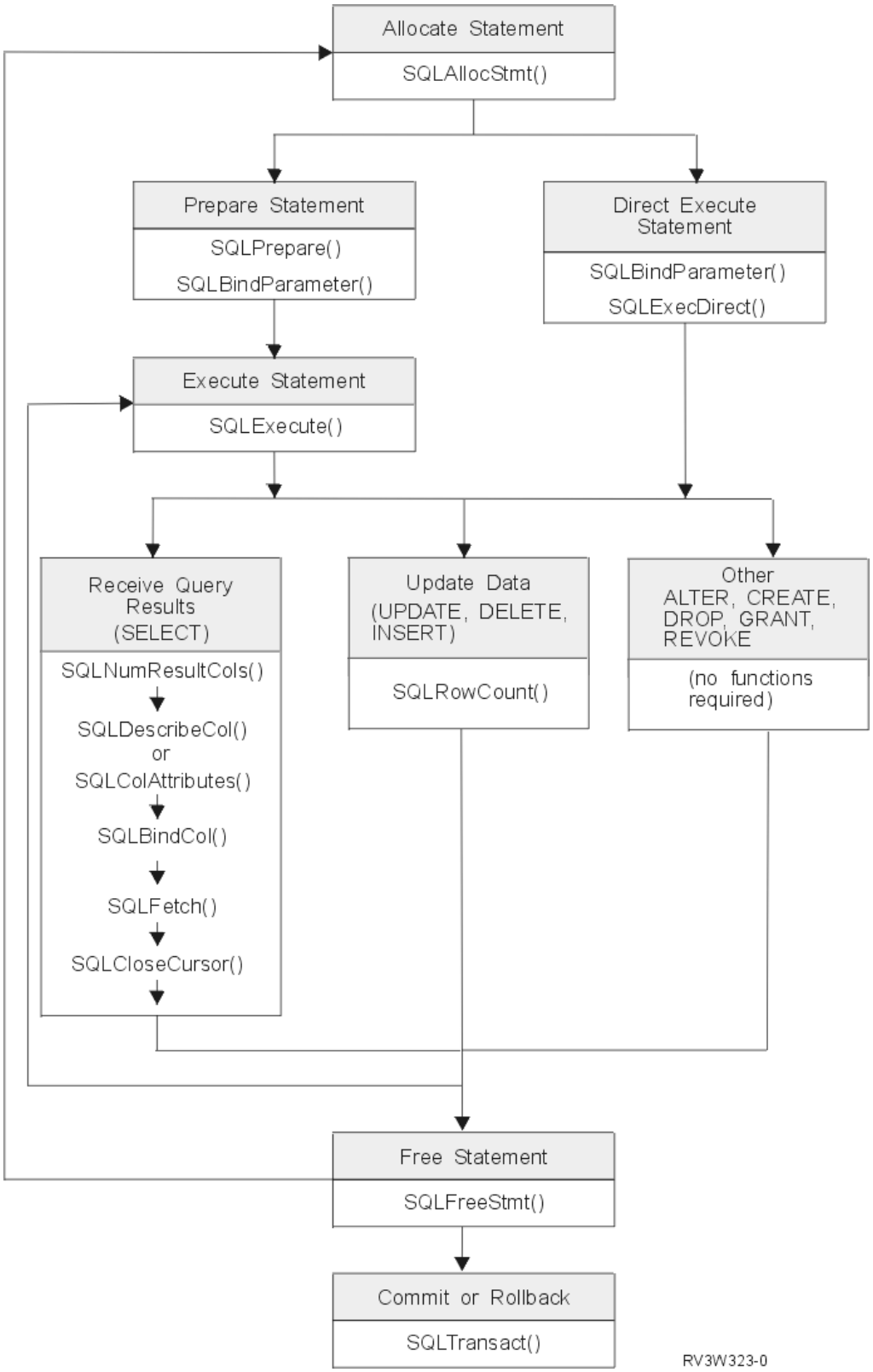

Figure 3. Transaction Processing

Figure 3 shows the steps and the DB2 UDB CLI functions in the transaction processing task. This task contains five steps:

- “Allocating statement handle(s) in a DB2 UDB CLI application”
- “Preparation and execution tasks in a DB2 UDB CLI application”
- “Processing results in a DB2 UDB CLI application” on page 13
- “Freeing statement handles in a DB2 UDB CLI application” on page 15
- “Commit or rollback in a DB2 UDB CLI application” on page 15

The function SQLAllocStmt is needed to obtain a statement handle that will be used to process the SQL statement. There are two methods of statement execution that can be used. By using SQLPrepare and SQLExecute, the program can break the process into two steps. The function SQLBindParameter is used to bind program addresses to host variables used in the SQL statement that was prepared. The second method is the direct execution method in which SQLPrepare and SQLExecute are replaced by a single call to SQLExecDirect.

Once the statement is executed, the remaining processing depends on the type of SQL statement. For SELECT statements, the program uses functions like SQLNumResultCols, SQLDescribeCol, SQLBindCol, SQLFetch, and SQLCloseCursor to process the result set. For statements that update data, SQLRowCount could be used to determine the number of affected rows. For other types of SQL statements, the processing is complete after the statement is executed. SQLFreeStmt is then used in all cases to indicate that the handle is no longer needed.

Allocating statement handle(s) in a DB2 UDB CLI application

`SQLAllocStmt()` allocates a statement handle. A statement handle refers to the data object that contains information about an SQL statement that is managed by DB2 UDB CLI. This includes information such as dynamic arguments, cursor information, bindings for dynamic arguments and columns, result values, and status information (these are discussed later). Each statement handle is associated with a connection handle.

Allocate a statement handle in order to run a statement. The limit for the total number of concurrently allocated handles is 80,000. This limit applies to all types of handles, including descriptor handles that are implicitly allocated by the implementation code. There also is a limit of 500 statement handles for a remote connection.

Preparation and execution tasks in a DB2 UDB CLI application

Once a statement handle has been allocated, there are two methods of specifying and executing SQL statements:

1. Prepare, and then execute:
   a. Call `SQLPrepare()` with an SQL statement as an argument.
   b. Call `SQLSetParam()`, if the SQL statement contains *parameter markers*.
   c. Call `SQLExecute()`
2. Execute direct:
   a. Call `SQLSetParam()`, if the SQL statement contains *parameter markers*.
   b. Call `SQLExecDirect()` with an SQL statement as an argument.

The first method splits the preparation of the statement from the execution. This method is used when:

- The statement is executed repeatedly (usually with different parameter values). This avoids having to prepare the same statement more than once.
- The application requires information about the columns in the result set, prior to statement execution.

The second method combines the prepare step and the execute step into one. This method is used when:

- The statement is executed once. This avoids having to call two functions to execute the statement.

- The application does not require information about the columns in the result set, before the statement is executed.

Binding parameters in SQL statements in a DB2 UDB CLI application

Both execution methods allow the use of parameter markers in place of an *expression* (or host variable in embedded SQL) in an SQL statement.

Parameter markers are represented by the '?' Character and indicate the position in the SQL statement where the contents of application variables are to be substituted when the statement is executed. The markers are referenced sequentially, from left to right, starting at 1.

When an application variable is associated with a parameter marker it is *bound* to the parameter marker. Binding is carried out by calling the `SQLSetParam()` function with:

- The number of the parameter marker
- A pointer to the application variable
- The SQL type of the parameter
- The data type and length of the variable.

The application variable is called a *deferred* argument since only the pointer is passed when `SQLSetParam()` is called. No data is read from the variable until the statement is executed. This applies to both buffer arguments and arguments that indicate the length of the data in the buffer. Deferred arguments allow the application to modify the contents of the bound parameter variables, and repeat the execution of the statement with the new values.

When calling `SQLSetParam()`, it is possible to bind a variable of a different type from that required by the SQL statement. In this case DB2 UDB CLI converts the contents of the bound variable to the correct type. For example, the SQL statement may require an integer value, but your application has a string representation of an integer. The string can be bound to the parameter, and DB2 UDB CLI converts the string to an integer when you execute the statement. Refer to "Data types and data conversion in DB2 UDB CLI functions" on page 17 for more information about data conversion.

For more information and examples refer to:

- "SQLPrepare - Prepare a Statement" on page 189
- "SQLSetParam - Set Parameter" on page 225
- "SQLExecute - Execute a Statement" on page 96
- "SQLExecDirect - Execute a Statement Directly" on page 94

Processing results in a DB2 UDB CLI application

The next step after the statement has been executed depends on the type of SQL statement.

Processing SELECT statements in a DB2 UDB CLI application

If the statement is a SELECT, the following steps are generally needed to retrieve each row of the result set:

1. Establish the structure of the result set, number of columns, column types and lengths
2. (Optionally) bind application variables to columns in order to receive the data
3. Repeatedly fetch the next row of data, and receive it into the bound application variables
4. (Optionally) columns that were not previously bound can be retrieved by calling `SQLGetData()` after each successful fetch.

Note: Each of the above steps requires some diagnostic checks.

The first step requires analyzing the executed or prepared statement. If the SQL statement was generated by the application this step is not necessary. This is because the application knows the structure of the result set and the data types of each column. If the SQL statement was generated (for example, entered by a user) at runtime, the application needs to query:

- The number of columns
- The type of each column
- The names of each column in the result set.

This information can be obtained by calling `SQLNumResultCols()` and `SQLDescribeCol()` (or `SQLColAttributes()`) after preparing the statement or after executing the statement.

The second step allows the application to retrieve column data directly into an application variable on the next call to `SQLFetch()`. For each column to be retrieved, the application calls `SQLBindCol()` to bind an application variable to a column in the result set. Similar to variables bound to parameter markers using `SQLSetParam()`, columns are bound using deferred arguments. This time the variables are output arguments, and data is written to them when `SQLFetch()` is called. `SQLGetData()` can also be used to retrieve data, so calling `SQLBindCol()` is optional.

The third step is to call `SQLFetch()` to fetch the first or next row of the result set. If any columns have been bound, the application variable is updated. If any data conversion was indicated by the data types specified on the call to `SQLBindCol`, the conversion occurs when `SQLFetch()` is called. Refer to “Data types and data conversion in DB2 UDB CLI functions” on page 17 for an explanation of data conversion.

The last (optional) step, is to call `SQLGetData()` to retrieve any columns that were not previously bound. All columns can be retrieved this way, provided they were not bound, or a combination of both methods can be used. `SQLGetData()` is also useful for retrieving variable length columns in smaller pieces, which cannot be done with bound columns. Data conversion can also be indicated here, as in `SQLBindCol()`. Refer to “Data types and data conversion in DB2 UDB CLI functions” on page 17 for more information.

For more information and examples refer to:

- “SQLBindCol - Bind a Column to an Application Variable” on page 33
- “SQLColAttributes - Column Attributes” on page 58
- “SQLDescribeCol - Describe Column Attributes” on page 76
- “SQLFetch - Fetch Next Row” on page 101
- “SQLGetData - Get Data From a Column” on page 130
- “SQLNumResultCols - Get Number of Result Columns” on page 183

Processing UPDATE, DELETE and INSERT statements in a DB2 UDB CLI application

If the statement is modifying data (UPDATE, DELETE or INSERT), no action is required, other than the normal check for diagnostic messages. In this case, `SQLRowCount()` can be used to obtain the number of rows affected by the SQL statement. For more information refer to “SQLNumResultCols - Get Number of Result Columns” on page 183.

If the SQL statement is a Positioned UPDATE or DELETE, it is necessary to use a *cursor*. A cursor is a moveable pointer to a row in the result table of a SELECT statement. In embedded SQL, cursors are used to retrieve, update or delete rows. When using DB2 UDB CLI, it is not necessary to define a cursor, because one is generated automatically.

In the case of Positioned UPDATE or DELETE statements, you need to specify the name of the cursor within the SQL statement. You can either define your own cursor name using `SQLSetCursorName()`, or query the name of the generated cursor using `SQLGetCursorName()`. It is best to use the generated name, since all error messages will reference this name, and not the one defined by `SQLSetCursorName()`.

Processing other SQL statements in a DB2 UDB CLI application

If the statement neither queries nor modifies the data, then there is no further action other than the normal check for diagnostic messages.

Freeing statement handles in a DB2 UDB CLI application

Call `SQLFreeStmt()` to end processing for a particular statement handle. This function can be used to do one or more of the following:

- Unbind all columns
- Unbind all parameters
- Close any cursors and discard the results
- Drop the statement handle, and release all associated resources

The statement handle can be reused provided it is not dropped.

Commit or rollback in a DB2 UDB CLI application

The last step is to either commit or rollback the *transaction*, using `SQLTransact()`.

A transaction is a recoverable unit of work, or a group of SQL statements that can be treated as one atomic operation. This means that all the operations within the group are to be completed (committed) or undone (rolled back), as if they were a single operation.

When using DB2 UDB CLI, transactions are started implicitly with the first access to the database using `SQLPrepare()`, `SQLExecDirect()` or `SQLGetTypeInfo()`. The transaction ends when you use `SQLTransact()` to either rollback or commit the transaction. This means that any SQL statements executed between these are treated as one unit of work.

When to call SQLTransact() in a DB2 UDB CLI application

Consider the following when deciding when to end a transaction:

- You can only commit or rollback the current transaction, so keep dependent statements within the same transaction.
- Various locks are held while you have an outstanding transaction. Ending the transaction releases the locks, and allows access to the data by other users. This is the case for all SQL statements, including SELECT statements.
- Once a transaction has successfully been committed or rolled back, it is fully recoverable from the system logs (this is dependent on the DBMS). Open transactions are not recoverable.

Effects of calling SQLTransact() in a DB2 UDB CLI application

When a transaction ends:

- all statements must be prepared before they can be used again.
- cursor names, bound parameters, and column bindings are maintained from one transaction to the next.
- All open cursors are closed.

For more information and an example refer to “SQLTransact - Transaction Management” on page 243.

Diagnostics in a DB2 UDB CLI application

Diagnostics refers to dealing with warning or error conditions generated within an application. There are two levels of diagnostics when calling DB2 UDB CLI functions :

- “Return codes from a DB2 UDB CLI application” on page 16
- “DB2 UDB CLI SQLSTATEs” on page 16 (Diagnostic Messages)

Refer to “SQLError - Retrieve Error Information” on page 91 for an example on error handling.

Return codes from a DB2 UDB CLI application

The following table lists all possible return codes for DB2 UDB CLI functions. Each function description in Chapter 3, “DB2 UDB CLI Functions” on page 21 lists the possible codes returned for each function.

Table 2. DB2 UDB CLI function return codes.

Return Code	Explanation
SQL_SUCCESS	The function completed successfully, no additional SQLSTATE information is available.
SQL_SUCCESS_WITH_INFO	The function completed successfully, with a warning or other information. Call `SQLError()` to receive the SQLSTATE and any other error information. The SQLSTATE will have a class of ’01’.
SQL_NO_DATA_FOUND	The function returned successfully, but no relevant data was found.
SQL_ERROR	The function failed. Call `SQLError()` to receive the SQLSTATE and any other error information.
SQL_INVALID_HANDLE	The function failed due to an invalid input handle (environment, connection or statement handle).

DB2 UDB CLI SQLSTATEs

Since different database servers often have different diagnostic message codes, DB2 UDB CLI provides a standard set of *SQLSTATEs* that are defined by the X/Open SQL CAE specification. This allows consistent message handling across different database servers.

SQLSTATEs are alphanumeric strings of 5 characters (bytes) with a format of `ccsss`, where `cc` indicates class and `sss` indicates subclass. Any SQLSTATE that has a class of:

- ’01’, is a warning.
- ’HY’, is generated by the command line interface (CLI) driver (either DB2 UDB CLI or Open Database Connectivity (ODBC)).

The `SQLError()` function also returns a *native* error code if the code was generated by the server. When connected to an IBM database server the native error code will be the SQLCODE. If the code was generated by DB2 UDB CLI instead of at the server, then the native error code is set to -99999.

DB2 UDB CLI SQLSTATEs include both additional IBM defined SQLSTATEs that are returned by the database server, and DB2 UDB CLI defined SQLSTATEs for conditions that are not defined in the X/Open specification. This allows for the maximum amount of diagnostic information to be returned. When running applications in Windows using ODBC, it is also possible to receive ODBC defined SQLSTATEs.

Follow these guidelines for using SQLSTATEs within your application:

- Always check the function return code before calling `SQLError()` to determine if diagnostic information is available.
- Use the SQLSTATEs rather than the native error code.
- To increase your application’s portability, only build dependencies on the subset of DB2 UDB CLI SQLSTATEs that are defined by the X/Open specification, and return the additional ones as information only. (Dependencies refers to the application making logic flow decisions based on specific SQLSTATEs.)
- For maximum diagnostic information, return the text message along with the SQLSTATE (if applicable, the text message will include the IBM defined SQLSTATE). It is also useful for the application to print out the name of the function that returned the error.

Data types and data conversion in DB2 UDB CLI functions

Table 3 shows all of the supported SQL types and their corresponding symbolic names. The symbolic names are used in SQLBindParam(), SQLBindParameter(), SQLSetParam(), SQLBindCol(), and SQLGetData() to indicate the data types of the arguments.

Each column is described below.

SQL Type
This column contains the SQL data type as it would appear in an SQL statement. The SQL data types are dependent on the DBMS.

SQL-Symbolic
This column contains an SQL symbolic name that is defined (in `sqlcli.h`) as an integer value. This value is used by various functions to identify an SQL data type in the first column.

Table 3. SQL Data Types and Default C Data Types

SQL Type	SQL Symbolic
CHAR	SQL_CHAR, SQL_WCHAR[2]
VARCHAR	SQL_VARCHAR, SQL_WVARCHAR[2]
GRAPHIC	SQL_GRAPHIC
VARGRAPHIC	SQL_VARGRAPHIC
SMALLINT	SQL_SMALLINT
BIGINT	SQL_BIGINT
INTEGER	SQL_INTEGER
DECIMAL	SQL_DECIMAL
NUMERIC	SQL_NUMERIC
DOUBLE	SQL_DOUBLE
FLOAT	SQL_FLOAT
REAL	SQL_REAL
DATE[1]	SQL_CHAR
TIME[1]	SQL_CHAR
TIMESTAMP[1]	SQL_CHAR
BLOB	SQL_BLOB
CLOB	SQL_CLOB
DBCLOB	SQL_DBCLOB
Note:	
[1] DATE, TIME, and TIMESTAMP values will be returned in character form.	
[2] SQL_WCHAR and SQL_WVARCHAR can be used to indicate Unicode data.	

For more information, see:

- “Other C data types in DB2 UDB CLI functions”
- “Data conversion in DB2 UDB CLI functions” on page 18

Other C data types in DB2 UDB CLI functions

As well as the data types that map to SQL data types, there are also C symbolic types used for other function arguments, such as pointers and handles.

Table 4. Generic Data Types and Actual C Data Types

Symbolic Type	Actual C Type	Typical Usage
SQLPOINTER	void *	Pointers to storage for data and parameters.
SQLHENV	long int	Handle referencing environment information.
SQLHDBC	long int	Handle referencing database connection information.
SQLHSTMT	long int	Handle referencing statement information.
SQLRETURN	long int	Return code from DB2 UDB CLI functions.

Data conversion in DB2 UDB CLI functions

As mentioned previously, DB2 UDB CLI manages the transfer and any required conversion of data between the application and the DBMS. Before the data transfer actually takes place, the source, target or both data types are indicated when calling `SQLBindParam()`, `SQLBindParameter()`, `SQLSetParam()`, `SQLBindCol()` or `SQLGetData()`. These functions use the symbolic type names shown in Table 3 on page 17, to identify the data types involved. Refer to the `SQLFetch()` "Example" on page 102, or `SQLGetCol()` "Example" on page 122 for examples of the functions that use the symbolic data types.

Table 5 shows the conversions supported by the DB2 UDB CLI. Only the default conversions are shown. Other conversions may be achieved by using SQL scalar functions or the SQL CAST function in the SQL syntax of the statement being executed.

The functions mentioned in the previous paragraph can be used to convert data to other types. Not all data conversions are supported or make sense. Table 5 shows the conversions that are supported by DB2 UDB CLI.

The first column in Table 5 contains the data type of the source, the remaining columns represent the target data types. An X indicates that DB2 UDB CLI supports the conversion.

Table 5. Supported Data Conversions

Source Data Type	VARGRAPHIC	GRAPHIC	TIMESTAMP	TIME	DATE	VARCHAR	DOUBLE	REAL	FLOAT	SMALLINT	BIGINT	INTEGER	DECIMAL	NUMERIC	CHAR	BLOB	CLOB	DBCLOB
CHAR VARCHAR			X	X	X	X				X					X		X	
GRAPHIC VARGRAPHIC	X	X																X
BLOB																X		
CLOB						X									X		X	
DBCLOB	X	X																X

Table 5. Supported Data Conversions (continued)

Source Data Type	VARGRAPHIC	GRAPHIC	TIMESTAMP	TIME	DATE	VARCHAR	DOUBLE	REAL	FLOAT	SMALLINT	BIGINT	INTEGER	DECIMAL	NUMERIC	CHAR	BLOB	CLOB	DBCLOB
INTEGER SMALLINT BIGINT DECIMAL NUMERIC DOUBLE FLOAT						X	X	1	X	X	X	X	X	2	X			
DATE			X		X	X									X			
TIME			X	X		X									X			
TIMESTAMP			X	X	X	X									X			

Notes:

1. REAL **not** supported by DB2 UDB for OS/2® or DB2 UDB for AIX/6000
2. NUMERIC **only** supported by DB2 UDB for iSeries treated as DECIMAL by other DBMSs)

Whenever truncation that is rounding or data type incompatibilities occur on a function call, either an SQL_ERROR or SQL_SUCCESS_WITH_INFO is returned. Further information is then indicated by the SQLSTATE value and other information returned by `SQLError()`.

Working with string arguments in DB2 UDB CLI functions

The following conventions deal with the various aspects of working with string arguments in DB2 UDB CLI functions.

- "Length of string arguments in DB2 UDB CLI functions"
- "String truncation in DB2 UDB CLI functions" on page 20
- "Interpretation of strings in DB2 UDB CLI functions" on page 20

Length of string arguments in DB2 UDB CLI functions

Input string arguments have an associated length argument. This argument indicates to DB2 UDB CLI, either the length of the allocated buffer (not including the null byte terminator),or the special value SQL_NTS. If SQL_NTS is passed, DB2 UDB CLI determines the length of the string by locating the null terminating character.

Output string arguments have two associated length arguments, one to specify the length of the allocated buffer and one to return the length of the string returned by DB2 UDB CLI. The returned length value is the total length of the string available for return, whether it fits in the buffer or not.

For SQL column data, if the output is an empty string, SQL_NULL_DATA is returned in the length argument.

If a function is called with a null pointer for an output length argument, DB2 UDB CLI will not return a length. This may be useful when it is known that the buffers are large enough for all possible results. If

DB2 UDB CLI attempts to return the SQL_NULL_DATA value to indicate a column contains null data, and the output length argument is a null pointer, the function call will fail.

Every character string that DB2 UDB CLI returns is terminated with a null terminating character (hex 00), except for strings that are returned from graphic data types. This requires that all buffers allocate enough space for the maximum number that are expected, plus one for the null-terminating character.

String truncation in DB2 UDB CLI functions

If an output string does not fit into a buffer, DB2 UDB CLI truncates the string to a length that is one less than the size of the buffer, and writes the null terminator. If truncation occurs, the function returns SQL_SUCCESS_WITH_INFO and an SQLSTATE by indicating truncation. The application can then compare the buffer length to the output length to determine which string was truncated.

For example, if `SQLFetch()` returns SQL_SUCCESS_WITH_INFO, and an SQLSTATE of 01004, at least one of the buffers bound to a column is too small to hold the data. For each buffer that is bound to a column, the application can compare the buffer length with the output length and determine which column was truncated.

Interpretation of strings in DB2 UDB CLI functions

DB2 UDB CLI ignores case, and removes leading and trailing blanks for all string input arguments, such as column names and cursor names, with the exception of:

- Any database data
- Delimited identifiers that are enclosed in double quotes)
- Password arguments.

Chapter 3. DB2 UDB CLI Functions

This topic provides a description of each function. Each of the DB2 UDB CLI functions contains the following information:

- **Purpose**

  This section gives a brief overview of what the function does. It also indicates if any functions should be called before and after calling the function being described.
- **Syntax**

  This section contains the 'C' prototype for the OS/400® environment.
- **Arguments**

  This section lists each function argument, along with its data type, a description and whether it is an input or output argument.

  Each DB2 UDB CLI argument is either an input or output argument. With the exception of `SQLGetInfo()`, DB2 UDB CLI only modifies arguments that are indicated as output.

  Some functions contain input or output arguments which are known as *deferred* or *bound* arguments. These arguments are pointers to buffers allocated by the application. These arguments are associated with (or bound to) either a parameter in an SQL statement, or a column in a result set. The data areas specified by the function are accessed by DB2 UDB CLI at a later time. It is important that these deferred data areas are still valid at the time DB2 UDB CLI accesses them.
- **Usage**

  This section provides information about how to use the function, and any special considerations. Possible error conditions are not discussed here, but are listed in the diagnostics section instead.
- **Return Codes**

  This section lists all the possible function return codes. When SQL_ERROR or SQL_SUCCESS_WITH_INFO is returned, error information can be obtained by calling `SQLError()`.

  Refer to "Diagnostics in a DB2 UDB CLI application" on page 15 for more information about return codes.
- **Diagnostics**

  This section contains a table that lists the SQLSTATEs explicitly returned by DB2 UDB CLI (SQLSTATEs generated by the DBMS may also be returned) and indicates the cause of the error. These values are obtained by calling `SQLError()` after the function returns a SQL_ERROR or SQL_SUCCESS_WITH_INFO.

  An "*****" in the first column indicates that the SQLSTATE is returned only by DB2 UDB CLI, and is not returned by other ODBC drivers.

  Refer to "Diagnostics in a DB2 UDB CLI application" on page 15 for more information about diagnostics.
- **Restrictions**

  This section indicates any differences or limitations between DB2 UDB CLI and ODBC that may affect an application.
- **Example**

  This section is a code fragment demonstrating the use of the function. The complete source used for all code fragments is listed in Appendix C, "Example DB2 UDB CLI application code listing" on page 265.
- **References**

  This section lists related DB2 UDB CLI functions.

The functions are:

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SQLAllocConnect - Allocate Connection Handle

Purpose

SQLAllocConnect() allocates a connection handle and associated resources within the environment identified by the input environment handle. Call SQLGetInfo() with fInfoType set to SQL_ACTIVE_CONNECTIONS, to query the number of connections that can be allocated at any one time.

SQLAllocEnv() must be called before calling this function.

Syntax

```
SQLRETURN SQLAllocConnect (SQLHENV    henv,
                           SQLHDBC    *phdbc);
```

Function Arguments

Table 6. SQLAllocConnect Arguments

Data Type	Argument	Use	Description
SQLHENV	*henv*	Input	Environment handle
SQLHDBC *	*phdbc*	Output	Pointer to connection handle

Usage

The output connection handle is used by DB2 UDB CLI to reference all information related to the connection, including general status information, transaction state, and error information.

If the pointer to the connection handle (*phdbc*) points to a valid connection handle allocated by SQLAllocConnect(), the original value is overwritten as a result of this call. This is an application programming error and is not detected by DB2 UDB CLI

Return Codes

- SQL_SUCCESS
- SQL_ERROR
- SQL_INVALID_HANDLE

If SQL_ERROR is returned, the *phdbc* argument is set to SQL_NULL_HDBC. The application should call SQLError() with the environment handle (*henv*) and with *hdbc* and *hstmt* arguments set to SQL_NULL_HDBC and SQL_NULL_HSTMT respectively.

Diagnostics

Table 7. SQLAllocConnect SQLSTATEs

CLI SQLSTATE	Description	Explanation
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	*phdbc* was a null pointer

Example

The following example shows how to obtain diagnostic information for the connection and the environment. For more examples of using SQLError(), refer to “Example: Interactive SQL and the equivalent DB2 UDB CLI function calls” on page 268 for a complete listing of typical.c.

See “Code disclaimer information” on page viii for information pertaining to code examples.

```
/*****************************************************************
** initialize
**  - allocate environment handle
**  - allocate connection handle
**  - prompt for server, user id, & password
**  - connect to server
*****************************************************************/

int initialize(SQLHENV *henv,
               SQLHDBC *hdbc)
{
SQLCHAR     server[SQL_MAX_DSN_LENGTH],
            uid[30],
            pwd[30];
SQLRETURN   rc;

    SQLAllocEnv (henv);         /* allocate an environment handle   */
    if (rc != SQL_SUCCESS )
        check_error (*henv, *hdbc, SQL_NULL_HSTMT, rc);

    SQLAllocConnect (*henv, hdbc);  /* allocate a connection handle     */
    if (rc != SQL_SUCCESS )
        check_error (*henv, *hdbc, SQL_NULL_HSTMT, rc);

    printf("Enter Server Name:\n");
    gets(server);
    printf("Enter User Name:\n");
    gets(uid);
    printf("Enter Password Name:\n");
    gets(pwd);

    if (uid[0] == '\0')
    {   rc = SQLConnect (*hdbc, server, SQL_NTS, NULL, SQL_NTS, NULL, SQL_NTS);
        if (rc != SQL_SUCCESS )
            check_error (*henv, *hdbc, SQL_NULL_HSTMT, rc);
    }
    else
    {   rc = SQLConnect (*hdbc, server, SQL_NTS, uid, SQL_NTS, pwd, SQL_NTS);
        if (rc != SQL_SUCCESS )
            check_error (*henv, *hdbc, SQL_NULL_HSTMT, rc);
    }
}/* end initialize */


/*****************************************************************/
int check_error (SQLHENV    henv,
                 SQLHDBC    hdbc,
                 SQLHSTMT   hstmt,
                 SQLRETURN  frc)
{
SQLRETURN   rc;

    print_error(henv, hdbc, hstmt);

    switch (frc){
    case SQL_SUCCESS : break;
    case SQL_ERROR :
    case SQL_INVALID_HANDLE:
        printf("\n ** FATAL ERROR, Attempting to rollback transaction **\n");
        rc = SQLTransact(henv, hdbc, SQL_ROLLBACK);
        if (rc != SQL_SUCCESS)
            printf("Rollback Failed, Exiting application\n");
        else
            printf("Rollback Successful, Exiting application\n");
        terminate(henv, hdbc);
        exit(frc);
```

```
        break;
    case SQL_SUCCESS_WITH_INFO :
        printf("\n ** Warning Message, application continuing\n");
        break;
    case SQL_NO_DATA_FOUND :
        printf("\n ** No Data Found ** \n");
        break;
    default :
        printf("\n ** Invalid Return Code ** \n");
        printf(" ** Attempting to rollback transaction **\n");
        SQLTransact(henv, hdbc, SQL_ROLLBACK);
        terminate(henv, hdbc);
        exit(frc);
        break;
    }
    return(SQL_SUCCESS);

}
```

References

- “SQLAllocEnv - Allocate Environment Handle” on page 27
- “SQLConnect - Connect to a Data Source” on page 69
- “SQLDisconnect - Disconnect from a Data Source” on page 83
- “SQLFreeConnect - Free Connection Handle” on page 114
- “SQLGetConnectAttr - Get the Value of a Connection Attribute” on page 124
- “SQLSetConnectOption - Set Connection Option” on page 213

SQLAllocEnv - Allocate Environment Handle

Purpose

SQLAllocEnv() allocates an environment handle and associated resources.

An application must call this function prior to SQLAllocConnect() or any other DB2 UDB CLI functions. The *henv* value is passed in all later function calls that require an environment handle as input.

Syntax

```
SQLRETURN SQLAllocEnv (SQLHENV    *phenv);
```

Function Arguments

Table 8. SQLAllocEnv Arguments

Data Type	Argument	Use	Description
SQLHENV *	*phenv*	Output	Pointer to environment handle

Usage

There can be only one active environment at any one time per application. Any later calls to SQLAllocEnv() returns the existing environment handle.

By default, the first successful call to SQLFreeEnv() releases the resources associated with the handle. This occurs no matter how many times SQLAllocEnv() was successfully called. If the environment attribute SQL_ATTR_ENVHNDL_COUNTER is set to SQL_TRUE, SQLFreeEnv() must be called once for each successful SQLAllocEnv() call before the resources associated with the handle are released.

To ensure that all DB2 UDB CLI resources are kept active, the program that calls SQLAllocEnv() should not terminate or leave the stack. Otherwise, the application will lose open cursors, statement handles, and other resources it has allocated.

Return Codes

- SQL_SUCCESS
- SQL_ERROR

If SQL_ERROR is returned and *phenv* is equal to SQL_NULL_HENV, then SQLError() cannot be called because there is no handle with which to associate additional diagnostic information.

If the return code is SQL_ERROR and the pointer to the environment handle is not equal to SQL_NULL_HENV, then the handle is a **restricted handle**. This means the handle can only be used in a call to SQLError() to obtain more error information, or to SQLFreeEnv().

Diagnostics

Table 9. SQLAllocEnv SQLSTATEs

SQLSTATE	Description	Explanation
58004	System error	Unrecoverable system error

Example

See “Code disclaimer information” on page viii for information pertaining to code examples.

SQLAllocEnv

```
/*****************************************************
** file = basiccon.c
**    - demonstrate basic connection to two datasources.
**    - error handling  ignored for simplicity
**
**  Functions used:
**
**    SQLAllocConnect  SQLDisconnect
**    SQLAllocEnv      SQLFreeConnect
**    SQLConnect       SQLFreeEnv
**
**
*****************************************************/

#include <stdio.h>
#include <stdlib.h>
#include "sqlcli.h"

int
connect(SQLHENV henv,
        SQLHDBC * hdbc);

#define MAX_DSN_LENGTH    18
#define MAX_UID_LENGTH    10
#define MAX_PWD_LENGTH    10
#define MAX_CONNECTIONS   5

int
main()
{
    SQLHENV         henv;
    SQLHDBC         hdbc[MAX_CONNECTIONS];

    /* allocate an environment handle   */
    SQLAllocEnv(&henv);

    /* Connect to first data source */
    connect(henv, &hdbc[0];);

    /* Connect to second data source */
    connect(henv, &hdbc[1];);

    /*********   Start Processing Step  ************************/
    /* allocate statement handle, execute statement, etc.       */
    /*********   End Processing Step  *************************/

    printf("\nDisconnecting .....\n");
    SQLFreeConnect(hdbc[0]);    /* free first connection handle  */
    SQLFreeConnect(hdbc[1]);    /* free second connection handle */
    SQLFreeEnv(henv);           /* free environment handle       */

    return (SQL_SUCCESS);
}

/*********************************************************************
**   connect - Prompt for connect options and connect              **
*********************************************************************/

int
connect(SQLHENV henv,
        SQLHDBC * hdbc)
{
    SQLRETURN       rc;
    SQLCHAR         server[MAX_DSN_LENGTH + 1], uid[MAX_UID_LENGTH + 1],
pwd[MAX_PWD_LENGTH
+ 1];
    SQLCHAR         buffer[255];
```

```
    SQLSMALLINT     outlen;

    printf("Enter Server Name:\n");
    gets((char *) server);
    printf("Enter User Name:\n");
    gets((char *) uid);
    printf("Enter Password Name:\n");
    gets((char *) pwd);

    SQLAllocConnect(henv, hdbc);/* allocate a connection handle     */

    rc = SQLConnect(*hdbc, server, SQL_NTS, uid, SQL_NTS, pwd, SQL_NTS);
    if (rc != SQL_SUCCESS) {
        printf("Error while connecting to database\n");
        return (SQL_ERROR);
    } else {
        printf("Successful Connect\n");
        return (SQL_SUCCESS);
    }
}
```

References

- “SQLAllocConnect - Allocate Connection Handle” on page 24
- “SQLFreeEnv - Free Environment Handle” on page 115
- “SQLAllocStmt - Allocate a Statement Handle” on page 31

SQLAllocHandle - Allocate Handle

Purpose

SQLAllocHandle() allocates any type of handle.

Syntax

```
SQLRETURN SQLAllocHandle (SQLSMALLINT htype,
                          SQLINTEGER ihandle,
                          SQLINTEGER *handle);
```

Function Arguments

Table 10. SQLAllocHandle Arguments

Data Type	Argument	Use	Description
SQLSMALLINT	*htype*	Input	Type of handle to allocate. Must be either SQL_HANDLE_ENV, SQL_HANDLE_DBC, SQL_HANDLE_DESC, or SQL_HANDLE_STMT.
SQLINTEGER	*ihandle*	Input	The handle that describes the context in which the new handle is allocated; however, if *htype* is SQL_HANDLE_ENV, this is SQL_NULL_HANDLE.
SQLINTEGER *	*handle*	Output	Pointer to the handle

Usage

This function combines the functions of SQLAllocEnv(), SQLAllocConnect(), and SQLAllocStmt().

If *htype* is SQL_HANDLE_ENV, *ihandle* must be SQL_NULL_HANDLE. If *htype* is SQL_HANDLE_DBC, *ihandle* must be a valid environment handle. If *htype* is either SQL_HANDLE_DESC or SQL_HANDLE_STMT, *ihandle* must be a valid connection handle.

Return Codes

- SQL_SUCCESS
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

SQL_ERROR is returned if the argument handle was a null pointer.

Table 11. SQLAllocHandle SQLSTATEs

SQLSTATE	Description	Explanation
58004	System error	Unrecoverable system error
HY014	Too many handles	The maximum number of handles has been allocated.

References

- “SQLAllocConnect - Allocate Connection Handle” on page 24
- “SQLAllocEnv - Allocate Environment Handle” on page 27
- “SQLAllocStmt - Allocate a Statement Handle” on page 31

SQLAllocStmt - Allocate a Statement Handle

Purpose

SQLAllocStmt() allocates a new statement handle and associates it with the connection specified by the connection handle. There is no defined limit on the number of statement handles that can be allocated at any one time.

SQLConnect() must be called before calling this function.

This function must be called before SQLBindParam(), SQLPrepare(), SQLExecute(), SQLExecDirect(), or any other function that has a statement handle as one of its input arguments.

Syntax

```
SQLRETURN SQLAllocStmt (SQLHDBC    hdbc,
                        SQLHSTMT   *phstmt);
```

Function Arguments

Table 12. SQLAllocStmt Arguments

Data Type	Argument	Use	Description
SQLHDBC	*hdbc*	Input	Connection handle
SQLHSTMT *	*phstmt*	Output	Pointer to statement handle

Usage

DB2 UDB CLI uses each statement handle to relate all the descriptors, result values, cursor information, and status information to the SQL statement processed. Although each SQL statement must have a statement handle, you can reuse the handles for different statements.

A call to this function requires that *hdbc* references an active database connection.

To execute a positioned update or delete, the application must use different statement handles for the SELECT statement and the UPDATE or DELETE statement.

If the input pointer to the statement handle (*phstmt*) points to a valid statement handle allocated by a previous call to SQLAllocStmt(), then the original value is overwritten as a result of this call. This is an application programming error and is not detected by DB2 UDB CLI.

Return Codes

- SQL_SUCCESS
- SQL_ERROR
- SQL_INVALID_HANDLE

If SQL_ERROR is returned, the *phstmt* argument is set to SQL_NULL_HSTMT. The application should call SQLError() with the same *hdbc* and with the *hstmt* argument set to SQL_NULL_HSTMT.

Diagnostics

Table 13. SQLAllocStmt SQLSTATEs

SQLSTATE	Description	Explanation
08003	Connection not open	The connection specified by the *hdbc* argument was not open. The connection must be established successfully (and the connection must be open) for the driver to allocate an *hstmt*.
40003 *	Statement completion unknown	The communication link between the CLI and the data source failed before the function completed processing.
58004	System error	Unrecoverable system error
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	*phstmt* was a null pointer
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.

Example

Refer to the `SQLFetch()` "Example" on page 102.

References

- "SQLConnect - Connect to a Data Source" on page 69
- "SQLFreeStmt - Free (or Reset) a Statement Handle" on page 117
- "SQLGetStmtOption - Returns Current Setting of A Statement Option" on page 165
- "SQLSetStmtOption - Set Statement Option" on page 229

SQLBindCol - Bind a Column to an Application Variable

Purpose

SQLBindCol() associates (bind) columns in a result set to application variables (storage buffers), for all data types. Data is transferred from the DBMS to the application when SQLFetch() is called.

This function is also used to specify any data conversion required. It is called once for each column in the result set that the application needs to retrieve.

SQLPrepare() or SQLExecDirect() is usually called before this function. It may also be necessary to call SQLDescribeCol() or SQLColAttributes().

SQLBindCol() must be called before SQLFetch(), to transfer data to the storage buffers specified by this call.

Syntax

```
SQLRETURN SQLBindCol (SQLHSTMT       hstmt,
                      SQLSMALLINT    icol,
                      SQLSMALLINT    fCType,
                      SQLPOINTER     rgbValue,
                      SQLINTEGER     cbValueMax,
                      SQLINTEGER     *pcbValue);
```

Function Arguments

Table 14. SQLBindCol Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle
SQLSMALLINT	*icol*	Input	Number identifying the column. Columns are numbered sequentially, from left to right, starting at 1.

Table 14. SQLBindCol Arguments (continued)

Data Type	Argument	Use	Description
SQLSMALLINT	*fCType*	Input	Application data type for column number *icol* in the result set. The following types are supported: • SQL_CHAR • SQL_VARCHAR • SQL_NUMERIC • SQL_DECIMAL • SQL_INTEGER • SQL_SMALLINT • SQL_BIGINT • SQL_FLOAT • SQL_REAL • SQL_DOUBLE • SQL_GRAPHIC • SQL_VARGRAPHIC • SQL_DATETIME • SQL_TYPE_DATE • SQL_TYPE_TIME • SQL_TYPE_TIMESTAMP • SQL_BLOB • SQL_CLOB • SQL_DBCLOB • SQL_BLOB_LOCATOR • SQL_CLOB_LOCATOR • SQL_DBCLOB_LOCATOR Specifying SQL_DEFAULT causes data to be transferred to its default data type, refer to Table 3 on page 17 for more information.
SQLPOINTER	*rgbValue*	Output (deferred)	Pointer to buffer where DB2 UDB CLI is to store the column data when the fetch occurs. If *rgbValue* is null, the column is unbound.
SQLINTEGER	*cbValueMax*	Input	Size of *rgbValue* buffer in bytes available to store the column data. If *fCType* is either SQL_CHAR or SQL_DEFAULT, then *cbValueMax* must be > 0 otherwise an error is returned. If *fcType* is either SQL_DECIMAL or SQL_NUMERIC, *cbValueMax* must actually be a precision and scale. The method to specify both values is to use *(precision * 256) + scale*. This is also the value returned as the LENGTH of these data types when using `SQLColAttributes()`. If *fcType* specifies any form of double-byte character data, then *cbValueMax* must be the number of double-byte characters, not the number of bytes.

Table 14. SQLBindCol Arguments (continued)

Data Type	Argument	Use	Description
SQLINTEGER *	*pcbValue*	Output (deferred)	Pointer to value which indicates the number of bytes DB2 UDB CLI has available to return in the *rgbValue* buffer. `SQLFetch()` returns `SQL_NULL_DATA` in this argument if the data value of the column is null. SQL_NTS is returned in this argument if the data value of the column is returned as a null-terminated string.

Note:

For this function, both *rgbValue* and *pcbValue* are deferred outputs, meaning that the storage locations these pointers point to are not updated until `SQLFetch()` is called. The locations referred to by these pointers must remain valid until `SQLFetch()` is called.

Usage

The application calls `SQLBindCol()` once for each column in the result set that it wants to retrieve. When `SQLFetch()` is called, the data in each of these *bound* columns is placed in the assigned location (given by the pointers *rgbValue* and *pcbValue*).

The application can query the attributes (such as data type and length) of the column by first calling `SQLDescribeCol()` or `SQLColAttributes()`. This information can then be used to specify the correct data type of the storage locations, or to indicate data conversion to other data types. Refer to “Data types and data conversion in DB2 UDB CLI functions” on page 17 for more information.

In later fetches, the application can change the binding of these columns or bind unbound columns by calling `SQLBindCol()`. The new binding does not apply to data fetched, it is used when the next `SQLFetch()` is called. To unbind a single column, call `SQLBindCol()` with *rgbValue* set to NULL. To unbind all the columns, the application should call `SQLFreeStmt()` with the *fOption* input set to SQL_UNBIND.

Columns are identified by a number, assigned sequentially from left to right, starting at 1. The number of columns in the result set can be determined by calling `SQLNumResultCols()` or `SQLColAttributes()` with the *fdescType* argument set to SQL_DESC_COUNT.

An application can choose not to bind every column, or even not to bind any columns. The data in the unbound columns (and only the unbound columns) can be retrieved using `SQLGetData()` after `SQLFetch()` has been called. `SQLBindCol()` is more efficient than `SQLGetData()`, and should be used whenever possible.

The application must ensure enough storage is allocated for the data to be retrieved. If the buffer is to contain variable length data, the application must allocate as much storage as the maximum length of the bound column requires, otherwise the data may be truncated.

If string truncation does occur, SQL_SUCCESS_WITH_INFO is returned and *pcbValue* is set to the actual size of *rgbValue* available for return to the application.

Return Codes

- SQL_SUCCESS
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 15. SQLBindCol SQLSTATEs

SQLSTATE	Description	Explanation
40003 *	Statement completion unknown	The communication link between the CLI and the data source failed before the function completed processing.
58004	System error	Unrecoverable system error
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY002	Invalid column number	The value specified for the argument *icol* was 0. The value specified for the argument *icol* exceeded the maximum number of columns supported by the data source.
HY003	Program type out of range	*fCType* was not a valid data type
HY009	Invalid argument value	*rgbValue* was a null pointer The value specified for the argument *cbValueMax* is less than 1 and the argument *fCType* is either SQL_CHAR or SQL_DEFAULT.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.
HY014	Too many handles	The maximum number of handles has been allocated, and use of this function requires an additional descriptor handle.
HYC00	Driver not capable	The driver recognizes, but does not support the data type specified in the argument *fCType* (see also **HY**003).

Example

Refer to the `SQLFetch()` "Example" on page 102.

References

- "SQLExecDirect - Execute a Statement Directly" on page 94
- "SQLExecute - Execute a Statement" on page 96
- "SQLFetch - Fetch Next Row" on page 101
- "SQLPrepare - Prepare a Statement" on page 189

SQLBindFileToCol - Bind LOB File Reference to LOB Column

Purpose

SQLBindFileToCol() is used to associate (bind) a LOB column in a result set to a file reference or an array of file references. This enables data in that column to be transferred directly into a file when each row is fetched for the statement handle.

The LOB file reference arguments (file name, file name length, file reference options) refer to a file within the application's environment (on the client). Before fetching each row, the application must make sure that these variables contain the name of a file, the length of the file name, and a file option (new / overwrite / append). These values can be changed between each fetch.

Syntax

```
SQLRETURN   SQLBindFileToCol (SQLHSTMT          StatementHandle,
                              SQLSMALLINT       ColumnNumber,
                              SQLCHAR           *FileName,
                              SQLSMALLINT       *FileNameLength,
                              SQLINTEGER        *FileOptions,
                              SQLSMALLINT       MaxFileNameLength,
                              SQLINTEGER        *StringLength,
                              SQLINTEGER        *IndicatorValue);
```

Function Arguments

Table 16. SQLBindFileToCol Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*StatementHandle*	input	Statement handle.
SQLSMALLINT	*ColumnNumber*	input	Number identifying the column. Columns are numbered sequentially, from left to right, starting at 1.
SQLCHAR *	*FileName*	input (deferred)	Pointer to the location that will contain the file name or an array of file names at the time of the next fetch using the *StatementHandle*. This is either the complete path name of the file(s) or a relative file name(s). If relative file name(s) are provided, they are appended to the current path of the running application. This pointer cannot be NULL.
SQLSMALLINT *	*FileNameLength*	input (deferred)	Pointer to the location that will contain the length of the file name (or an array of lengths) at the time of the next fetch using the *StatementHandle*. If this pointer is NULL, then a length of SQL_NTS is assumed. The maximum value of the file name length is 255.

Table 16. SQLBindFileToCol Arguments (continued)

Data Type	Argument	Use	Description
SQLINTEGER *	*FileOptions*	input (deferred)	Pointer to the location that will contain the file option to be used when writing the file at the time of the next fetch using the *StatementHandle*. The following *FileOptions* are supported: **SQL_FILE_CREATE** Create a new file. If a file by this name already exists, SQL_ERROR will be returned. **SQL_FILE_OVERWRITE** If the file already exists, overwrite it. Otherwise, create a new file. **SQL_FILE_APPEND** If the file already exists, append the data to it. Otherwise, create a new file. Only one option can be chosen per file, there is no default.
SQLSMALLINT	*MaxFileNameLength*	input	This specifies the length of the *FileName* buffer.
SQLINTEGER *	*StringLength*	output (deferred)	Pointer to the location that contains the length in bytes of the LOB data that is returned. If this pointer is NULL, nothing is returned.
SQLINTEGER *	*IndicatorValue*	output (deferred)	Pointer to the location that contains an indicator value.

Usage

The application calls `SQLBindFileToCol()` once for each column that should be transferred directly to a file when a row is fetched. LOB data is written directly to the file without any data conversion, and without appending null-terminators.

FileName, *FileNameLength*, and *FileOptions* must be set before each fetch. When `SQLFetch()` or `SQLFetchScroll()` is called, the data for any column which has been bound to a LOB file reference is written to the file or files pointed to by that file reference. Errors associated with the deferred input argument values of `SQLBindFileToCol()` are reported at fetch time. The LOB file reference, and the deferred *StringLength* and *IndicatorValue* output arguments are updated between fetch operations.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Error Conditions

Table 17. SQLBindFileToCol SQLSTATEs

SQLSTATE	Description	Explanation
58004	Unexpected system failure	Unrecoverable system error.
HY002	Invalid column number	The value specified for the argument *icol* was less than 1. The value specified for the argument *icol* exceeded the maximum number of columns supported by the data source.

Table 17. SQLBindFileToCol SQLSTATEs (continued)

SQLSTATE	Description	Explanation
HY009	Invalid argument value	*FileName*, *StringLength* or *FileOptions* is a null pointer.
HY010	Function sequence error	The function was called while in a data-at-execute (`SQLParamData()`, `SQLPutData()`) operation. The function was called while within a BEGIN COMPOUND and END COMPOUND SQL operation.
HY090	Invalid string or buffer length	The value specified for the argument *MaxFileNameLength* was less than 0.
HYC00	Driver not capable	The application is currently connected to a data source that does not support large objects.

Restrictions

This function is not available when connected to DB2 servers that do not support Large Object data types.

References

- "SQLBindCol - Bind a Column to an Application Variable" on page 33
- "SQLFetch - Fetch Next Row" on page 101
- "SQLBindFileToParam - Bind LOB File Reference to LOB Parameter" on page 40

SQLBindFileToParam - Bind LOB File Reference to LOB Parameter

Purpose

SQLBindFileToParam() is used to associate (bind) a parameter marker in an SQL statement to a file reference or an array of file references. This enables data from the file to be transferred directly into a LOB column when that statement is subsequently executed.

The LOB file reference arguments (file name, file name length, file reference options) refer to a file within the application's environment (on the client). Before calling SQLExecute() or SQLExecDirect(), the application must make sure that this information is available in the deferred input buffers. These values can be changed between SQLExecute() calls.

Syntax

```
SQLRETURN SQLBindFileToParam (SQLHSTMT          StatementHandle,
                              SQLSMALLINT       ParameterNumber,
                              SQLSMALLINT       DataType,
                              SQLCHAR           *FileName,
                              SQLSMALLINT       *FileNameLength,
                              SQLINTEGER        *FileOptions,
                              SQLSMALLINT       MaxFileNameLength,
                              SQLINTEGER        *IndicatorValue);
```

Function Arguments

Table 18. SQLBindFileToParam Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*StatementHandle*	input	Statement handle.
SQLSMALLINT	*ParameterNumber*	input	Parameter marker number. Parameters are numbered sequentially, from left to right, starting at 1.
SQLSMALLINT	*DataType*	input	SQL Data Type of the column. The data type must be one of: • SQL_BLOB • SQL_CLOB • SQL_DBCLOB
SQLCHAR *	*FileName*	input (deferred)	Pointer to the location that will contain the file name or an array of file names when the statement (*StatementHandle*) is executed. This is either the complete path name of the file or a relative file name. If a relative file name is provided, it is appended to the current path of the client process. This argument cannot be NULL.
SQLSMALLINT *	*FileNameLength*	input (deferred)	Pointer to the location that will contain the length of the file name (or an array of lengths) at the time of the next SQLExecute() or SQLExecDirect() using the *StatementHandle*. If this pointer is NULL, then a length of SQL_NTS is assumed. The maximum value of the file name length is 255.

Table 18. SQLBindFileToParam Arguments (continued)

Data Type	Argument	Use	Description
SQLINTEGER *	*FileOptions*	input (deferred)	Pointer to the location that will contain the file option (or an array of file options) to be used when reading the file. The location will be accessed when the statement (*StatementHandle*) is executed. Only one option is supported (and it must be specified): **SQL_FILE_READ** A regular file that can be opened, read and closed. (The length is computed when the file is opened) This pointer cannot be NULL.
SQLSMALLINT	*MaxFileNameLength*	input	This specifies the length of the *FileName* buffer. If the application calls `SQLParamOptions()` to specify multiple values for each parameter, this is the length of each element in the *FileName* array.
SQLINTEGER *	*IndicatorValue*	output (deferred)	Pointer to the location that contains an indicator value (or array of values), which is set to SQL_NULL_DATA if the data value of the parameter is to be null. It must be set to 0 (or the pointer can be set to null) when the data value is not null.

Usage

The application calls `SQLBindFileToParam()` once for each parameter marker whose value should be obtained directly from a file when a statement is executed. Before the statement is executed, *FileName*, *FileNameLength*, and *FileOptions* values must be set. When the statement is executed, the data for any parameter which has been bound using `SQLBindFIleToParam()` is read from the referenced file and passed to the server.

A LOB parameter marker can be associated with (bound to) an input file using `SQLBindFileToParam()`, or with a stored buffer using `SQLBindParameter()`. The most recent bind parameter function call determines the type of binding that is in effect.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Error Conditions

Table 19. SQLBindFileToParam SQLSTATEs

SQLSTATE	Description	Explanation
58004	Unexpected system failure	Unrecoverable system error.
HY004	SQL data type out of range	The value specified for *DataType* was not a valid SQL type for this function call.
HY009	Invalid argument value	*FileName*, *FileOptions FileNameLength*, is a null pointer.

Table 19. SQLBindFileToParam SQLSTATEs (continued)

SQLSTATE	Description	Explanation
HY010	Function sequence error	The function was called while in a data-at-execute (`SQLParamData()`, `SQLPutData()`) operation. The function was called while within a BEGIN COMPOUND and END COMPOUND SQL operation.
HY090	Invalid string or buffer length	The value specified for the input argument *MaxFileNameLength* was less than 0.
HY093	Invalid parameter number	The value specified for *ParameterNumber* was either less than 1 or greater than the maximum number of parameters supported.
HYC00	Driver not capable	The server does not support Large Object data types.

Restrictions

This function is not available when connected to DB2 servers that do not support Large Object data types.

References

- "SQLBindParam - Binds A Buffer To A Parameter Marker" on page 43
- "SQLExecute - Execute a Statement" on page 96
- "SQLParamOptions - Specify an Input Array for a Parameter" on page 187

SQLBindParam - Binds A Buffer To A Parameter Marker

Purpose

SQLBindParam() binds an application variable to a parameter marker in an SQL statement. This function can also be used to bind an application variable to a parameter of a stored procedure CALL statement where the parameter may be input, or output. This function is the same as SQLSetParam().

Syntax

```
SQLRETURN SQLBindParam (SQLHSTMT    hstmt,
                        SQLSMALLINT ipar,
                        SQLSMALLINT fCType,
                        SQLSMALLINT fSqlType,
                        SQLINTEGER  cbParamDef,
                        SQLSMALLINT ibScale,
                        SQLPOINTER  rgbValue,
                        SQLINTEGER  *pcbValue);
```

Function Arguments

Table 20. SQLBindParam Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle
SQLSMALLINT	*ipar*	Input	Parameter marker number, ordered sequentially left to right, starting at 1.

SQLBindParam

Table 20. SQLBindParam Arguments (continued)

Data Type	Argument	Use	Description
SQLSMALLINT	*fCType*	Input	Application data type of the parameter. The following types are supported: • SQL_CHAR • SQL_VARCHAR • SQL_NUMERIC • SQL_DECIMAL • SQL_INTEGER • SQL_SMALLINT • SQL_BIGINT • SQL_FLOAT • SQL_REAL • SQL_DOUBLE • SQL_GRAPHIC • SQL_VARGRAPHIC • SQL_DATETIME • SQL_TYPE_DATE • SQL_TYPE_TIME • SQL_TYPE_TIMESTAMP • SQL_BLOB • SQL_CLOB • SQL_DBCLOB • SQL_BLOB_LOCATOR • SQL_CLOB_LOCATOR • SQL_DBCLOB_LOCATOR Specifying SQL_DEFAULT causes data to be transferred from its default application data type to the type indicated in *fSqlType*.

Table 20. SQLBindParam Arguments (continued)

Data Type	Argument	Use	Description
SQLSMALLINT	*fSqlType*	Input	SQL Data Type of the parameter. The supported types are: • SQL_CHAR • SQL_VARCHAR • SQL_NUMERIC • SQL_DECIMAL • SQL_INTEGER • SQL_SMALLINT • SQL_BIGINT • SQL_FLOAT • SQL_REAL • SQL_DOUBLE • SQL_GRAPHIC • SQL_VARGRAPHIC • SQL_DATETIME • SQL_TYPE_DATE • SQL_TYPE_TIME • SQL_TYPE_TIMESTAMP • SQL_BLOB • SQL_CLOB • SQL_DBCLOB • SQL_BLOB_LOCATOR • SQL_CLOB_LOCATOR • SQL_DBCLOB_LOCATOR
SQLINTEGER	*cbParamDef*	Input	Precision of the corresponding parameter marker. If *fSqlType* denotes: • A single-byte character string (for example, SQL_CHAR), this is the maximum length in bytes sent for this parameter. This length includes the null-termination character. • A double-byte character string (for example, SQL_GRAPHIC), this is the maximum length in double-byte characters for this parameter. • SQL_DECIMAL OR SQL_NUMERIC, this is the maximum decimal precision. • Otherwise, this argument is unused.
SQLSMALLINT	*ibScale*	Input	Scale of the corresponding parameter if *fSqlType* is SQL_DECIMAL or SQL_NUMERIC. If *fSqlType* is SQL_TIMESTAMP, this is the number of digits to the right of the decimal point in the character representation of a timestamp (for example, the scale of yyyy-mm-dd hh:mm:ss.fff is 3). Other than for the *fSqlType* values mentioned here, *ibScale* is unused.

Table 20. SQLBindParam Arguments (continued)

Data Type	Argument	Use	Description
SQLPOINTER	*rgbValue*	Input (deferred) or output (deferred)	At execution time, if *pcbValue* does not contain SQL_NULL_DATA or SQL_DATA_AT_EXEC, then *rgbValue* points to a buffer that contains the actual data for the parameter. If *pcbValue* contains SQL_DATA_AT_EXEC, then *rgbValue* is an application-defined 32-bit value that is associated with this parameter. This 32-bit value is returned to the application through a later `SQLParamData()` call.
SQLINTEGER *	*pcbValue*	Input (deferred) or output (deferred) or both	A variable whose value is interpreted when the statement is executed: • If a null value is used as the parameter, *pcbValue* must contain the value SQL_NULL_DATA. • If the dynamic argument is supplied at execute-time by calling `ParamData()` and `PutData()`, *pcbValue* must contain the value SQL_DATA_AT_EXEC. • If *fcType* is SQL_CHAR and the data in *rgbValue* contains a null-terminated string, *pcbValue* must either contain the length of the data in *rgbValue* or contain the value SQL_NTS. • If *fcType* is SQL_CHAR and the data in *rgbValue* is not null-terminated, *pcbValue* must contain the length of the data in *rgbValue*. • If *fcType* is a LOB type, *pcbValue* must contain the length of the data in *rgbValue*. • Otherwise, *pcbValue* must be zero.

Usage

When `SQLBindParam()` is used to bind an application variable to an output parameter for a stored procedure, DB2 UDB CLI provides some performance enhancement if the *rgbValue* buffer is placed consecutively in memory after the *pcbValue* buffer.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 21. SQLBindParam SQLSTATEs

SQLSTATE	Description	Explanation
07006	Restricted data type attribute violation.	Same as `SQLSetParam()`.

Table 21. SQLBindParam SQLSTATEs (continued)

SQLSTATE	Description	Explanation
40003 *	Statement completion unknown	The communication link between the CLI and the data source failed before the function completed processing.
58004	System error	Unrecoverable system error
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY003	Program type out of range	Same as `SQLSetParam()`.
HY004	SQL data type out of range	Same as `SQLSetParam()`.
HY009	Invalid argument value	Both *rgbValue, pcbValue* were null pointers, or *ipar* was less than one..
HY010	Function sequence error	Function was called after `SQLExecute()` or `SQLExecDirect()` had returned SQL_NEED_DATA, but data have not been sent for all *data-at-execution* parameters.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.
HY014	Too many handles	The maximum number of handles has been allocated.

SQLBindParameter - Bind A Parameter Marker to a Buffer

Purpose

SQLBindParameter() is used to associate (bind) parameter markers in an SQL statement to application variables. Data is transferred from the application to the DBMS when SQLExecute() or SQLExecDirect() is called. Data conversion may occur as the data is transferred.

This function must also be used to bind an application storage to a parameter of a stored procedure CALL statement where the parameter may be input, output or both. This function is essentially an extension of SQLSetParam().

Syntax

```
SQLRETURN SQLBindParameter(SQLHSTMT          StatementHandle,
                           SQLSMALLINT      ParameterNumber,
                           SQLSMALLINT       InputOutputType,
                           SQLSMALLINT       ValueType,
                           SQLSMALLINT       ParameterType,
                           SQLINTEGER        ColumnSize,
                           SQLSMALLINT       DecimalDigits,
                           SQLPOINTER        ParameterValuePtr,
                           SQLINTEGER        BufferLength,
                           SQLINTEGER       *StrLen_or_IndPtr);
```

Function Arguments

Table 22. SQLBindParameter Arguments

Data Type	Argument	Use	Description
SQLHSTMT	StatementHandle	input	Statement Handle
SQLSMALLINT	ParameterNumber	input	Parameter marker number, ordered sequentially left to right, starting at 1.

Table 22. SQLBindParameter Arguments (continued)

Data Type	Argument	Use	Description
SQLSMALLINT	InputOutputType	input	The type of parameter. The value of the SQL_DESC_PARAMETER_TYPE field of the IPD is also set to this argument. The supported types are: • SQL_PARAM_INPUT: The parameter marker is associated with an SQL statement that is not a stored procedure CALL; or, it marks an input parameter of the CALLed stored procedure. When the statement is executed, actual data value for the parameter is sent to the server: the *ParameterValuePtr* buffer must contain valid input data values; the *StrLen_or_IndPtr* buffer must contain the corresponding length value or SQL_NTS, SQL_NULL_DATA, or (if the value should be sent via `SQLParamData()` and `SQLPutData()`) SQL_DATA_AT_EXEC. • SQL_PARAM_INPUT_OUTPUT: The parameter marker is associated with an input/output parameter of the CALLed stored procedure. When the statement is executed, actual data value for the parameter is sent to the server: the *ParameterValuePtr* buffer must contain valid input data values; the *StrLen_or_IndPtr* buffer must contain the corresponding length value or SQL_NTS, SQL_NULL_DATA, or (if the value should be sent via `SQLParamData()` and `SQLPutData()`) SQL_DATA_AT_EXEC. • SQL_PARAM_OUTPUT: The parameter marker is associated with an output parameter of the CALLed stored procedure or the return value of the stored procedure. After the statement is executed, data for the output parameter is returned to the application buffer specified by *ParameterValuePtr* and *StrLen_or_IndPtr*, unless both are NULL pointers, in which case the output data is discarded. If an output parameter does not have a return value then *StrLen_or_IndPtr* is set to SQL_NULL_DATA.

SQLBindParameter

Table 22. SQLBindParameter Arguments (continued)

Data Type	Argument	Use	Description
SQLSMALLINT	ValueType	input	C data type of the parameter. The following types are supported: • SQL_CHAR • SQL_VARCHAR • SQL_NUMERIC • SQL_DECIMAL • SQL_INTEGER • SQL_SMALLINT • SQL_BIGINT • SQL_FLOAT • SQL_REAL • SQL_DOUBLE • SQL_GRAPHIC • SQL_VARGRAPHIC • SQL_DATETIME • SQL_TYPE_DATE • SQL_TYPE_TIME • SQL_TYPE_TIMESTAMP • SQL_BLOB • SQL_CLOB • SQL_DBCLOB • SQL_BLOB_LOCATOR • SQL_CLOB_LOCATOR • SQL_DBCLOB_LOCATOR Specifying SQL_C_DEFAULT causes data to be transferred from its default C data type to the type indicated in *ParameterType*.
SQLSMALLINT	ParameterType	input	SQL Data Type of the parameter.
SQLINTEGER	ColumnSize	input	Precision of the corresponding parameter marker. If *ParameterType* denotes: • A binary or single-byte character string (for example, SQL_CHAR), this is the maximum length in bytes for this parameter marker. • A double-byte character string (for example, SQL_GRAPHIC), this is the maximum length in double-byte characters for this parameter. • SQL_DECIMAL or SQL_NUMERIC, this is the maximum decimal precision. • Otherwise, this argument is ignored.

Table 22. SQLBindParameter Arguments (continued)

Data Type	Argument	Use	Description
SQLSMALLINT	DecimalDigits	input	Scale of the corresponding parameter if *ParameterType* is SQL_DECIMAL or SQL_NUMERIC. If *ParameterType* is SQL_TYPE_TIMESTAMP, this is the number of digits to the right of the decimal point in the character representation of a timestamp (for example, the scale of yyyy-mm-dd hh:mm:ss.fff is 3). Other than for the *ParameterType* values mentioned here, *DecimalDigits* is ignored.
SQLPOINTER	ParameterValuePtr	input (deferred) and/or output (deferred)	• On input (*InputOutputType* set to SQL_PARAM_INPUT, or SQL_PARAM_INPUT_OUTPUT): At execution time, if *StrLen_or_IndPtr* does not contain SQL_NULL_DATA or SQL_DATA_AT_EXEC, then *ParameterValuePtr* points to a buffer that contains the actual data for the parameter. If *StrLen_or_IndPtr* contains SQL_DATA_AT_EXEC, then *ParameterValuePtr* is an application-defined 32-bit value that is associated with this parameter. This 32-bit value is returned to the application via a subsequent `SQLParamData()` call. If `SQLParamOptions()` is called to specify multiple values for the parameter, then *ParameterValuePtr* is a pointer to an input buffer array of *BufferLength* bytes. • On output (*InputOutputType* set to SQL_PARAM_OUTPUT, or SQL_PARAM_INPUT_OUTPUT): *ParameterValuePtr* points to the buffer where the output parameter value of the stored procedure will be stored. If *InputOutputType* is set to SQL_PARAM_OUTPUT, and both *ParameterValuePtr* and *StrLen_or_IndPtr* are NULL pointers, then the output parameter value or the return value from the stored procedure call is discarded.
SQLINTEGER	BufferLength	input	Not used.

Table 22. SQLBindParameter Arguments (continued)

Data Type	Argument	Use	Description
SQLINTEGER *	StrLen_or_IndPtr	input (deferred) and/or output (deferred)	If this is an input or input/output parameter: This is the pointer to the location which contains (when the statement is executed) the length of the parameter marker value stored at *ParameterValuePtr*. To specify a null value for a parameter marker, this storage location must contain SQL_NULL_DATA. If *ValueType* is SQL_C_CHAR, this storage location must contain either the exact length of the data stored at *ParameterValuePtr*, or SQL_NTS if the contents at *ParameterValuePtr* is null-terminated. If *ValueType* indicates LOB data, this storage location must contain the length of the data stored at *ParameterValuePtr*. If *ValueType* indicates character data (explicitly, or implicitly using SQL_C_DEFAULT), and this pointer is set to NULL, it is assumed that the application will always provide a null-terminated string in *ParameterValuePtr*. This also implies that this parameter marker will never have a null value. When `SQLExecute()` or `SQLExecDirect()` is called, and *StrLen_or_IndPtr* points to a value of SQL_DATA_AT_EXEC, the data for the parameter will be sent with `SQLPutData()`. This parameter is referred to as a **data-at-execution** parameter.

Usage

A parameter marker is represented by a ″?″ character in an SQL statement and is used to indicate a position in the statement where an application supplied value is to be substituted when the statement is executed. This value is obtained from an application variable.

The application must bind a variable to each parameter marker in the SQL statement before executing the SQL statement. For this function, *ParameterValuePtr* and *StrLen_or_IndPtr* are deferred arguments; the storage locations must be valid and contain input data values when the statement is executed. This means either keeping the `SQLExecDirect()` or `SQLExecute()` call in the same procedure scope as the `SQLBindParameter()` calls, or, these storage locations must be dynamically allocated or declared statically or globally.

Parameter markers are referred to by number (*ParameterNumber*) and are numbered sequentially from left to right, starting at 1.

All parameters bound by this function remain in effect until `SQLFreeStmt()` is called with either the SQL_DROP or SQL_RESET_PARAMS option, or until `SQLBindParameter()` is called again for the same parameter *ParameterNumber* number.

After the SQL statement has been executed and the results have been processed, the application may wish to reuse the statement handle to execute a different SQL statement. If the parameter marker specifications are different (number of parameters, length or type) then `SQLFreeStmt()` should be called with SQL_RESET_PARAMS to reset or clear the parameter bindings.

The C buffer data type that is given by *ValueType* must be compatible with the SQL data type that is indicated by *ParameterType*, or an error will occur.

An application can pass the value for a parameter either in the *ParameterValuePtr* buffer or with one or more calls to `SQLPutData()`. In latter case, these parameters are data-at-execution parameters. The application informs DB2 UDB CLI of a data-at-execution parameter by placing the SQL_DATA_AT_EXEC value in the *StrLen_or_IndPtr* buffer. It sets the *ParameterValuePtr* input argument to a 32 bit value which will be returned on a subsequent `SQLParamData()` call and can be used to identify the parameter position.

Since the data in the variables referenced by *ParameterValuePtr* and *StrLen_or_IndPtr* is not verified until the statement is executed, data content or format errors are not detected or reported until `SQLExecute()` or `SQLExecDirect()` is called.

`SQLBindParameter()` essentially extends the capability of the `SQLSetParam()` function by providing a method of specifying whether a parameter is input, input and output, or output. This information is necessary for the proper handling of parameters for stored procedures.

The *InputOutputType* argument specifies the type of the parameter. All parameters in the SQL statements that do not call procedures are input parameters. Parameters in stored procedure calls can be input, input/output, or output parameters. Even though the DB2 stored procedure argument convention typically implies that all procedure arguments are input/output, the application programmer may still choose to specify more exactly the input or output nature on the `SQLBindParameter()` to follow a more rigorous coding style. Also, note that these types should be consistent with the parameter types specified when the stored procedure was registered with the SQL CREATE PROCEDURE statement.

- If an application cannot determine the type of a parameter in a procedure call, set *InputOutputType* to SQL_PARAM_INPUT; if the data source returns a value for the parameter, DB2 UDB CLI discards it.
- If an application has marked a parameter as SQL_PARAM_INPUT_OUTPUT or SQL_PARAM_OUTPUT and the data source does not return a value, DB2 UDB CLI sets the *StrLen_or_IndPtr* buffer to SQL_NULL_DATA.
- If an application marks a parameter as SQL_PARAM_OUTPUT, data for the parameter is returned to the application after the CALL statement has been processed. If the *ParameterValuePtr* and *StrLen_or_IndPtr* arguments are both null pointers, DB2 UDB CLI discards the output value. If the data source does not return a value for an output parameter, DB2 UDB CLI sets the *StrLen_or_IndPtr* buffer to SQL_NULL_DATA.
- For this function, both *ParameterValuePtr* and *StrLen_or_IndPtr* are deferred arguments. In the case where *InputOutputType* is set to SQL_PARAM_INPUT or SQL_PARAM_INPUT_OUTPUT, the storage locations must be valid and contain input data values when the statement is executed. This means either keeping the `SQLExecDirect()` or `SQLExecute()` call in the same procedure scope as the `SQLBindParameter()` calls, or, these storage locations must be dynamically allocated or statically / globally declared.

  Similarly, if *InputOutputType* is set to SQL_PARAM_OUTPUT or SQL_PARAM_INPUT_OUTPUT, the ParameterValuePtr and StrLen_or_IndPtr buffer locations must remain valid until the CALL statement has been executed.

An application can pass the value for a parameter either in the *ParameterValuePtr* buffer or with one or more calls to `SQLPutData()`. In latter case, these parameters are data-at-execution parameters. The application informs DB2 UDB CLI of a data-at-execution parameter by placing the SQL_DATA_AT_EXEC value in the StrLen_or_IndPtr buffer. It sets the *ParameterValuePtr* input argument to a 32 bit value which will be returned on a subsequent `SQLParamData()` call and can be used to identify the parameter position.

When `SQLBindParameter()` is used to bind an application variable to an output parameter for a stored procedure, DB2 UDB CLI can provide some performance enhancement if the *ParameterValuePtr* buffer is placed consecutively in memory after the *StrLen_or_IndPtr* buffer. For example:

SQLBindParameter

```
struct {  SQLINTEGER  StrLen_or_IndPtr;
          SQLCHAR     ParameterValuePtr[MAX_BUFFER];
       } column;
```

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Error Conditions

Table 23. SQLBindParameter SQLSTATEs

SQLSTATE	Description	Explanation
07006	Conversion not valid	The conversion from the data value identified by the *ValueType* argument to the data type identified by the *ParameterType* argument is not a meaningful conversion. (For example, conversion from SQL_C_DATE to SQL_DOUBLE.)
40003 **08**S01	Communication link failure	The communication link between the application and data source failed before the function completed.
58004	Unexpected system failure	Unrecoverable system error.
HY001	Memory allocation failure	DB2 UDB CLI is unable to allocate memory required to support execution or completion of the function.
HY003	Program type out of range	The value specified by the argument *ParameterNumber* not a valid data type or SQL_C_DEFAULT.
HY004	SQL data type out of range	The value specified for the argument *ParameterType* is not a valid SQL data type.
HY009	Argument value not valid	The argument *ParameterValuePtr* was a null pointer and the argument *StrLen_or_IndPtr* was a null pointer, and *InputOutputType* is not SQL_PARAM_OUTPUT.
HY010	Function sequence error	Function was called after `SQLExecute()` or `SQLExecDirect()` had returned SQL_NEED_DATA, but data have not been sent for all *data-at-execution* parameters.
HY013	Unexpected memory handling error	DB2 UDB CLI was unable to access memory required to support execution or completion of the function.
HY014	Too many handles	The maximum number of handles has been allocated.
HY021	Inconsistent descriptor information	The descriptor information checked during a consistency check was not consistent.
HY090	String or buffer length not valid	The value specified for the argument *BufferLength* was less than 0.
HY093	Parameter number not valid	The value specified for the argument *ValueType* was less than 1 or greater than the maximum number of parameters supported by the server.
HY094	Scale value not valid	The value specified for *ParameterType* was either SQL_DECIMAL or SQL_NUMERIC and the value specified for *DecimalDigits* was less than 0 or greater than the value for the argument *ParamDef* (precision). The value specified for *ParameterType* was SQL_C_TIMESTAMP and the value for *ParameterType* was either SQL_CHAR or SQL_VARCHAR and the value for *DecimalDigits* was less than 0 or greater than 6.

Table 23. SQLBindParameter SQLSTATEs (continued)

SQLSTATE	Description	Explanation
HY104	Precision value not valid	The value specified for *ParameterType* was either SQL_DECIMAL or SQL_NUMERIC and the value specified for *ParamDef* was less than 1.
HY105	Parameter type not valid	*InputOutputType* is not one of SQL_PARAM_INPUT, SQL_PARAM_OUTPUT, or SQL_PARAM_INPUT_OUTPUT.
HYC00	Driver not capable	DB2 UDB CLI or data source does not support the conversion specified by the combination of the value specified for the argument *ValueType* and the value specified for the argument *ParameterType*. The value specified for the argument *ParameterType* is not supported by either DB2 UDB CLI or the data source.

References

- "SQLExecDirect - Execute a Statement Directly" on page 94
- "SQLExecute - Execute a Statement" on page 96
- "SQLParamData - Get Next Parameter For Which A Data Value Is Needed" on page 185
- "SQLPutData - Passing Data Value for A Parameter" on page 204

SQLCancel - Cancel Statement

Purpose

SQLCancel() attempts to end the processing of an ongoing SQL statement operation that is executing asynchronously.

SQLCancel() is for compatibility purposes only, and has no effect on SQL statement execution.

Syntax

```
SQLRETURN SQLCancel (SQLHSTMT     hstmt);
```

Function Arguments

Table 24. SQLCancel Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle

Usage

A successful return code indicates that the implementation has accepted the cancel request; it does not ensure that the processing is cancelled.

Return Codes

- SQL_SUCCESS
- SQL_INVALID_HANDLE
- SQL_ERROR

Diagnostics

Table 25. SQLCancel SQLSTATEs

SQLSTATE	Description	Explanation
HY009 *	Invalid argument value	*hstmt* is not a statement handle

Restrictions

DB2 UDB CLI does not support asynchronous statement execution.

SQLCloseCursor - Close Cursor Statement

Purpose

SQLCloseCursor() closes the open cursor on a statement handle.

Syntax

```
SQLRETURN SQLCloseCursor (SQLHSTMT     hstmt);
```

Function Arguments

Table 26. SQLCancel Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle

Usage

Calling SQLCloseCursor() closes any cursor associated with the statement handle and discards any pending results. If no open cursor is associated with the statement handle, the function has no effect.

If the statement handle references a stored procedure that has multiple result sets, the SQLCloseCursor() closes only the current result set. Any additional result sets remain open and usable.

Return Codes

- SQL_SUCCESS
- SQL_INVALID_HANDLE
- SQL_ERROR

Diagnostics

Table 27. SQLCancel SQLSTATEs

SQLSTATE	Description	Explanation
08003 *	Connection not open	The connection for hstmt was not established.
HY009 *	Invalid argument value	*hstmt* is not a statement handle

SQLColAttributes - Column Attributes

Purpose

SQLColAttributes() obtains an attribute for a column of the result set, and is also used to determine the number of columns. SQLColAttributes() is a more extensible alternative to the SQLDescribeCol() function.

Either SQLPrepare() or SQLExecDirect() must be called before calling this function.

This function (or SQLDescribeCol()) must be called before SQLBindCol(), if the application does not know the various attributes (such as, data type and length) of the column.

Syntax

```
SQLRETURN SQLColAttributes (SQLHSTMT       hstmt,
                            SQLSMALLINT    icol,
                            SQLSMALLINT    fDescType,
                            SQLCHAR        *rgbDesc,
                            SQLINTEGER     cbDescMax,
                            SQLINTEGER     *pcbDesc,
                            SQLINTEGER     *pfDesc);
```

Function Arguments

Table 28. SQLColAttributes Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle
SQLSMALLINT	*icol*	Input	Column number in result set (must be between 1 and the number of columns in the results set inclusive). This argument is ignored when SQL_DESC_COUNT is specified.
SQLSMALLINT	*fDescType*	Input	Supported values are described in Table 29.
SQLCHAR *	*rgbDesc*	Output	Pointer to buffer for string column attributes
SQLINTEGER	*cbDescMax*	Input	Length of descriptor buffer (*rgbDesc*)
SQLINTEGER *	*pcbDesc*	Output	Actual number of bytes in the descriptor to return. If this argument contains a value equal to or higher than the length *rgbDesc* buffer, truncation has occurred. The descriptor would then be truncated to *cbDescMax* - 1 bytes.
SQLINTEGER *	*pfDesc*	Output	Pointer to integer which holds information regarding numeric column attributes.

Table 29. fDescType descriptor types

Descriptor	Type	Description
SQL_DESC_COUNT	SMALLINT	The number of columns in the result set is returned in *pfDesc*.
SQL_DESC_NAME	CHAR(128)	The name of the column *icol* is returned in *rgbDesc*. If the column is an expression, then the result returned is product specific.

Table 29. fDescType descriptor types (continued)

Descriptor	Type	Description
SQL_DESC_TYPE	SMALLINT	The SQL data type of the column identified in *icol* is returned in *pfDesc*. The possible values for *pfSqlType* are listed in Table 5 on page 18.
SQL_DESC_LENGTH	INTEGER	The number of *bytes* of data associated with the column is returned in *pfDesc*. If the column identified in *icol* is character based, for example, SQL_CHAR, SQL_VARCHAR, or SQL_LONG_VARCHAR, the actual length or maximum length is returned. If the column type is SQL_DECIMAL or SQL_NUMERIC, SQL_DESC_LENGTH will be *(precision * 256) + scale*. This is returned so that the same value can be passed as input on `SQLBindCol()`. The precision and scale can also be obtained as separate values for these data types by using SQL_DESC_PRECISION and SQL_DESC_SCALE.
SQL_DESC_PRECISION	SMALLINT	The precision attribute of the column is returned.
SQL_DESC_SCALE	SMALLINT	The scale attribute of the column is returned.
SQL_DESC_NULLABLE	SMALLINT	If the column identified by *icol* can contain nulls, then SQL_NULLABLE is returned in *pfDesc*. If the column is constrained not to accept nulls, then SQL_NO_NULLS is returned in *pfDesc*.
SQL_DESC_UNNAMED	SMALLINT	This is SQL_NAMED if the NAME field is an actual name, or SQL_UNNAMED if the NAME field is an implementation-generated name.
SQL_DESC_AUTO_INCREMENT	INTEGER	SQL_TRUE if the column can be incremented automatically upon insertion of a new row to the table. SQL_FALSE if the column cannot be incremented automatically.

Table 29. fDescType descriptor types (continued)

Descriptor	Type	Description
SQL_DESC_SEARCHABLE	INTEGER	SQL_UNSEARCHABLE if the column cannot be used in a **WHERE** clause. SQL_LIKE_ONLY if the column can be used in **WHERE** clause only with the **LIKE** predicate. SQL_ALL_EXCEPT_LIKE if the column can be used in a **WHERE** clause with all comparison operators except **LIKE**. SQL_SEARCHABLE if the column can be used in a **WHERE** clause with any comparison operator. For this attribute to be retrieved, the attribute SQL_ATTR_EXTENDED_COL_INFO must have been set to SQL_TRUE for either the statement handle or the connection handle.
SQL_DESC_UPDATABLE	INTEGER	Column is described by the values for the defined constants: SQL_ATTR_READONLY SQL_ATTR_WRITE SQL_ATTR_READWRITE_UNKNOWN SQL_COLUMN_UPDATABLE describes the updatability of the column in the result set. Whether a column is updatable can be based on the data type, user privileges, and the definition of the result set itself. If it is unclear whether a column is updatable, SQL_ATTR_READWRITE_UNKNOWN should be returned. For this attribute to be retrieved, the attribute SQL_ATTR_EXTENDED_COL_INFO must have been set to SQL_TRUE for either the statement handle or the connection handle.
SQL_DESC_BASE_TABLE	CHAR(128)	The name of the underlying table over which this column is built. For this attribute to be retrieved, the attribute SQL_ATTR_EXTENDED_COL_INFO must have been set to SQL_TRUE for either the statement handle or the connection handle.

Table 29. fDescType descriptor types (continued)

Descriptor	Type	Description
SQL_DESC_BASE_COLUMN	CHAR(128)	The name of the actual column in the underlying table over which this column is built. For this attribute to be retrieved, the attribute SQL_ATTR_EXTENDED_COL_INFO must have been set to SQL_TRUE for either the statement handle or the connection handle.
SQL_DESC_BASE_SCHEMA	CHAR(128)	The schema name of the underlying table over which this column is built. For this attribute to be retrieved, the attribute SQL_ATTR_EXTENDED_COL_INFO must have been set to SQL_TRUE for either the statement handle or the connection handle.
SQL_DESC_LABEL	CHAR(128)	The label for this column, if one exists. Otherwise, a zero-length string. For this attribute to be retrieved, the attribute SQL_ATTR_EXTENDED_COL_INFO must have been set to SQL_TRUE for either the statement handle or the connection handle.

Usage

Instead of returning a specific set of arguments like `SQLDescribeCol()`, `SQLColAttributes()` can be used to specify which attribute you want to receive for a specific column. If the desired information is a string, it is returned in *rgbDesc*. If the desired information is a number, it is returned in *pfDesc*.

Although `SQLColAttributes()` allows for future extensions, it requires more calls to receive the same information than `SQLDescribeCol()` for each column.

If a *fDescType* descriptor type does not apply to the database server, an empty string is returned in *rgbDesc* or zero is returned in *pfDesc*, depending on the expected result of the descriptor.

Columns are identified by a number (numbered sequentially from left to right starting with 1) and may be described in any order.

Calling `SQLColAttributes()` with *fDescType* set to SQL_DESC_COUNT is an alternative to calling `SQLNumResultCols()` to determine whether any columns can be returned.

Call `SQLNumResultCols()` before calling `SQLColAttributes()` to determine whether a result set exists.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR

SQLColAttributes

- SQL_INVALID_HANDLE
- SQL_NO_DATA_FOUND

Diagnostics

Table 30. SQLColAttributes SQLSTATEs

SQLSTATE	Description	Explanation
07009	Invalid column number	The value specified for the argument *icol* was less than 1.
HY009	Invalid argument value	The value specified for the argument *fDescType* was not equal to a value specified in Table 29 on page 58. The argument *rgbDesc*, *pcbDesc* or *pfDesc* was a null pointer..
HY010	Function sequence error	The function was called prior to calling `SQLPrepare()` or `SQLExecDirect()` for the *hstmt*.
HYC00	Driver not capable	The SQL data type returned by the database server for column *icol* is not recognized by DB2 UDB CLI.

References

- “SQLBindCol - Bind a Column to an Application Variable” on page 33
- “SQLDescribeCol - Describe Column Attributes” on page 76
- “SQLExecDirect - Execute a Statement Directly” on page 94
- “SQLExecute - Execute a Statement” on page 96
- “SQLPrepare - Prepare a Statement” on page 189

SQLColumnPrivileges - Get privileges associated with the columns of a table

Purpose

SQLColumnPrivileges() returns a list of columns and associated privileges for the specified table. The information is returned in an SQL result set, which can be retrieved using the same functions that are used to process a result set generated from a query.

Syntax

```
SQLRETURN SQLColumnPrivileges  (
                SQLHSTMT            StatementHandle,
                SQLCHAR             *CatalogName,
                SQLSMALLINT         NameLength1,
                SQLCHAR             *SchemaName,
                SQLSMALLINT         NameLength2,
                SQLCHAR             *TableName
                SQLSMALLINT         NameLength3,
                SQLCHAR             *ColumnName,
                SQLSMALLINT         NameLength4);
```

Function Arguments

Table 31. SQLColumnPrivileges Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*Statement Handle*	Input	Statement handle
SQLCHAR *	*CatalogName*	Input	Catalog qualifier of a 3 part table name. This must be a NULL pointer or a zero length string.
SQLSMALLINT	*NameLength1*	Input	Length of *CatalogName*. This must be set to 0.
SQLCHAR *	*SchemaName*	Input	Schema qualifier of table name.
SQLSMALLINT	*NameLength2*	Input	Length of *SchemaName*
SQLCHAR *	*TableName*	Input	Table Name.
SQLSMALLINT	*NameLength3*	Input	Length of *TableName.*
SQLCHAR *	*ColumnName*	Input	Buffer that can contain a *pattern-value* to qualify the result set by column name.
SQLSMALLINT	*NameLength4*	Input	Length of *ColumnName.*

Usage

The results are returned as a standard result set containing the columns listed in Table 32 on page 64. The result set is ordered by TABLE_CAT, TABLE_SCHEM, TABLE_NAME, COLUMN_NAME, and PRIVILEGE. If multiple privileges are associated with any given column, each privilege is returned as a separate row. A typical application may wish to call this function after a call to SQLColumns() to determine column privilege information. The application should use the character strings returned in the TABLE_SCHEM, TABLE_NAME, COLUMN_NAME columns of the SQLColumns() result set as input arguments to this function

Since calls to SQLColumnPrivileges() in many cases map to a complex and thus expensive query against the system catalog, they should be used sparingly, and the results saved rather than repeating the calls.

SQLColumnPrivileges

The VARCHAR columns of the catalog functions result set have been declared with a maximum length attribute of 128 to be consistent with SQL92 limits. Since DB2 names are less than 128, the application can choose to always set aside 128 characters (plus the null-terminator) for the output buffer, or alternatively, call `SQLGetInfo()` with the SQL_MAX_CATALOG_NAME_LEN, SQL_MAX_SCHEMA_NAME_LEN, SQL_MAX_TABLE_NAME_LEN, and SQL_MAX_COLUMN_NAME_LEN to determine respectively the actual lengths of the TABLE_CAT, TABLE_SCHEM, TABLE_NAME, and COLUMN_NAME columns supported by the connected DBMS.

Note that the *ColumnName* argument accepts a search pattern.

Although new columns may be added and the names of the existing columns changed in future releases, the position of the current columns will not change.

Table 32. Columns Returned By SQLColumnPrivileges

Column Number/Name	Data Type	Description
TABLE_CAT	VARCHAR(128)	This is always NULL.
TABLE_SCHEM	VARCHAR(128)	The name of the schema containing TABLE_NAME.
TABLE_NAME	VARCHAR(128) not NULL	Name of the table or view
COLUMN_NAME	VARCHAR(128) not NULL	Name of the column of the specified table or view.
GRANTOR	VARCHAR(128)	Authorization ID of the user who granted the privilege.
GRANTEE	VARCHAR(128)	Authorization ID of the user to whom the privilege is granted.
PRIVILEGE	VARCHAR(128)	The column privilege. This can be: • INSERT • REFERENCES • SELECT • UPDATE
IS_GRANTABLE	VARCHAR(3)	Indicates whether the grantee is permitted to grant the privilege to other users. Either YES or NO.

Note: The column names used by DB2 CLI follow the X/Open CLI CAE specification style. The column types, contents and order are identical to those defined for the `SQLColumnPrivileges()` result set in ODBC.

If there is more than one privilege associated with a column, then each privilege is returned as a separate row in the result set.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 33. SQLColumnPrivileges SQLSTATEs

SQLSTATE	Description	Explanation
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid string or buffer length	The value of one of the name length arguments was less than 0, but not equal SQL_NTS.
HY010	Function sequence error	Cursor open for statement handle. No connection for this statement handle.

Restrictions

None

Example

```
/* From the CLI sample TBINFO.C */
/* ... */

    /* call SQLColumnPrivileges */
    printf("\n Call SQLColumnPrivileges for:\n");
    printf(" tbSchema = %s\n", tbSchema);
    printf(" tbName = %s\n", tbName);
    sqlrc = SQLColumnPrivileges( hstmt, NULL, 0,
                                 tbSchema, SQL_NTS,
                                 tbName, SQL_NTS,
                                 colNamePattern, SQL_NTS);
```

References

- “SQLColumns - Get Column Information for a Table” on page 66
- “SQLTables - Get Table Information” on page 241

SQLColumns - Get Column Information for a Table

Purpose

SQLColumns() returns a list of columns in the specified tables. The information is returned in an SQL result set, which can be retrieved using the same functions that are used to fetch a result set generated by a SELECT statement.

Syntax

```
SQLRETURN SQLColumns  (SQLHSTMT       hstmt,
                       SQLCHAR        *szCatalogName,
                       SQLSMALLINT    cbCatalogName,
                       SQLCHAR        *szSchemaName,
                       SQLSMALLINT    cbSchemaName,
                       SQLCHAR        *szTableName,
                       SQLSMALLINT    cbTableName,
                       SQLCHAR        *szColumnName,
                       SQLSMALLINT    cbColumnName);
```

Function Arguments

Table 34. SQLColumns Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle
SQLCHAR *	*szCatalogName*	Input	Buffer that may contain a *pattern-value* to qualify the result set. *Catalog* is the first part of a three-part table name. This must be a NULL pointer or a zero length string.
SQLSMALLINT	*cbCatalogName*	Input	Length of *szCatalogName*. This must be set to 0.
SQLCHAR *	*szSchemaName*	Input	Buffer that may contain a *pattern-value* to qualify the result set by schema name.
SQLSMALLINT	*cbSchemaName*	Input	Length of *szSchemaName*
SQLCHAR *	*szTableName*	Input	Buffer that may contain a *pattern-value* to qualify the result set by table name.
SQLSMALLINT	*cbTableName*	Input	Length of *szTableName*
SQLCHAR *	*szColumnName*	Input	Buffer that may contain a *pattern-value* to qualify the result set by column name.
SQLSMALLINT	*cbColumnName*	Input	Length of *szColumnName*

Usage

This function retrieves information about the columns of a table or a list of tables.

SQLColumns() returns a standard result set. Table 35 on page 67 lists the columns in the result set. Applications should anticipate that additional columns beyond the REMARKS columns can be added in future releases.

The *szCatalogName, szSchemaName, szTableName*, and *szColumnName* arguments accept search patterns. An escape character can be specified in conjunction with a wildcard character to allow that actual character to be used in the search pattern. The escape character is specified on the SQL_ATTR_ESCAPE_CHAR environment attribute.

This function does not return information on the columns in a result set, which is retrieved by SQLDescribeCol() or SQLColAttributes(). If an application wants to obtain column information for a result set, it should always call SQLDescribeCol() or SQLColAttributes() for efficiency. SQLColumns() maps to a complex query against the system catalogs, and can require a large amount of system resources.

Table 35. Columns Returned By SQLColumns

Column Name	Data Type	Description
TABLE_CAT	VARCHAR(128)	The current server.
TABLE_SCHEM	VARCHAR(128)	The name of the schema containing TABLE_NAME.
TABLE_NAME	VARCHAR(128)	Name of the table or view
COLUMN_NAME	VARCHAR(128)	Column identifier. Name of the column of the specified table or view.
DATA_TYPE	SMALLINT not NULL	Identifies the SQL data type of the column.
TYPE_NAME	VARCHAR(128) not NULL	Character string representing the name of the data type corresponding to DATA_TYPE.
LENGTH_PRECISION	INTEGER	If DATA TYPE is an approximate numeric data type, this column contains the number of bits of mantissa precision of the the column. For exact numeric data types, this column contains the total number of decimal digit allowed in the column. For time, timestamp data types, this column contains the number of digits of precision of the fractional seconds component; otherwise, this column is NULL. **Note:** The ODBC definition of precision is typically the number of digits to store the data type.
BUFFER_LENGTH	INTEGER	The maximum number of bytes to store data from this column if SQL_DEFAULT were specified on the SQLBindCol(), SQLGetData() and SQLBindParam() calls.
NUM_SCALE	SMALLINT	The scale of the column. NULL is returned for data types where scale is not applicable.
NUM_PREC_RADIX	SMALLINT	Either 10 or 2 or NULL. If DATA_TYPE is an approximate numeric data type, this column contains the value 2, then the LENGTH_PRECISION column contains the number of bits allowed in the column. If DATA_TYPE is an exact numeric data type, this column contains the value 10 and the LENGTH_PRECISION and NUM_SCALE columns contain the number of decimal digits allowed for the column. For numeric data types, the DBMS can return a NUM_PREC_RADIX of either 10 or 2. NULL is returned for data types where radix is not applicable.
NULLABLE	SMALLINT not NULL	SQL_NO_NULLS if the column does not accept NULL values. SQL_NULLABLE if the column accepts NULL values.
REMARKS	VARCHAR(254)	May contain descriptive information about the column.

Table 35. Columns Returned By SQLColumns (continued)

Column Name	Data Type	Description
COLUMN_DEF	VARCHAR(254)	The column's default value. If the default value is a numeric literal, then this column contains the character representation of the numeric literal with no enclosing single quotes. If the default value is a character string, then this column is that string enclosed in single quotes. If the default value a *pseudo-literal*, such as for DATE, TIME, and TIMESTAMP columns, then this column contains the keyword of the pseudo-literal (for example, CURRENT DATE) with no enclosing quotes. If NULL was specified as the default value, then this column returns the word NULL, not enclosed in quotes. If the default value cannot be represented without truncation, then this column contains TRUNCATED with no enclosing single quotes. If no default value was specified, then this column is NULL.
DATETIME_CODE	INTEGER	This column is currently NULL.
CHAR_OCTET_LENGTH	INTEGER	Contains the maximum length in octets for a character data type column. For Single Byte character sets, this is the same as LENGTH_PRECISION. For all other data types it is NULL.
ORDINAL_POSITION	INTEGER NOT NULL	The ordinal position of the column in the table. The first column in the table is number 1.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 36. SQLColumns SQLSTATEs

SQLSTATE	Description	Explanation
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid string or buffer length	The value of one of the name length arguments was less than 0, but not equal SQL_NTS.
HY010	Function sequence error	Cursor open for statement handle. No connection for this statement handle.

SQLConnect - Connect to a Data Source

Purpose

SQLConnect() establishes a connection to the target database. The application must supply a target SQL database, and optionally an authorization-name, and an authentication-string.

SQLAllocConnect() must be called before calling this function.

This function must be called before calling SQLAllocStmt().

Syntax

```
SQLRETURN SQLConnect (SQLHDBC         hdbc,
                      SQLCHAR         *szDSN,
                      SQLSMALLINT     cbDSN,
                      SQLCHAR         *szUID,
                      SQLSMALLINT     cbUID,
                      SQLCHAR         *szAuthStr,
                      SQLSMALLINT     cbAuthStr);
```

Function Arguments

Table 37. SQLConnect Arguments

Data Type	Argument	Use	Description
SQLHDBC	*hdbc*	Input	Connection handle
SQLCHAR *	*szDSN*	Input	Data source: The name or alias-name of the database.
SQLSMALLINT	*cbDSN*	Input	Length of contents of *szDSN* argument
SQLCHAR *	*szUID*	Input	Authorization-name (user identifier)
SQLSMALLINT	*cbUID*	Input	Length of contents of *szUID* argument
SQLCHAR *	*szAuthStr*	Input	Authentication-string (password)
SQLSMALLINT	*cbAuthStr*	Input	Length of contents of *szAuthStr* argument

Usage

You can define various connection characteristics (options) in the application using SQLSetConnectOption().

The input length arguments to SQLConnect() (*cbDSN*, *cbUID*, *cbAuthStr*) can be set to the actual length of their associated data. This does not include any null-terminating character or to SQL_NTS to indicate that the associated data is null-terminated.

Leading and trailing blanks in the *szDSN* and *szUID* argument values are stripped before processing unless they are enclosed in quotes.

The data source must already be defined on the system for the connect to work. On iSeries, you can use the Work with Relational Database Directory Entries (WRKRDBDIRE) command to determine which data sources have been defined already, and to optionally define additional data sources.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO

SQLConnect

- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 38. SQLConnect SQLSTATEs

SQLSTATE	Description	Explanation
08001	Unable to connect to data source	The driver was unable to establish a connection with the data source (server).
08002	Connection in use	The specified *hdbc* has been used to establish a connection with a data source and the connection is still open.
08004	Data source rejected establishment of connection	The data source (server) rejected the establishment of the connection.
28000	Invalid authorization specification	The value specified for the argument *szUID* or the value specified for the argument *szAuthStr* violated restrictions defined by the data source.
58004	System error	Unrecoverable system error
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	The value specified for argument *cbDSN* was less than 0, but not equal to SQL_NTS and the argument *szDSN* was not a null pointer. The value specified for argument *cbUID* was less than 0, but not equal to SQL_NTS and the argument *szUID* was not a null pointer. The value specified for argument *cbAuthStr* was less than 0, but not equal to SQL_NTS and the argument *szAuthStr* was not a null pointer. A non matching double quote (″) was found in either the *szDSN*, *szUID*, or *szAuthStr* argument.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.
HY501 *	Invalid data source name	An invalid data source name was specified in argument *szDSN*.

Restrictions

The implicit connection (or default database) option for IBM DBMSs is not supported. `SQLConnect()` must be called before any SQL statements can be executed. iSeries does not support multiple simultaneous connections to the same data source in a single job.

When you are using DB2 UDB CLI on a newer release, `SQLConnect()` can encounter an SQL0144 message. This indicates that the data source (the server) has obsolete SQL packages that must be deleted. To delete these packages, run the following command on the server system:

```
DLTSQLPKG SQLPKG(QGPL/QSQCLI*)
```

The next `SQLConnect()` will create a new SQL package.

Example

Refer to the `SQLAllocEnv()` “Example” on page 27.

References

- “SQLAllocConnect - Allocate Connection Handle” on page 24
- “SQLAllocStmt - Allocate a Statement Handle” on page 31

SQLCopyDesc - Copy Description Statement

Purpose

SQLCopyDesc() copies the fields of the data structure associated with the source handle to the data structure associated with the target handle.

Any existing data in the data structure associated with the target handle is overwritten, except that the ALLOC_TYPE field is not changed.

Syntax

```
SQLRETURN SQLCopyDesc (SQLHDESC     sDesc)
                      (SQLHDESC     tDesc);
```

Function Arguments

Table 39. SQLCancel Arguments

Data Type	Argument	Use	Description
SQLHDESC	*sDesc*	Input	Source descriptor handle
SQLHDESC	*tDesc*	Input	Target descriptor handle

Usage

Handles for the automatically-generated row and parameter descriptors of a statement can be obtained by calling GetStmtAttr().

Return Codes

- SQL_SUCCESS
- SQL_INVALID_HANDLE
- SQL_ERROR

SQLDataSources - Get List of Data Sources

Purpose

SQLDataSources() returns a list of target databases available, one at a time. A database must be cataloged to be available. For more information on cataloging, refer to the usage notes for SQLConnect() or see the online help for the Work with Relational Database (RDB) Directory Entries (WRKRDBDIRE) command.

SQLDataSources() is usually called before a connection is made, to determine the databases that are available to connect to.

Syntax

```
SQLRETURN   SQLDataSources   (SQLHENV          EnvironmentHandle,
                              SQLSMALLINT      Direction,
                              SQLCHAR          *ServerName,
                              SQLSMALLINT      BufferLength1,
                              SQLSMALLINT      *NameLength1Ptr,
                              SQLCHAR          *Description,
                              SQLSMALLINT      BufferLength2,
                              SQLSMALLINT      *NameLength2Ptr);
```

Function Arguments

Table 40. SQLDataSources Arguments

Data Type	Argument	Use	Description
SQLHENV	*EnvironmentHandle*	input	Environment handle.
SQLSMALLINT	*Direction*	input	Used by application to request the first data source name in the list or the next one in the list. *Direction* can take on only the following values: • SQL_FETCH_FIRST • SQL_FETCH_NEXT
SQLCHAR *	*ServerName*	output	Pointer to buffer to hold the data source name retrieved.
SQLSMALLINT	*BufferLength1*	input	Maximum length of the buffer pointed to by *ServerName*. This should be less than or equal to SQL_MAX_DSN_LENGTH + 1.
SQLSMALLINT *	*NameLength1Ptr*	output	Pointer to location where the maximum number of bytes available to return in the *ServerName* will be stored.
SQLCHAR *	*Description*	output	Pointer to buffer where the description of the data source is returned. DB2 UDB CLI will return the ***Comment*** field associated with the database catalogued to the DBMS.
SQLSMALLINT	*BufferLength2*	input	Maximum length of the *Description* buffer.
SQLSMALLINT *	*NameLength2Ptr*	output	Pointer to location where this function will return the actual number of bytes available to return for the description of the data source.

Usage

The application can call this function any time by setting *Direction* to either SQL_FETCH_FIRST or SQL_FETCH_NEXT.

If SQL_FETCH_FIRST is specified, the first database in the list will always be returned.

SQLDataSources

If SQL_FETCH_NEXT is specified:

- Directly following a SQL_FETCH_FIRST call, the second database in the list is returned
- Before any other `SQLDataSources()` call, the first database in the list is returned
- When there are no more databases in the list, SQL_NO_DATA_FOUND is returned. If the function is called again, the first database is returned.
- Any other time, the next database in the list is returned.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE
- SQL_NO_DATA_FOUND

Error Conditions

Table 41. SQLDataSources SQLSTATEs

SQLSTATE	Description	Explanation
01004	Data truncated	The data source name returned in the argument *ServerName* was longer than the value specified in the argument *BufferLength1*. The argument *NameLength1Ptr* contains the length of the full data source name. (Function returns SQL_SUCCESS_WITH_INFO.) The data source name returned in the argument *Description* was longer than the value specified in the argument *BufferLength2*. The argument *NameLength2Ptr* contains the length of the full data source description. (Function returns SQL_SUCCESS_WITH_INFO.)
58004	Unexpected system failure	Unrecoverable system error.
HY000	General error	An error occurred for which there was no specific SQLSTATE and for which no specific SQLSTATE was defined. The error message returned by `SQLError()` in the argument *ErrorMsg* describes the error and its cause.
HY001	Memory allocation failure	DB2 UDB CLI is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	The argument *ServerName*, *NameLength1Ptr*, *Description*, or *NameLength2Ptr* was a null pointer. Invalid value for the direction.
HY013	Unexpected memory handling error	DB2 UDB CLI was unable to access memory required to support execution or completion of the function.
HY103	Direction option out of range	The value specified for the argument *Direction* was not equal to SQL_FETCH_FIRST or SQL_FETCH_NEXT.

Authorization

None.

Example

```
/* From CLI sample datasour.c */
/* ... */
```

```
#include <stdio.h>
#include <stdlib.h>
#include <sqlcli1.h>
#include "samputil.h"          /* Header file for CLI sample code */

/* ... */

/************************************************************************
** main
** - initialize
** - terminate
************************************************************************/
int main() {

    SQLHANDLE henv ;
    SQLRETURN rc ;
    SQLCHAR source[SQL_MAX_DSN_LENGTH + 1], description[255] ;
    SQLSMALLINT buffl, desl ;

/* ... */

    /* allocate an environment handle */
    rc = SQLAllocHandle( SQL_HANDLE_ENV, SQL_NULL_HANDLE, &henv ) ;
    if ( rc != SQL_SUCCESS ) return( terminate( henv, rc ) ) ;

    /* list the available data sources (servers) */
    printf( "The following data sources are available:\n" ) ;
    printf( "ALIAS NAME                     Comment(Description)\n" ) ;
    printf( "-----------------------------------------------------\n" ) ;

    while ( ( rc = SQLDataSources( henv,
                                   SQL_FETCH_NEXT,
                                   source,
                                   SQL_MAX_DSN_LENGTH + 1,
                                   &buffl,
                                   description,
                                   255,
                                   &desl
                                 )
            ) != SQL_NO_DATA_FOUND
          ) printf( "%-30s  %s\n", source, description ) ;

    rc = SQLFreeHandle( SQL_HANDLE_ENV,  henv ) ;
    if ( rc != SQL_SUCCESS ) return( terminate( henv, rc ) ) ;

    return( SQL_SUCCESS ) ;


}
```

References

None.

SQLDescribeCol - Describe Column Attributes

Purpose

SQLDescribeCol() returns the result descriptor information (column name, type, precision) for the indicated column in the result set generated by a SELECT statement.

If the application only needs one attribute of the descriptor information, the SQLColAttributes() function could be used in place of SQLDescribeCol(). Refer to "SQLColAttributes - Column Attributes" on page 58 for more information.

Either SQLPrepare() or SQLExecDirect() must be called before calling this function.

This function (or SQLColAttributes()) is usually called before SQLBindCol().

Syntax

```
SQLRETURN SQLDescribeCol (SQLHSTMT       hstmt,
                          SQLSMALLINT    icol,
                          SQLCHAR        *szColName,
                          SQLSMALLINT    cbColNameMax,
                          SQLSMALLINT    *pcbColName,
                          SQLSMALLINT    *pfSqlType,
                          SQLINTEGER     *pcbColDef,
                          SQLSMALLINT    *pibScale,
                          SQLSMALLINT    *pfNullable);
```

Function Arguments

Table 42. SQLDescribeCol Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle
SQLSMALLINT	*icol*	Input	Column number to be described
SQLCHAR *	*szColName*	Output	Pointer to column name buffer
SQLSMALLINT	*cbColNameMax*	Input	Size of *szColName* buffer
SQLSMALLINT *	*pcbColName*	Output	Bytes available to return for *szColName* argument. Truncation of column name (*szColName*) to *cbColNameMax - 1* bytes occurs if *pcbColName* is greater than or equal to *cbColNameMax*.
SQLSMALLINT *	*pfSqlType*	Output	SQL data type of column
SQLINTEGER *	*pcbColDef*	Output	Precision of column as defined in the database. If *fSqlType* denotes a graphic SQL data type, then this variable indicates the maximum number of double-byte *characters* the column can hold.
SQLSMALLINT *	*pibScale*	Output	Scale of column as defined in the database (only applies to SQL_DECIMAL, SQL_NUMERIC, SQL_TIMESTAMP).
SQLSMALLINT *	*pfNullable*	Output	Indicates whether NULLS are allowed for this column • SQL_NO_NULLS • SQL_NULLABLE

Usage

Columns are identified by a number and are numbered sequentially from left to right starting with 1, and may be described in any order.

A valid pointer and buffer space must be be made available for the *szColName* argument. If a null pointer is specified for any of the remaining pointer arguments, DB2 UDB CLI assumes that the information is not needed by the application and nothing is returned.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

If `SQLDescribeCol()` returns either SQL_ERROR, or SQL_SUCCESS_WITH_INFO, one of the following SQLSTATEs may be obtained by calling the `SQLError()` function.

Table 43. SQLDescribeCol SQLSTATEs

SQLSTATE	Description	Explanation
01004	Data truncated	The column name returned in the argument *szColName* was longer than the value specified in the argument *cbColNameMax*. The argument *pcbColName* contains the length of the full column name. (Function returns SQL_SUCCESS_WITH_INFO.)
07005 *	Not a SELECT statement	The statement associated with the *hstmt* did not return a result set. There were no columns to describe. (Call `SQLNumResultCols()` first to determine if there are any rows in the result set.)
07009	Invalid column number	The value specified for the argument *icol* was less than 1. The value specified for the argument *icol* was greater than the number of columns in the result set.
40003 *	Statement completion unknown	The communication link between the CLI and the data source failed before the function completed processing.
58004	System error	Unrecoverable system error
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	The length specified in argument *cbColNameMax* was less than 1. The argument *szColName* or *pcbColName* was a null pointer.
HY010	Function sequence error	The function was called prior to calling `SQLPrepare()` or `SQLExecDirect()` for the *hstmt*.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.
HYC00	Driver not capable	The SQL data type of column *icol* is not recognized by DB2 UDB CLI.

Example

Refer to “Example: Interactive SQL and the equivalent DB2 UDB CLI function calls” on page 268 for a complete listing of the following example.

```
/*****************************************************************
** file = typical.c
...
/*****************************************************************
** display_results
**
**  - for each column
**      - get column name
**      - bind column
**  - display column headings
**  - fetch each row
**      - if value truncated, build error message
**      - if column null, set value to "NULL"
**      - display row
**      - print truncation message
**  - free local storage
*****************************************************************/
display_results(SQLHSTMT hstmt,
                SQLSMALLINT nresultcols)
{
SQLCHAR         colname[32];
SQLSMALLINT     coltype;
SQLSMALLINT     colnamelen;
SQLSMALLINT     nullable;
SQLINTEGER      collen[MAXCOLS];
SQLSMALLINT     scale;
SQLINTEGER      outlen[MAXCOLS];
SQLCHAR *       data[MAXCOLS];
SQLCHAR         errmsg[256];
SQLRETURN       rc;
SQLINTEGER      i;
SQLINTEGER      displaysize;

    for (i = 0; i < nresultcols; i++)
    {
        SQLDescribeCol (hstmt, i+1, colname, sizeof (colname),
        &colnamelen, &coltype, &collen[i], &scale, &nullable);

        /* get display lenght for column */
        SQLColAttributes (hstmt, i+1, SQL_COLUMN_DISPLAY_SIZE, NULL, 0,
            NULL, &displaysize);

        /* set column length to max of display length, and column name
           length.  Plus one byte for null terminator       */
        collen[i] = max(displaysize, strlen((char *) colname) ) + 1;


        /* allocate memory to bind column                            */
        data[i] = (SQLCHAR *) malloc (collen[i]);

        /* bind columns to program vars, converting all types to CHAR */
        SQLBindCol (hstmt, i+1, SQL_CHAR, data[i], collen[i],
&outlen[i]);
    }
    printf("\n");

    /* display result rows                                           */
    while ((rc = SQLFetch (hstmt)) != SQL_NO_DATA_FOUND)
    {
        errmsg[0] = '\0';
        for (i = 0; i < nresultcols; i++)
        {
            /* Build a truncation message for any columns truncated */
```

```
            if (outlen[i] >= collen[i])
            {    sprintf ((char *) errmsg + strlen ((char *) errmsg),
                          "%d chars truncated, col %d\n",
                           outlen[i]-collen[i]+1, i+1);
            }
            if (outlen[i] == SQL_NULL_DATA)
            else
        } /* for all columns in this row  */

        printf ("\n%s", errmsg);  /* print any truncation messages    */
    } /* while rows to fetch */

    /* free data buffers                                              */
    for (i = 0; i < nresultcols; i++)
    {
        free (data[i]);
    }

}/* end display_results
```

References

- “SQLColAttributes - Column Attributes” on page 58
- “SQLExecDirect - Execute a Statement Directly” on page 94
- “SQLNumResultCols - Get Number of Result Columns” on page 183
- “SQLPrepare - Prepare a Statement” on page 189

SQLDescribeParam - Return Description of a Parameter Marker

Purpose

SQLDescribeParam() returns the description of a parameter marker associated with a prepared SQL statement. This information is also available in the fields of the implementation parameter descriptor (IPD).

Syntax

```
SQLRETURN   SQLDescribeParam (SQLHSTMT          StatementHandle,
                              SQLSMALLINT       ParameterNumber,
                              SQLSMALLINT       *DataTypePtr,
                              SQLINTEGER        *ParameterSizePtr,
                              SQLSMALLINT       *DecimalDigitsPtr,
                              SQLSMALLINT       *NullablePtr);
```

Function Arguments

Table 44. SQLDescribeParam Arguments

Data Type	Argument	Use	Description
SQLHSTMT	StatementHandle	input	Statement handle.
SQLSMALLINT	ParameterNumber	input	Parameter marker number ordered sequentially in increasing parameter order, starting at 1.
SQLSMALLINT *	DataTypePtr	output	Pointer to a buffer in which to return the SQL data type of the parameter.
SQLINTEGER *	ParameterSizePtr	output	Pointer to a buffer in which to return the size of the column or expression of the corresponding parameter marker as defined by the data source.
SQLSMALLINT *	DecimalDigitsPtr	output	Pointer to a buffer in which to return the number of decimal digits of the column or expression of the corresponding parameter as defined by the data source.
SQLSMALLINT *	NullablePtr	output	Pointer to a buffer in which to return a value that indicates whether the parameter allows NULL values. This value is read from the SQL_DESC_NULLABLE field of the IPD. One of the following: • SQL_NO_NULLS – The parameter does not allow NULL values (this is the default value). • SQL_NULLABLE – The parameter allows NULL values. • SQL_NULLABLE_UNKNOWN – Cannot determine if the parameter allows NULL values.

Usage

Parameter markers are numbered in increasing parameter order, starting with 1, in the order they appear in the SQL statement.

SQLDescribeParam() does not return the type (input, output, or both input and output) of a parameter in an SQL statement. Except in calls to procedures, all parameters in SQL statements are input parameters. To determine the type of each parameter in a call to a procedure, an application calls SQLProcedureColumns().

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_STILL_EXECUTING
- SQL_ERROR
- SQL_INVALID_HANDLE

Error Conditions

Table 45. SQLDescribeParam SQLSTATEs

SQLSTATE	Description	Explanation
01000	Warning	Informational message. (Function returns SQL_SUCCESS_WITH_INFO.)
07009	Invalid descriptor index	The value specified for the argument *ParameterNumber* less than 1. The value specified for the argument *ParameterNumber* was greater than the number of parameters in the associated SQL statement. The parameter marker was part of a non-DML statement. The parameter marker was part of a SELECT list.
08S01	Communication link failure	The communication link between DB2 UDB CLI and the data source to which it was connected failed before the function completed processing.
21S01	Insert value list does not match column list	The number of parameters in the INSERT statement did not match the number of columns in the table named in the statement.
HY000	General error	
HY001	Memory allocation failure	DB2 UDB CLI was unable to allocate memory required to support execution or completion of the function.
HY008	Operation cancelled.	
HY009	Invalid argument value	The argument *DataTypePtr*, *ParameterSizePtr*, *DecimalDigitsPtr*, or *NullablePtr* was a null pointer.
HY010	Function sequence error	The function was called prior to calling `SQLPrepare()` or `SQLExecDirect()` for the *StatementHandle*.
HY013	Unexpected memory handling error	The function call could not be processed because the underlying memory objects could not be accessed, possibly because of low memory conditions.

Restrictions

None.

References

- “SQLBindParam - Binds A Buffer To A Parameter Marker” on page 43
- “SQLCancel - Cancel Statement” on page 56
- “SQLExecute - Execute a Statement” on page 96
- “SQLPrepare - Prepare a Statement” on page 189

SQLDisconnect - Disconnect from a Data Source

Purpose

`SQLDisconnect()` closes the connection associated with the database connection handle.

After calling this function, either call `SQLConnect()` to connect to another database, or call `SQLFreeConnect()`.

Syntax

```
SQLRETURN SQLDisconnect (SQLHDBC    hdbc);
```

Function Arguments

Table 46. SQLDisconnect Arguments

Data Type	Argument	Use	Description
SQLHDBC	*hdbc*	Input	Connection handle

Usage

If an application calls `SQLDisconnect` before it has freed all the statement handles associated with the connection, DB2 UDB CLI frees them after it successfully disconnects from the database.

If SQL_SUCCESS_WITH_INFO is returned, it implies that even though the disconnect from the database is successful, additional error or implementation specific information is available. For example:

- A problem was encountered on the clean up after the disconnect, or,
- If there is no current connection because of an event that occurred independently of the application (such as communication failure).

After a successful `SQLDisconnect()` call, the application can re-use *hdbc* to make another `SQLConnect()` request.

If the *hdbc* is participating in a DUOW two-phase commit connection, the disconnect may not occur immediately. The actual disconnect occurs at the next commit issued for the distributed transaction.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 47. SQLDisconnect SQLSTATEs

SQLSTATE	Description	Explanation
01002	Disconnect error	An error occurred during the disconnect. However, the disconnect succeeded. (Function returns SQL_SUCCESS_WITH_INFO.)
08003	Connection not open	The connection specified in the argument *hdbc* was not open.

Table 47. SQLDisconnect SQLSTATEs (continued)

SQLSTATE	Description	Explanation
25000	Invalid transaction state	There was a transaction in process on the connection specified by the argument *hdbc*. The transaction remains active, and the connection cannot be disconnected.
58004	System error	Unrecoverable system error
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.

Example

Refer to the `SQLAllocEnv()` "Example" on page 27.

References

- "SQLAllocConnect - Allocate Connection Handle" on page 24
- "SQLConnect - Connect to a Data Source" on page 69
- "SQLTransact - Transaction Management" on page 243

SQLDriverConnect - (Expanded) Connect to a Data Source

Purpose

`SQLDriverConnect()` is an alternative to `SQLConnect()`. Both functions establish a connection to the target database, but `SQLDriverConnect()` uses a connection string to determine the data source name, user ID and password. The functions are the same; both are supported for compatibility purposes.

Syntax

```
SQLRETURN   SQLDriverConnect (SQLHDBC           ConnectionHandle,
                              SQLHWND           WindowHandle,
                              SQLCHAR           *InConnectionString,
                              SQLSMALLINT       StringLength1,
                              SQLCHAR           *OutConnectionString,
                              SQLSMALLINT       BufferLength,
                              SQLSMALLINT       *StringLength2Ptr,
                              SQLSMALLINT       DriverCompletion);
```

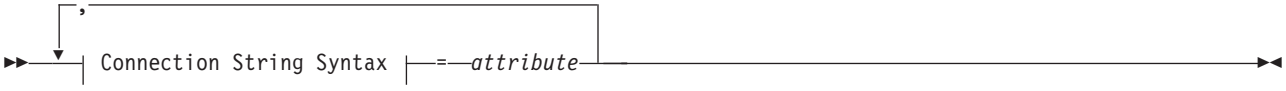
Function Arguments

Table 48. SQLDriverConnect Arguments

Data Type	Argument	Use	Description
SQLHDBC	*ConnectionHandle*	input	Connection handle
SQLHWND	*hwindow*	input	Window handle (platform dependent): on Windows, this is the parent Windows handle. On OS/2, this is the parent PM window handle. On AIX®, this is the parent MOTIF Widget window handle. On iSeries, it is ignored.
SQLCHAR *	*InConnectionString*	input	A full, partial or empty (null pointer) connection string (see syntax and description below).
SQLSMALLINT	*StringLength1*	input	Length of *InConnectionString*.
SQLCHAR *	*OutConnectionString*	output	Pointer to buffer for the completed connection string. If the connection was established successfully, this buffer will contain the completed connection string.
SQLSMALLINT	*BufferLength*	input	Maximum size of the buffer pointed to by *OutConnectionString*.
SQLSMALLINT *	*StringLength2Ptr*	output	Pointer to the number of bytes available to return in the *OutConnectionString* buffer. If the value of *StringLength2Ptr* is greater than or equal to *BufferLength*, the completed connection string in *OutConnectionString* is truncated to *BufferLength* - 1 bytes.
SQLSMALLINT	*DriverCompletion*	input	Indicates when DB2 UDB CLI should prompt the user for more information. Possible values: • SQL_DRIVER_COMPLETE • SQL_DRIVER_COMPLETE_REQUIRED • SQL_DRIVER_NOPROMPT

Usage

The connection string is used to pass one or more values that are needed to complete a connection. The contents of the connection string and the value of *DriverCompletion* will determine how the connection should be established.



Connection String Syntax

Each keyword above has an attribute that is equal to the following:

DSN Data source name. The name or alias-name of the database. The data source name is required if *DriverCompletion* is equal to SQL_DRIVER_NOPROMPT.

UID Authorization-name (user identifier).

PWD The password that corresponds to the authorization name. If there is no password for the user ID, an empty is specified (PWD=;).

iSeries currently has no DB2 UDB CLI–defined keywords.

The value of *DriverCompletion* is verified to be valid, but all result in the same behavior. A connection is attempted with the information that is contained in the connection string. If there is not enough information, SQL_ERROR is returned.

Once a connection is established, the complete connection string is returned. Applications that need to set up multiple connections to the same database for a given user ID should store this output connection string. This string can then be used as the input connection string value on future `SQLDriverConnect()` calls.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_NO_DATA_FOUND
- SQL_INVALID_HANDLE
- SQL_ERROR

Error Conditions

All of the diagnostics that are generated by “SQLConnect - Connect to a Data Source” on page 69 can be returned here as well. The following table shows the additional diagnostics that can be returned.

Table 49. SQLDriverConnect SQLSTATEs

SQLSTATE	Description	Explanation
01004	Data truncated	The buffer *szConnstrOut* was not large enough to hold the entire connection string. The argument *StringLength2Ptr* contains the actual length of the connection string available for return. (Function returns SQL_SUCCESS_WITH_INFO)

Table 49. SQLDriverConnect SQLSTATEs (continued)

SQLSTATE	Description	Explanation
01S00	Invalid connection string attribute	An invalid keyword or attribute value was specified in the input connection string, but the connection to the data source was successful anyway because one of the following occurred: • The unrecognized keyword was ignored. • The invalid attribute value was ignored, the default value was used instead. (Function returns SQL_SUCCESS_WITH_INFO)
HY009	Invalid argument value	The argument *InConnectionString*, *OutConnectionString*, or *StringLength2PTR* was a null pointer. The argument DriverCompletion was not equal to 1.
HY090	Invalid string or buffer length	The value specified for *StringLength1* was less than 0, but not equal to SQL_NTS. The value specified for *BufferLength* was less than 0.
HY110	Invalid driver completion	The value specified for the argument *fCompletion* was not equal to one of the valid values.

Restrictions

None.

Example

```
/* From CLI sample drivrcon.c */
/* ... */
/*********************************************************************
**   drv_connect - Prompt for connect options and connect              **
*********************************************************************/

int
drv_connect(SQLHENV henv,
            SQLHDBC * hdbc,
            SQLCHAR con_type)
{
    SQLRETURN       rc;
    SQLCHAR         server[SQL_MAX_DSN_LENGTH + 1];
    SQLCHAR         uid[MAX_UID_LENGTH + 1];
    SQLCHAR         pwd[MAX_PWD_LENGTH + 1];
    SQLCHAR         con_str[255];
    SQLCHAR         buffer[255];
    SQLSMALLINT     outlen;

    printf("Enter Server Name:\n");
    gets((char *) server);
    printf("Enter User Name:\n");
    gets((char *) uid);
    printf("Enter Password Name:\n");
    gets((char *) pwd);

    /* Allocate a connection handle */
    SQLAllocHandle( SQL_HANDLE_DBC,
                          henv,
                          hdbc
                        );
    CHECK_HANDLE( SQL_HANDLE_DBC, *hdbc, rc);

    sprintf((char *)con_str, "DSN=%s;UID=%s;PWD=%s;",
```

```
            server, uid, pwd);

    rc = SQLDriverConnect(*hdbc,
            (SQLHWND) NULL,
            con_str,
            SQL_NTS,
            buffer, 255, &outlen,
            SQL_DRIVER_NOPROMPT);
    if (rc != SQL_SUCCESS) {
        printf("Error while connecting to database, RC= %ld\n", rc);
        CHECK_HANDLE( SQL_NULL_HENV, *hdbc, rc);
        return (SQL_ERROR);
    } else {
        printf("Successful Connect\n");
        return (SQL_SUCCESS);
    }
}
```

References

- “SQLConnect - Connect to a Data Source” on page 69

SQLEndTran - Commit or roll back a transaction

Purpose

SQLEndTran() commits or rolls back the current transaction in the connection.

All changes to the database performed on the connection since connect time or the previous call to SQLEndTran() (whichever is the most recent) are committed or rolled back.

If a transaction is active on a connection, the application must call SQLEndTran() before it can disconnect from the database.

Syntax

```
SQLRETURN SQLEndTran (SQLSMALLINT    hType,
                      SQLINTEGER     handle,
                      SQLSMALLINT    fType);
```

Function Arguments

Table 50. SQLEndTran Arguments

Data Type	Argument	Use	Description
SQLSMALLINT	*hType*	Input	Type of handle It must contain SQL_HANDLE_ENV or SQL_HANDLE_DBC.
SQLINTEGER	*handle*	Input	Handle to use when performing the COMMIT or ROLLBACK.
SQLSMALLINT	*fType*	Input	Desired action for the transaction. The value for this argument must be one of: • SQL_COMMIT • SQL_ROLLBACK • SQL_COMMIT_HOLD • SQL_ROLLBACK_HOLD • SQL_SAVEPOINT_NAME_ROLLBACK • SQL_SAVEPOINT_NAME_RELEASE

Usage

Completing a transaction with SQL_COMMIT or SQL_ROLLBACK has the following effects:

- Statement handles are still valid after a call to SQLEndTran().
- Cursor names, bound parameters, and column bindings survive transactions.
- Open cursors are closed, and any result sets that are pending retrieval are discarded.

Completing the transaction with SQL_COMMIT_HOLD or SQL_ROLLBACK_HOLD will still commit or roll back the database changes, but will not cause cursors to be closed.

If no transaction is currently active on the connection, calling SQLEndTran() has no effect on the database server and returns SQL_SUCCESS.

SQLEndTran() may fail while executing the COMMIT or ROLLBACK due to a loss of connection. In this case the application may be unable to determine whether the COMMIT or ROLLBACK has been processed, and a database administrator's help may be required. Refer to the DBMS product information for more information on transaction logs and other transaction management tasks.

SQLEndTran

When using either SQL_SAVEPOINT_NAME_ROLLBACK or SQL_SAVEPOINT_NAME_RELEASE, you must already have set the savepoint name using `SQLSetConnectAttr`.

Return Codes

- SQL_SUCCESS
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 51. SQLEndTran SQLSTATEs

SQLSTATE	Description	Explanation
08003	Connection not open	The *hdbc* was not in a connected state.
08007	Connection failure during transaction	The connection associated with the *hdbc* failed during the execution of the function during the execution of the function and it cannot be determined whether the requested COMMIT or ROLLBACK occurred before the failure.
58004	System error	Unrecoverable system error
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY010	Function sequence error	SQL_SAVEPOINT_NAME_ROLLBACK or SQL_SAVEPOINT_NAME_RELEASE was used, but the savepoint name was not established by calling `SQLSetConnectAttr()` for attribute SQL_ATTR_SAVEPOINT_NAME.
HY012	Invalid transaction operation state	The value specified for the argument *fType* was neither SQL_COMMIT not SQL_ROLLBACK.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.

SQLError - Retrieve Error Information

Purpose

SQLError() returns the diagnostic information associated with the most recently called DB2 UDB CLI function for a particular statement, connection or environment handle.

The information consists of a standardized SQLSTATE, native error code, and a text message. Refer to "Diagnostics in a DB2 UDB CLI application" on page 15 for more information.

Call SQLError() after receiving a return code of SQL_ERROR or SQL_SUCCESS_WITH_INFO from another function call.

Syntax

```
SQLRETURN SQLError (SQLHENV       henv,
                    SQLHDBC       hdbc,
                    SQLHSTMT      hstmt,
                    SQLCHAR       *szSqlState,
                    SQLINTEGER    *pfNativeError,
                    SQLCHAR       *szErrorMsg,
                    SQLSMALLINT   cbErrorMsgMax,
                    SQLSMALLINT   *pcbErrorMsg);
```

Function Arguments

Table 52. SQLError Arguments

Data Type	Argument	Use	Description
SQLHENV	*henv*	Input	Environment handle. To obtain diagnostic information associated with an environment, pass a valid environment handle. Set *hdbc* and *hstmt* to SQL_NULL_HDBC and SQL_NULL_HSTMT respectively.
SQLHDBC	*hdbc*	Input	Database connection handle. To obtain diagnostic information associated with a connection, pass a valid database connection handle, and set *hstmt* to SQL_NULL_HSTMT. The *henv* argument is ignored.
SQLHSTMT	*hstmt*	Input	Statement handle. To obtain diagnostic information associated with a statement, pass a valid statement handle. The *henv* and *hdbc* arguments are ignored.
SQLCHAR *	*szSqlState*	Output	SQLSTATE as a string of 5 characters terminated by a null character. The first 2 characters indicate error class; the next 3 indicate subclass. The values correspond directly to SQLSTATE values defined in the X/Open SQL CAE specification and the ODBC specification, augmented with IBM specific and product specific SQLSTATE values.
SQLINTEGER *	*pfNativeError*	Output	Native error code. In DB2 UDB CLI, the *pfNativeError* argument contains the SQLCODE value returned by the DBMS. If the error is generated by DB2 UDB CLI and not the DBMS, this field is set to -99999.

Table 52. SQLError Arguments (continued)

Data Type	Argument	Use	Description
SQLCHAR *	*szErrorMsg*	Output	Pointer to buffer to contain the implementation defined message text. In DB2 UDB CLI, only the DBMS generated messages is returned; DB2 UDB CLI itself will not return any message text describing the problem.
SQLSMALLINT	*cbErrorMsgMax*	Input	Maximum (that is, the allocated) length of the buffer *szErrorMsg*. The recommended length to allocate is SQL_MAX_MESSAGE_LENGTH + 1.
SQLSMALLINT *	*pcbErrorMsg*	Output	Pointer to total number of bytes available to return to the *szErrorMsg* buffer.

Usage

The SQLSTATEs are those defined by the X/OPEN SQL CAE and the X/Open SQL CLI snapshot, augmented with IBM specific and product specific SQLSTATE values.

To obtain diagnostic information associated with:

- An environment, pass a valid environment handle. Set *hdbc* and *hstmt* to SQL_NULL_HDBC and SQL_NULL_HSTMT respectively.
- A connection, pass a valid database connection handle, and set *hstmt* to SQL_NULL_HSTMT. The *henv* argument is ignored.
- To obtain diagnostic information associated with a statement, pass a valid statement handle. The *henv* and *hdbc* arguments are ignored.

If diagnostic information generated by one DB2 UDB CLI function is not retrieved before a function other than `SQLError()` is called with the same handle, the information for the previous function call is lost. This is true whether or not diagnostic information is generated for the second DB2 UDB CLI function call.

To avoid truncation of the error message, declare a buffer length of SQL_MAX_MESSAGE_LENGTH + 1. The message text will never be longer than this.

Return Codes

- SQL_ERROR
- SQL_INVALID_HANDLE
- SQL_NO_DATA_FOUND
- SQL_SUCCESS

Diagnostics

SQLSTATEs are not defined since `SQLError()` does not generate diagnostic information for itself. SQL_ERROR is returned if argument `szSqlState`, `pfNativeError`, `szErrorMsg`, or `pcbErrorMsg` was a null pointer.

Example

Refer to “Example: Interactive SQL and the equivalent DB2 UDB CLI function calls” on page 268 for a complete listing of the following example.

```
/************************************************************************
** file = typical.c
************************************************************************/
```

```
int print_error (SQLHENV    henv,
                 SQLHDBC    hdbc,
                 SQLHSTMT   hstmt)
{
SQLCHAR     buffer[SQL_MAX_MESSAGE_LENGTH + 1];
SQLCHAR     sqlstate[SQL_SQLSTATE_SIZE + 1];
SQLINTEGER  sqlcode;
SQLSMALLINT length;


    while ( SQLError(henv, hdbc, hstmt, sqlstate, &sqlcode, buffer,
                     SQL_MAX_MESSAGE_LENGTH + 1, &length) == SQL_SUCCESS )
    {
        printf("\n **** ERROR *****\n");
        printf("         SQLSTATE: %s\n", sqlstate);
        printf("Native Error Code: %ld\n", sqlcode);
        printf("%s \n", buffer);
    };
    return (0);

}
```

SQLExecDirect - Execute a Statement Directly

Purpose

SQLExecDirect directly executes the specified SQL statement. The statement can only be executed once. Also, the connected database server must be able to prepare the statement.

Syntax

```
SQLRETURN SQLExecDirect (SQLHSTMT      hstmt,
                         SQLCHAR       *szSqlStr,
                         SQLINTEGER    cbSqlStr);
```

Function Arguments

Table 53. SQLExecDirect Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle. There must not be an open cursor associated with *hstmt*, see "SQLFreeStmt - Free (or Reset) a Statement Handle" on page 117 for more information.
SQLCHAR *	*szSqlStr*	Input	SQL statement string. The connected database server must be able to prepare the statement.
SQLINTEGER	*cbSqlStr*	Input	Length of contents of *szSqlStr* argument. The length must be set to either the exact length of the statement, or if the statement is null-terminated, set to SQL_NTS.

Usage

The SQL statement cannot be a COMMIT or ROLLBACK. Instead, SQLTransact() must be called to issue COMMIT or ROLLBACK. For more information about supported SQL statements refer to Table 1 on page 4.

The SQL statement string may contain parameter markers. A parameter marker is represented by a "?" character, and indicates a position in the statement where the value of an application variable is to be substituted, when SQLExecDirect() is called. SQLBindParam() binds (or associates) an application variable to each parameter marker, to indicate if any data conversion should be performed at the time the data is transferred. All parameters must be bound before calling SQLExecDirect().

If the SQL statement is a SELECT, SQLExecDirect() generates a cursor name, and open the cursor. If the application has used SQLSetCursorName() to associate a cursor name with the statement handle, DB2 UDB CLI associates the application generated cursor name with the internally generated one.

To retrieve a row from the result set generated by a SELECT statement, call SQLFetch() after SQLExecDirect() returns successfully.

If the SQL statement is a Positioned DELETE or a Positioned UPDATE, the cursor referenced by the statement must be positioned on a row. Additionally the SQL statement must be defined on a separate statement handle under the same connection handle.

There must not be an open cursor on the statement handle.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE
- SQL_NO_DATA_FOUND

SQL_NO_DATA_FOUND is returned if the SQL statement is a Searched UPDATE or Searched DELETE and no rows satisfy the search condition.

Diagnostics

Table 54. SQLExecDirect SQLSTATEs

SQLSTATE	Description	Explanation
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	The argument *szSqlStr* was a null pointer. The argument *cbSqlStr* was less than 1, but not equal to SQL_NTS.
HY010	Function sequence error	Either no connection or there is an open cursor for this statement handle.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.

Note: There are many other SQLSTATE values that may be generated by the DBMS, on execution of the statement.

Example

Refer to the `SQLFetch()` "Example" on page 102.

References

- "SQLExecute - Execute a Statement" on page 96
- "SQLFetch - Fetch Next Row" on page 101
- "SQLSetParam - Set Parameter" on page 225

SQLExecute - Execute a Statement

Purpose

SQLExecute() executes a statement, that was successfully prepared using SQLPrepare(), once or multiple times. The statement is executed using the current values of any application variables that were bound to parameter markers by SQLBindParam().

Syntax

```
SQLRETURN SQLExecute (SQLHSTMT     hstmt);
```

Function Arguments

Table 55. SQLExecute Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle. There must not be an open cursor associated with hstmt, see "SQLFreeStmt - Free (or Reset) a Statement Handle" on page 117 for more information.

Usage

The SQL statement string may contain parameter markers. A parameter marker is represented by a "?" character, and indicates a position in the statement where the value of an application variable is to be substituted, when SQLExecute() is called. SQLBindParam() is used to bind (or associate) an application variable to each parameter marker, and to indicate if any data conversion should be performed at the time the data is transferred. All parameters must be bound before calling SQLExecute().

Once the application has processed the results from the SQLExecute() call, it can execute the statement again with new (or the same) values in the application variables.

A statement executed by SQLExecDirect() cannot be re-executed by calling SQLExecute(); SQLPrepare() must be called first.

If the prepared SQL statement is a SELECT, SQLExecute() generates a cursor name, and opens the cursor. If the application has used SQLSetCursorName() to associate a cursor name with the statement handle, DB2 UDB CLI associates the application generated cursor name with the internally generated cursor name.

To execute a SELECT statement more than once, the application must close the cursor by calling call SQLFreeStmt() with the SQL_CLOSE option. There must not be an open cursor on the statement handle when calling SQLExecute().

To retrieve a row from the result set generated by a SELECT statement, call SQLFetch() after SQLExecute() returns successfully.

If the SQL statement is a positioned DELETE or a positioned UPDATE, the cursor referenced by the statement must be positioned on a row at the time SQLExecute() is called, and must be defined on a separate statement handle under the same connection handle.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO

- SQL_ERROR
- SQL_INVALID_HANDLE
- SQL_NO_DATA_FOUND

SQL_NO_DATA_FOUND is returned if the SQL statement is a Searched UPDATE or Searched DELETE and no rows satisfy the search condition.

Diagnostics

The SQLSTATEs for `SQLExecute()` include all those for `SQLExecDirect()` (refer to Table 54 on page 95) except for **HY**009, and with the addition of the SQLSTATE in the following table.

Table 56. SQLExecute SQLSTATEs

SQLSTATE	Description	Explanation
HY010	Function sequence error	The specified *hstmt* was not in prepared state. `SQLExecute()` was called without first calling `SQLPrepare`.

Note: There are many other SQLSTATE values that may be generated by the DBMS, on execution of the statement.

Example

Refer to the `SQLPrepare()` "Example" on page 190

References

- "SQLExecDirect - Execute a Statement Directly" on page 94
- "SQLBindCol - Bind a Column to an Application Variable" on page 33
- "SQLPrepare - Prepare a Statement" on page 189
- "SQLFetch - Fetch Next Row" on page 101
- "SQLSetParam - Set Parameter" on page 225

SQLExtendedFetch - Fetch Array of Rows

Purpose

SQLExtendedFetch() extends the function of SQLFetch() by returning a block of data containing multiple rows (called a *rowset*), in the form of an array, for each bound column. The size of the rowset is determined by the SQL_ROWSET_SIZE attribute on an SQLSetStmtAttr() call.

To fetch one row of data at a time, an application should call SQLFetch().

Syntax

```
SQLRETURN   SQLExtendedFetch (SQLHSTMT          StatementHandle,
                              SQLSMALLINT       FetchOrientation,
                              SQLINTEGER        FetchOffset,
                              SQLINTEGER        *RowCountPtr,
                              SQLSMALLINT       *RowStatusArray);
```

Function Arguments

Table 57. SQLExtendedFetch Arguments

Data Type	Argument	Use	Description
SQLHSTMT	StatementHandle	Input	Statement handle.
SQLSMALLINT	FetchOrientation	Input	Fetch orientation. See Table 62 on page 107 for possible values.
SQLINTEGER	FetchOffset	Input	Row offset for relative positioning.
SQLINTEGER *	RowCountPtr	Output	Number of the rows actually fetched. If an error occurs during processing, *RowCountPtr* points to the ordinal position of the row (in the rowset) that precedes the row where the error occurred. If an error occurs retrieving the first row *RowCountPtr* points to the value 0.
SQLSMALLINT *	RowStatusArray	Output	An array of status values. The number of elements must equal the number of rows in the rowset (as defined by the SQL_ROWSET_SIZE attribute). A status value for each row fetched is returned: • SQL_ROW_SUCCESS If the number of rows fetched is less than the number of elements in the status array (that is, less than the rowset size), the remaining status elements are set to SQL_ROW_NOROW. DB2 UDB CLI cannot detect whether a row has been updated or deleted since the start of the fetch. Therefore, the following ODBC defined status values will not be reported: • SQL_ROW_DELETED • SQL_ROW_UPDATED

Usage

SQLExtendedFetch() is used to perform an array fetch of a set of rows. An application specifies the size of the array by calling SQLSetStmtAttr() with the SQL_ROWSET_SIZE attribute.

Before SQLExtendedFetch() is called the first time, the cursor is positioned before the first row. After SQLExtendedFetch() is called, the cursor is positioned on the row in the result set corresponding to the last row element in the rowset just retrieved.

For any columns in the result set that have been bound via the SQLBindCol() function, DB2 UDB CLI converts the data for the bound columns as necessary and stores it in the locations bound to these columns. The result set must be bound in a row-wise fashion. This means that the values for all the columns of the first row will be contiguous, followed by the values of the second row, and so on. Also, if indicator variables are used, they will all be returned in one contiguous storage location.

When using this procedure to retrieve multiple rows, all columns must be bound, and the storage must be contiguous. When using this function to retrieve rows from an SQL procedure result set, only the SQL_FETCH_NEXT orientation is supported. The user is responsible for allocating enough storage for the number of rows that are specified in SQL_ROWSET_SIZE.

The cursor must be a scrollable cursor for SQLExtendedFetch() to use any orientation other than SQL_FETCH_NEXT. See “SQLSetStmtAttr - Set a Statement Attribute” on page 226 for information on setting the SQL_ATTR_CURSOR_SCROLLABLE attribute.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE
- SQL_NO_DATA_FOUND

Error Conditions

Table 58. SQLExtendedFetch SQLSTATEs

SQLSTATE	Description	Explanation
HY009	Invalid argument value	The argument value *RowCountPtr* or *RowStatusArray* was a null pointer. The value specified for the argument FetchOrientation was not recognized.
HY010	Function sequence error	SQLExtendedFetch() was called for an StatementHandle after SQLFetch() was called and before SQLFreeStmt() had been called with the SQL_CLOSE option. The function was called prior to calling SQLPrepare() or SQLExecDirect() for the *StatementHandle*. The function was called while in a data-at-execute (SQLParamData(), SQLPutData()) operation.

Restrictions

None.

References

- “SQLBindCol - Bind a Column to an Application Variable” on page 33
- “SQLExecute - Execute a Statement” on page 96
- “SQLExecDirect - Execute a Statement Directly” on page 94

SQLExtendedFetch

- “SQLFetch - Fetch Next Row” on page 101

SQLFetch - Fetch Next Row

Purpose

SQLFetch() advances the cursor to the next row of the result set, and retrieves any bound columns.

SQLFetch() can be used to receive the data directly into variables you specify with SQLBindCol(), or the columns can be received individually after the fetch, by calling SQLGetData(). Data conversion is also performed when SQLFetch() is called, if conversion was indicated when the column was bound.

Syntax

```
SQLRETURN SQLFetch (SQLHSTMT    hstmt);
```

Function Arguments

Table 59. SQLFetch Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle

Usage

SQLFetch() can only be called if the most recently executed statement on *hstmt*, was a SELECT.

The number of application variables bound with SQLBindCol() must not exceed the number of columns in the result set or SQLFetch() will fail.

If SQLBindCol() has not been called to bind any columns, then SQLFetch() does not return data to the application, but just advances the cursor. In this case SQLGetData() can then be called to obtain all of the columns individually. Data in unbound columns is discarded when SQLFetch() advances the cursor to the next row.

If any bound variables are not large enough to hold the data returned by SQLFetch(), the data is truncated. If character data is truncated, SQL_SUCCESS_WITH_INFO is returned, and an SQLSTATE is generated indicating truncation. The SQLBindCol() deferred output argument *pcbValue* contains the actual length of the column data retrieved from the server. The application should compare the output length to the input length (*pcbValue* and *cbValueMax* arguments from SQLBindCol()) to determine which character columns have been truncated.

Truncation of numeric data types is not reported if the truncation involves digits to the right of the decimal point. If truncation occurs to the left of the decimal point, an error is returned (refer to the diagnostics section).

Truncation of graphic data types is treated the same as character data types. Except the *rgbValue* buffer is filled to the nearest multiple of two bytes that is still less than or equal to the *cbValueMax* specified in SQLBindCol(). Graphic data transferred between DB2 UDB CLI and the application is never null-terminated.

When all the rows have been retrieved from the result set, or the remaining rows are not needed, SQLFreeStmt() should be called to close the cursor and discard the remaining data and associated resources.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE
- SQL_NO_DATA_FOUND

SQL_NO_DATA_FOUND is returned if there are no rows in the result set, or previous `SQLFetch()` calls have fetched all the rows from the result set.

Diagnostics

Table 60. SQLFetch SQLSTATEs

SQLSTATE	Description	Explanation
01004	Data truncated	The data returned for one or more columns was truncated. String values are right truncated. (SQL_SUCCESS_WITH_INFO is returned if no error occurred.)
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY010	Function sequence error	The specified *hstmt* was not in an executed state. The function was called without first calling SQLExecute or SQLExecDirect.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.

Example

See “Code disclaimer information” on page viii for information pertaining to code examples.

```
/*****************************************************************************
** file = fetch.c
**
** Example of executing an SQL statement.
** SQLBindCol & SQLFetch is used to retrive data from the result set
** directly into application storage.
**
** Functions used:
**
**        SQLAllocConnect      SQLFreeConnect
**        SQLAllocEnv          SQLFreeEnv
**        SQLAllocStmt         SQLFreeStmt
**        SQLConnect           SQLDisconnect
**
**        SQLBindCol           SQLFetch
**        SQLTransact          SQLExecDirect
**        SQLError
**
*****************************************************************************/

#include <stdio.h>
#include <string.h>
#include "sqlcli.h"

#define MAX_STMT_LEN 255

int initialize(SQLHENV *henv,
               SQLHDBC *hdbc);
```

```
int terminate(SQLHENV henv,
              SQLHDBC hdbc);

int print_error (SQLHENV    henv,
                 SQLHDBC    hdbc,
                 SQLHSTMT   hstmt);

int check_error (SQLHENV    henv,
                 SQLHDBC    hdbc,
                 SQLHSTMT   hstmt,
                 SQLRETURN  frc);

/******************************************************************
** main
** - initialize
** - terminate
******************************************************************/
int main()
{
    SQLHENV     henv;
    SQLHDBC     hdbc;
    SQLCHAR     sqlstmt[MAX_STMT_LEN + 1]="";
    SQLRETURN   rc;

    rc = initialize(&henv, &hdbc);
    if (rc == SQL_ERROR) return(terminate(henv, hdbc));


    {SQLHSTMT   hstmt;
     SQLCHAR    sqlstmt[]="SELECT deptname, location from org where division = 'Eastern'";
     SQLCHAR    deptname[15],
                location[14];
     SQLINTEGER rlength;

        rc = SQLAllocStmt(hdbc, &hstmt);
        if (rc != SQL_SUCCESS )
           check_error (henv, hdbc, SQL_NULL_HSTMT, rc);

        rc = SQLExecDirect(hstmt, sqlstmt, SQL_NTS);
        if (rc != SQL_SUCCESS )
            check_error (henv, hdbc, hstmt, rc);

        rc = SQLBindCol(hstmt, 1, SQL_CHAR, (SQLPOINTER) deptname, 15,
                        &rlength);
        if (rc != SQL_SUCCESS )
            check_error (henv, hdbc, hstmt, rc);
        rc = SQLBindCol(hstmt, 2, SQL_CHAR, (SQLPOINTER) location, 14,
                        &rlength);
        if (rc != SQL_SUCCESS )
            check_error (henv, hdbc, hstmt, rc);

        printf("Departments in Eastern division:\n");
        printf("DEPTNAME       Location\n");
        printf("-------------- -------------\n");

        while ((rc = SQLFetch(hstmt)) == SQL_SUCCESS)
        {
            printf("%-14.14s %-13.13s \n", deptname, location);
        }
        if (rc != SQL_NO_DATA_FOUND )
           check_error (henv, hdbc, hstmt, rc);

        rc = SQLFreeStmt(hstmt, SQL_DROP);
        if (rc != SQL_SUCCESS )
            check_error (henv, hdbc, SQL_NULL_HSTMT, rc);
    }
```

```
    rc = SQLTransact(henv, hdbc, SQL_COMMIT);
    if (rc != SQL_SUCCESS )
        check_error (henv, hdbc, SQL_NULL_HSTMT, rc);

    terminate(henv, hdbc);
    return (0);
}/* end main */

/*****************************************************************
** initialize
**  - allocate environment handle
**  - allocate connection handle
**  - prompt for server, user id, & password
**  - connect to server
*****************************************************************/

int initialize(SQLHENV *henv,
               SQLHDBC *hdbc)
{
SQLCHAR     server[SQL_MAX_DSN_LENGTH],
            uid[30],
            pwd[30];
SQLRETURN   rc;

    rc = SQLAllocEnv (henv);         /* allocate an environment handle    */
    if (rc != SQL_SUCCESS )
        check_error (*henv, *hdbc, SQL_NULL_HSTMT, rc);

    rc = SQLAllocConnect (*henv, hdbc);  /* allocate a connection handle   */
    if (rc != SQL_SUCCESS )
        check_error (*henv, *hdbc, SQL_NULL_HSTMT, rc);

    printf("Enter Server Name:\n");
    gets(server);
    printf("Enter User Name:\n");
    gets(uid);
    printf("Enter Password Name:\n");
    gets(pwd);

    if (uid[0] == '\0')
    {   rc = SQLConnect (*hdbc, server, SQL_NTS, NULL, SQL_NTS, NULL, SQL_NTS);
        if (rc != SQL_SUCCESS )
            check_error (*henv, *hdbc, SQL_NULL_HSTMT, rc);
    }
    else
    {   rc = SQLConnect (*hdbc, server, SQL_NTS, uid, SQL_NTS, pwd, SQL_NTS);
        if (rc != SQL_SUCCESS )
            check_error (*henv, *hdbc, SQL_NULL_HSTMT, rc);
    }

    return(SQL_SUCCESS);
}/* end initialize */

/*****************************************************************
** terminate
**  - disconnect
**  - free connection handle
**  - free environment handle
*****************************************************************/
int terminate(SQLHENV henv,
              SQLHDBC hdbc)
{
SQLRETURN   rc;

    rc = SQLDisconnect (hdbc);              /* disconnect from database  */
```

```
    if (rc != SQL_SUCCESS )
        print_error (henv, hdbc, SQL_NULL_HSTMT);
    rc = SQLFreeConnect (hdbc);              /* free connection handle    */
    if (rc != SQL_SUCCESS )
        print_error (henv, hdbc, SQL_NULL_HSTMT);
    rc = SQLFreeEnv (henv);                  /* free environment handle   */
    if (rc != SQL_SUCCESS )
        print_error (henv, hdbc, SQL_NULL_HSTMT);

    return(rc);
}/* end terminate */

/*********************************************************************
**  - print_error   - call SQLError(), display SQLSTATE and message
*********************************************************************/

int print_error (SQLHENV    henv,
                 SQLHDBC    hdbc,
                 SQLHSTMT   hstmt)
{
SQLCHAR     buffer[SQL_MAX_MESSAGE_LENGTH + 1];
SQLCHAR     sqlstate[SQL_SQLSTATE_SIZE + 1];
SQLINTEGER  sqlcode;
SQLSMALLINT length;


    while ( SQLError(henv, hdbc, hstmt, sqlstate, &sqlcode, buffer,
                     SQL_MAX_MESSAGE_LENGTH + 1, &length) == SQL_SUCCESS )
    {
        printf("\n **** ERROR *****\n");
        printf("         SQLSTATE: %s\n", sqlstate);
        printf("Native Error Code: %ld\n", sqlcode);
        printf("%s \n", buffer);
    };

    return ( SQL_ERROR);
} /* end print_error */

/*********************************************************************
**  - check_error   - call print_error(), checks severity of return code
*********************************************************************/
int check_error (SQLHENV    henv,
                 SQLHDBC    hdbc,
                 SQLHSTMT   hstmt,
                 SQLRETURN  frc)
{
SQLRETURN   rc;

    print_error(henv, hdbc, hstmt);

    switch (frc){
    case SQL_SUCCESS : break;
    case SQL_ERROR :
    case SQL_INVALID_HANDLE:
        printf("\n ** FATAL ERROR, Attempting to rollback transaction **\n");
        rc = SQLTransact(henv, hdbc, SQL_ROLLBACK);
        if (rc != SQL_SUCCESS)
            printf("Rollback Failed, Exiting application\n");
        else
            printf("Rollback Successful, Exiting application\n");
        terminate(henv, hdbc);
        exit(frc);
        break;
    case SQL_SUCCESS_WITH_INFO :
        printf("\n ** Warning Message, application continuing\n");
        break;
    case SQL_NO_DATA_FOUND :
```

```
        printf("\n ** No Data Found ** \n");
        break;
    default :
        printf("\n ** Invalid Return Code ** \n");
        printf(" ** Attempting to rollback transaction **\n");
        SQLTransact(henv, hdbc, SQL_ROLLBACK);
        terminate(henv, hdbc);
        exit(frc);
        break;
    }
    return(SQL_SUCCESS);

} /* end check_error */
```

References

- “SQLBindCol - Bind a Column to an Application Variable” on page 33
- “SQLExecute - Execute a Statement” on page 96
- “SQLExecDirect - Execute a Statement Directly” on page 94
- “SQLGetCol - Retrieve one column of a row of the result set” on page 119
- “SQLFetchScroll - Fetch From a Scrollable Cursor” on page 107

SQLFetchScroll - Fetch From a Scrollable Cursor

Purpose

SQLFetchScroll() positions the cursor based on the requested orientation, then retrieves any bound columns.

SQLFetchScroll() can be used to receive the data directly into variables you specify with SQLBindCol(), or the columns can be received individually after the fetch, by calling SQLGetData(). Data conversion is also performed when SQLFetchScroll() is called, if conversion was indicated when the column was bound.

Syntax

```
SQLRETURN SQLFetchScroll (SQLHSTMT    hstmt,
                          SQLSMALLINT fOrient,
                          SQLINTEGER  fOffset);
```

Function Arguments

Table 61. SQLFetchScroll Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle
SQLSMALLINT	*fOrient*	Input	Fetch orientation. See Table 62 for possible values.
SQLINTEGER	*fOffset*	Input	Row offset for relative positioning.

Usage

SQLFetchScroll() can only be called if the most recently executed statement on *hstmt*, was a SELECT.

SQLFetchScroll() acts like SQLFetch(), except the *fOrient* parameter positions the cursor before any data is retrieved. The cursor must be a scrollable cursor for SQLFetchScroll() to use any orientation other than SQL_FETCH_NEXT. See “SQLSetStmtAttr - Set a Statement Attribute” on page 226 for information on setting the SQL_ATTR_CURSOR_SCROLLABLE attribute.

When using this function to retrieve rows from an SQL procedure result set, only the SQL_FETCH_NEXT orientation is supported.

Table 62. Statement Attributes

fOrient	Description
SQL_FETCH_NEXT	Move to the row following the current cursor position.
SQL_FETCH_FIRST	Move to the first row of the result set.
SQL_FETCH_LAST	Move to the last row of the result set.
SQL_FETCH_PRIOR	Move to the row preceding the current cursor position.
SQL_FETCH_RELATIVE	If *fOffset* is: • Positive, advance the cursor that number of rows. • Negative, back up the cursor that number of rows. • Zero, do not move the cursor.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE
- SQL_NO_DATA_FOUND

Diagnostics

Table 63. SQLFetchScroll SQLSTATEs

SQLSTATE	Description	Explanation
01004	Data truncated	The data returned for one or more columns was truncated. String values are right truncated. (SQL_SUCCESS_WITH_INFO is returned if no error occurred.)
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	Invalid orientation.
HY010	Function sequence error	The specified *hstmt* was not in an executed state. The function was called without first calling SQLExecute or SQLExecDirect.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.

References

- “SQLBindCol - Bind a Column to an Application Variable” on page 33
- “SQLExecute - Execute a Statement” on page 96
- “SQLExecDirect - Execute a Statement Directly” on page 94
- “SQLGetCol - Retrieve one column of a row of the result set” on page 119
- “SQLFetch - Fetch Next Row” on page 101

SQLForeignKeys - Get the List of Foreign Key Columns

Purpose

SQLForeignKeys() returns information about foreign keys for the specified table. The information is returned in an SQL result set which can be processed using the same functions that are used to retrieve a result that is generated by a query.

Syntax

```
SQLRETURN   SQLForeignKeys   (SQLHSTMT          StatementHandle,
                              SQLCHAR           *PKCatalogName,
                              SQLSMALLINT       NameLength1,
                              SQLCHAR           *PKSchemaName,
                              SQLSMALLINT       NameLength2,
                              SQLCHAR           *PKTableName,
                              SQLSMALLINT       NameLength3,
                              SQLCHAR           *FKCatalogName,
                              SQLSMALLINT       NameLength4,
                              SQLCHAR           *FKSchemaName,
                              SQLSMALLINT       NameLength5,
                              SQLCHAR           *FKTableName,
                              SQLSMALLINT       NameLength6);
```

Function Arguments

Table 64. SQLForeignKeys Arguments

Data Type	Argument	Use	Description
SQLHSTMT	StatementHandle	input	Statement handle.
SQLCHAR *	PKCatalogName	input	Catalog qualifier of the primary key table. This must be a NULL pointer or a zero length string.
SQLSMALLINT	NameLength1	input	Length of *PKCatalogName*. This must be set to 0.
SQLCHAR *	PKSchemaName	input	Schema qualifier of the primary key table.
SQLSMALLINT	NameLength2	input	Length of *PKSchemaName*
SQLCHAR *	PKTableName	input	Name of the table name containing the primary key.
SQLSMALLINT	NameLength3	input	Length of *PKTableName*
SQLCHAR *	FKCatalogName	input	Catalog qualifier of the table containing the foreign key. This must be a NULL pointer or a zero length string.
SQLSMALLINT	NameLength4	input	Length of *FKCatalogName*. This must be set to 0.
SQLCHAR *	FKSchemaName	input	Schema qualifier of the table containing the foreign key.
SQLSMALLINT	NameLength5	input	Length of *FKSchemaName*
SQLCHAR *	FKTableName	input	Name of the table containing the foreign key.
SQLSMALLINT	NameLength6	input	Length of *FKTableName*

Usage

If *PKTableName* contains a table name, and *FKTableName* is an empty string, SQLForeignKeys() returns a result set that contains the primary key of the specified table and all of the foreign keys (in other tables) that refer to it.

SQLForeignKeys

If *FKTableName* contains a table name, and *PKTableName* is an empty string, `SQLForeignKeys()` returns a result set that contains all of the foreign keys in the specified table and the primary keys (in other tables) to which they refer.

If both *PKTableName* and *FKTableName* contain table names, `SQLForeignKeys()` returns the foreign keys in the table specified in *FKTableName* that refer to the primary key of the table specified in *PKTableName*. This should be one key at the most.

If the schema qualifier argument that is associated with a table name is not specified, then the schema name defaults to the one currently in effect for the current connection.

Table 65 lists the columns of the result set generated by the `SQLForeignKeys()` call. If the foreign keys that are associated with a primary key are requested, the result set is ordered by FKTABLE_CAT, FKTABLE_SCHEM, FKTABLE_NAME, and ORDINAL_POSITION. If the primary keys that are associated with a foreign key are requested, the result set is ordered by PKTABLE_CAT, PKTABLE_SCHEM, PKTABLE_NAME, and ORDINAL_POSITION.

Although new columns might be added and the names of the existing columns might be changed in future releases, the position of the current columns will not change.

Table 65. Columns Returned By SQLForeignKeys

Column Number/Name	Data Type	Description
1 PKTABLE_CAT	VARCHAR(128)	The current server.
2 PKTABLE_SCHEM	VARCHAR(128)	The name of the schema containing PKTABLE_NAME.
3 PKTABLE_NAME	VARCHAR(128) not NULL	Name of the table containing the primary key.
4 PKCOLUMN_NAME	VARCHAR(128) not NULL	Primary key column name.
5 FKTABLE_CAT	VARCHAR(128)	The current server.
6 FKTABLE_SCHEM	VARCHAR(128)	The name of the schema containing FKTABLE_NAME.
7 FKTABLE_NAME	VARCHAR(128) not NULL	The name of the table containing the Foreign key.
8 FKCOLUMN_NAME	VARCHAR(128) not NULL	Foreign key column name.
9 ORDINAL_POSITION	SMALLINT not NULL	The ordinal position of the column in the key, starting at 1.
10 UPDATE_RULE	SMALLINT	Action to be applied to the foreign key when the SQL operation is UPDATE: • SQL_RESTRICT • SQL_NO_ACTION The update rule for IBM DB2 DBMSs is always either RESTRICT or SQL_NO_ACTION. However, ODBC applications may encounter the following UPDATE_RULE values when connected to non-IBM RDBMSs: • SQL_CASCADE • SQL_SET_NULL

Table 65. Columns Returned By SQLForeignKeys (continued)

Column Number/Name	Data Type	Description
11 DELETE_RULE	SMALLINT	Action to be applied to the foreign key when the SQL operation is DELETE: • SQL_CASCADE • SQL_NO_ACTION • SQL_RESTRICT • SQL_SET_DEFAULT • SQL_SET_NULL
12 FK_NAME	VARCHAR(128)	Foreign key identifier. NULL if not applicable to the data source.
13 PK_NAME	VARCHAR(128)	Primary key identifier. NULL if not applicable to the data source.

Note: The column names used by DB2 UDB CLI follow the X/Open CLI CAE specification style. The column types, contents and order are identical to those defined for the `SQLForeignKeys()` result set in ODBC.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_STILL_EXECUTING
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 66. SQLForeignKeys SQLSTATEs

SQLSTATE	Description	Explanation
24000	Invalid cursor state	A cursor is already opened on the statement handle.
40003 **08**S01	Communication link failure	The communication link between the application and data source failed before the function completed.
HY001	Memory allocation failure	DB2 UDB CLI is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	The arguments *PKTableName* and *FKTableName* were both NULL pointers.
HY010	Function sequence error	
HY014	No more handles	DB2 UDB CLI was unable to allocate a handle due to internal resources.
HY090	Invalid string or buffer length	The value of one of the name length arguments was less than 0, but not equal SQL_NTS. The length of the table or owner name is greater than the maximum length supported by the server. Refer to “SQLGetInfo - Get General Information” on page 146.
HYC00	Driver not capable	DB2 UDB CLI does not support *catalog* as a qualifier for table name.
HYT00	Timeout expired	

Restrictions

None.

Example

```
/* From CLI sample browser.c */
/* ... */
SQLRETURN list_foreign_keys( SQLHANDLE hstmt,
                             SQLCHAR * schema,
                             SQLCHAR * tablename
                           ) {

/* ... */
    rc = SQLForeignKeys(hstmt, NULL, 0,
                        schema, SQL_NTS, tablename, SQL_NTS,
                        NULL, 0,
                        NULL, SQL_NTS, NULL, SQL_NTS);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 2, SQL_C_CHAR, (SQLPOINTER) pktable_schem.s, 129,
                    &pktable_schem.ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 3, SQL_C_CHAR, (SQLPOINTER) pktable_name.s, 129,
                    &pktable_name.ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 4, SQL_C_CHAR, (SQLPOINTER) pkcolumn_name.s, 129,
                    &pkcolumn_name.ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 6, SQL_C_CHAR, (SQLPOINTER) fktable_schem.s, 129,
                    &fktable_schem.ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 7, SQL_C_CHAR, (SQLPOINTER) fktable_name.s, 129,
                    &fktable_name.ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 8, SQL_C_CHAR, (SQLPOINTER) fkcolumn_name.s, 129,
                    &fkcolumn_name.ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 10, SQL_C_SHORT, (SQLPOINTER) &update_rule,
                    0, &update_ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 11, SQL_C_SHORT, (SQLPOINTER) &delete_rule,
                    0, &delete_ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 12, SQL_C_CHAR, (SQLPOINTER) fkey_name.s, 129,
                    &fkey_name.ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 13, SQL_C_CHAR, (SQLPOINTER) pkey_name.s, 129,
                    &pkey_name.ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    printf("Primary Key and Foreign Keys for %s.%s\n", schema, tablename);
    /* Fetch each row, and display */
    while ((rc = SQLFetch(hstmt)) == SQL_SUCCESS) {
        printf("  %s  %s.%s.%s\n      Update Rule ",
               pkcolumn_name.s, fktable_schem.s, fktable_name.s, fkcolumn_name.s);
        if (update_rule == SQL_RESTRICT) {
            printf("RESTRICT ");  /* always for IBM DBMSs */
        } else {
            if (update_rule == SQL_CASCADE) {
               printf("CASCADE ");  /* non-IBM only */
            } else {
```

```
            printf("SET NULL ");
        }
    }
    printf(", Delete Rule: ");
    if (delete_rule== SQL_RESTRICT) {
        printf("RESTRICT ");  /* always for IBM DBMSs */
    } else {
        if (delete_rule == SQL_CASCADE) {
            printf("CASCADE ");  /* non-IBM only */
        } else {
            if (delete_rule == SQL_NO_ACTION) {
               printf("NO ACTION ");  /* non-IBM only */
            } else {
                 printf("SET NULL ");
              }
        }
    }
    printf("\n");
    if (pkey_name.ind > 0 ) {
        printf("     Primary Key Name: %s\n", pkey_name.s);
    }
    if (fkey_name.ind > 0 ) {
        printf("     Foreign Key Name: %s\n", fkey_name.s);
    }
}
```

References

- “SQLPrimaryKeys - Get Primary Key Columns of A Table” on page 193
- “SQLStatistics - Get Index and Statistics Information For A Base Table” on page 235

SQLFreeConnect - Free Connection Handle

Purpose

SQLFreeConnect() invalidates and frees the connection handle. All DB2 UDB CLI resources associated with the connection handle are freed.

SQLDisconnect() must be called before calling this function.

Either SQLFreeEnv() is called next to continue terminating the application, or SQLAllocHandle(), to allocate a new connection handle.

Syntax

```
SQLRETURN SQLFreeConnect (SQLHDBC    hdbc);
```

Function Arguments

Table 67. SQLFreeConnect Arguments

Data Type	Argument	Use	Description
SQLHDBC	*hdbc*	Input	Connection handle

Usage

If this function is called when a connection still exists, SQL_ERROR is returned, and the connection handle remains valid.

Return Codes

- SQL_SUCCESS
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 68. SQLFreeConnect SQLSTATEs

SQLSTATE	Description	Explanation
58004	System error	Unrecoverable system error
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY010	Function sequence error	The function was called prior to SQLDisconnect() for the *hdbc*.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.

Example

Refer to the SQLAllocEnv() “Example” on page 27.

References

- “SQLDisconnect - Disconnect from a Data Source” on page 83
- “SQLFreeEnv - Free Environment Handle” on page 115

SQLFreeEnv - Free Environment Handle

Purpose

SQLFreeEnv() invalidates and frees the environment handle. All DB2 UDB CLI resources associated with the environment handle are freed.

SQLFreeConnect() must be called before calling this function.

This function is the last DB2 UDB CLI step an application needs before terminating.

Syntax

```
SQLRETURN SQLFreeEnv (SQLHENV    henv);
```

Function Arguments

Table 69. SQLFreeEnv Arguments

Data Type	Argument	Use	Description
SQLHENV	*henv*	Input	Environment handle

Usage

If this function is called when there is still a valid connection handle, SQL_ERROR is returned, and the environment handle remains valid.

Return Codes

- SQL_SUCCESS
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 70. SQLFreeEnv SQLSTATEs

SQLSTATE	Description	Explanation
58004	System error	Unrecoverable system error
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY010	Function sequence error	There is an *hdbc* which is in allocated or connected state. Call SQLDisconnect and SQLFreeConnect for the *hdbc* before calling SQLFreeEnv.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.

Example

Refer to the SQLAllocEnv() “Example” on page 27.

References

- “SQLFreeConnect - Free Connection Handle” on page 114

SQLFreeHandle - Free a Handle

Purpose

SQLFreeHandle() invalidates and frees a handle.

Syntax

```
SQLRETURN SQLFreeHandle (SQLSMALLINT htype,
                         SQLINTEGER handle);
```

Function Arguments

Table 71. SQLFreeHandle Arguments

Data Type	Argument	Use	Description
SQLSMALLINT	*hType*	Input	Handle type. Must be SQL_HANDLE_ENV, SQL_HANDLE_DBC, SQL_HANDLE_STMT, or SQL_HANDLE_DESC.
SQLINTEGER	*handle*	Input	The handle to be freed

Usage

SQLFreeHandle() combines the function of SQLFreeEnv(), SQLFreeConnect(), and SQLFreeStmt().

Return Codes

- SQL_SUCCESS
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 72. SQLFreeHandle SQLSTATEs

SQLSTATE	Description	Explanation
58004	System error	Unrecoverable system error
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY010	Function sequence error	There is an *hdbc* which is in allocated or connected state. Call SQLDisconnect and SQLFreeConnect for the *hdbc* before calling SQLFreeHandle.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.

References

- “SQLFreeConnect - Free Connection Handle” on page 114
- “SQLFreeEnv - Free Environment Handle” on page 115
- “SQLFreeStmt - Free (or Reset) a Statement Handle” on page 117

SQLFreeStmt - Free (or Reset) a Statement Handle

Purpose

SQLFreeStmt() ends processing on the statement referenced by the statement handle. Use this function to:

- Close a cursor
- Reset parameters
- Unbind columns from variables
- Drop the statement handle and free the DB2 UDB CLI resources associated with the statement handle.

SQLFreeStmt() is called after executing an SQL statement and processing the results.

Syntax

```
SQLRETURN SQLFreeStmt (SQLHSTMT       hstmt,
                       SQLSMALLINT    fOption);
```

Function Arguments

Table 73. SQLFreeStmt Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle
SQLSMALLINT	*fOption*	Input	Option specifying the manner of freeing the statement handle. The option must have one of the following values: • SQL_CLOSE • SQL_DROP • SQL_UNBIND • SQL_RESET_PARAMS

Usage

SQLFreeStmt() can be called with the following options:

- SQL_CLOSE

  The cursor (if any) associated with the statement handle (*hstmt*) is closed and all pending results are discarded. The application can reopen the cursor by calling SQLExecute() with the same or different values in the application variables (if any) that are bound to *hstmt*. The cursor name is retained until the statement handle is dropped or the next successful SQLSetCursorName() call. If no cursor has been associated with the statement handle, this option has no effect (no warning or error is generated).
- SQL_DROP

  DB2 UDB CLI resources associated with the input statement handle are freed, and the handle is invalidated. The open cursor, if any, is closed and all pending results are discarded.
- SQL_UNBIND

  All the columns bound by previous SQLBindCol() calls on this statement handle are released (the association between application variables or file references and result set columns is broken).
- SQL_RESET_PARAMS

  All the parameters set by previous SQLBindParam() calls on this statement handle are released. The association between application variables or file references and parameter markers in the SQL statement of the statement handle is broken.

To reuse a statement handle to execute a different statement and if the previous statement:

- Was a SELECT, you must close the cursor.
- Used a different number or type of parameters, the parameters must be reset.
- Used a different number or type of column bindings, the columns must be unbound.

Alternatively you may drop the statement handle and allocate a new one.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

SQL_SUCCESS_WITH_INFO is not returned if *fOption* is set to SQL_DROP, since there would be no statement handle to use when `SQLError()` is called.

Diagnostics

Table 74. SQLFreeStmt SQLSTATEs

SQLSTATE	Description	Explanation
40003 *	Statement completion unknown	The communication link between the CLI and the data source failed before the function completed processing.
58004	System error	Unrecoverable system error
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	The value specified for the argument *fOption* was not SQL_CLOSE, SQL_DROP, SQL_UNBIND, or SQL_RESET_PARAMS.

Example

Refer to the `SQLFetch()` "Example" on page 102.

References

- "SQLAllocStmt - Allocate a Statement Handle" on page 31
- "SQLBindCol - Bind a Column to an Application Variable" on page 33
- "SQLFetch - Fetch Next Row" on page 101
- "SQLFreeConnect - Free Connection Handle" on page 114
- "SQLSetParam - Set Parameter" on page 225

SQLGetCol - Retrieve one column of a row of the result set

Purpose

SQLGetCol() retrieves data for a single column in the current row of the result set. This is an alternative to SQLBindCol(), which transfers data directly into application variables on a call to SQLFetch(). SQLGetCol() is also used to retrieve large character based data in pieces.

SQLFetch() must be called before SQLGetCol().

After calling SQLGetCol() for each column, SQLFetch() is called to retrieve the next row.

Syntax

```
SQLRETURN SQLGetCol  (SQLHSTMT       hstmt,
                      SQLSMALLINT    icol,
                      SQLSMALLINT    fCType,
                      SQLPOINTER     rgbValue,
                      SQLINTEGER     cbValueMax,
                      SQLINTEGER     *pcbValue);
```

Function Arguments

Table 75. SQLGetCol Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle
SQLSMALLINT	*icol*	Input	Column number for which the data retrieval is requested
SQLSMALLINT	*fCType*	Input	Application data type of the column identified by *icol*. The following types are supported: • SQL_CHAR • SQL_VARCHAR • SQL_NUMERIC • SQL_DECIMAL • SQL_BIGINT • SQL_INTEGER • SQL_SMALLINT • SQL_FLOAT • SQL_REAL • SQL_DOUBLE • SQL_GRAPHIC • SQL_VARGRAPHIC • SQL_DATETIME • SQL_TYPE_DATE • SQL_TYPE_TIME • SQL_TYPE_TIMESTAMP
SQLPOINTER	*rgbValue*	Output	Pointer to buffer where the retrieved column data is to be stored.

Table 75. SQLGetCol Arguments (continued)

Data Type	Argument	Use	Description
SQLINTEGER	*cbValueMax*	Input	Maximum size of the buffer pointed to by *rgbValue*. If *fcType* is either SQL_DECIMAL or SQL_NUMERIC, *cbValueMax* actually must be a precision and scale. The method to specify both values is to use (precision * 256) + scale. This is also the value returned as the LENGTH of these data types when using `SQLColAttributes()`.
SQLINTEGER *	*pcbValue*	Output	Pointer to value that indicates the number of bytes DB2 UDB CLI has available to return in the *rgbValue* buffer. If the data is being retrieved in pieces, this contains the number of bytes still remaining, excluding any bytes of the column's data that has been obtained from previous calls to `SQLGetCol()`. The value is SQL_NULL_DATA if the data value of the column is null. If this pointer is NULL and `SQLFetch()` has obtained a column containing null data, then this function will fail because it has no means of reporting this. If `SQLFetch()` has fetched a column containing graphic data, then the pointer to *pcbValue* must not be NULL or this function will fail because it has no means of informing the application about the length of the data retrieved in the *rgbValue* buffer.

Usage

`SQLGetCol()` can be used with `SQLBindCol()` for the same row, as long as the value of *icol* does not specify a column that has been bound. The general steps are:

1. `SQLFetch()` - advances cursor to first row, retrieves first row, transfers data for bound columns.
2. `SQLGetCol()` - transfers data for specified (unbound) column.
3. Repeat step 2 for each column needed.
4. `SQLFetch()` - advances cursor to next row, retrieves next row, transfers data for bound columns.
5. Repeat steps 2, 3 and 4 for each row in the result set, or until the result set is no longer needed.

`SQLGetCol()` retrieves long columns if the C data type (*fCType*) is SQL_CHAR or if *fCType* is SQL_DEFAULT and the column type is CHAR or VARCHAR.

On each `SQLGetCol()` call, if the data available for return is greater than or equal to *cbValueMax*, truncation occurs. A function return code of SQL_SUCCESS_WITH_INFO that is coupled with a SQLSTATE that denotes data truncation indicates truncation. The application can call `SQLGetCol()` again, with the same *icol* value, to obtain later data from the same unbound column starting at the point of truncation. To obtain the entire column, the application repeats such calls until the function returns SQL_SUCCESS. The next call to `SQLGetCol()` returns SQL_NO_DATA_FOUND.

To discard the column data part way through the retrieval, the application can call `SQLGetCol()` with *icol* set to the next column position of interest. To discard unretrieved data for the entire row, the application should call `SQLFetch()` to advance the cursor to the next row; or, if it is not interested in any more data from the result set, call `SQLFreeStmt()` to close the cursor.

The *fCType* input argument determines the type of data conversion (if any) needed before the column data is placed into the storage area pointed to by *rgbValue*.

The contents returned in rgbValue is always null-terminated unless SQLSetEnvAttr() was used to change the SQL_ATTR_OUTPUT_NTS attribute or if the application is retrieving the data in multiple chunks. If the application is retrieving the data in multiple chunks, the null-terminating byte will only be added to the last portion of data.

Truncation of numeric data types is not reported if the truncation involves digits to the right of the decimal point. If truncation occurs to the left of the decimal point, an error is returned (refer to the diagnostics section).

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE
- SQL_NO_DATA_FOUND

SQL_NO_DATA_FOUND is returned when the preceding `SQLGetCol()` call has retrieved all of the data for this column.

SQL_SUCCESS is returned if a zero-length string is retrieved by `SQLGetCol()`. If this is the case, *pcbValue* contains 0, and *rgbValue* contains a null terminator.

If the preceding call to `SQLFetch()` failed, `SQLGetCol()` should not be called since the result is undefined.

Diagnostics

Table 76. SQLGetCol SQLSTATEs

SQLSTATE	Description	Explanation
07006	Restricted data type attribute violation	The data value cannot be converted to the C data type specified by the argument *fCType*.
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	The value of the argument *cbValueMax* is less than 1 and the argument *fCType* is SQL_CHAR. The specified column number was not valid. The argument *rgbValue* or *pcbValue* was a null pointer.
HY010	Function sequence error	The specified *hstmt* was not in a cursor positioned state. The function was called without first calling `SQLFetch()`.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.
HYC00	Driver not capable	The SQL data type for the specified data type is recognized but not supported by the driver. The requested conversion from the SQL data type to the application data *fCType* cannot be performed by the driver or the data source.

Restrictions

ODBC requires that *icol* not specify a column of a lower number than the column last retrieved by SQLGetCol() for the same row on the same statement handle. ODBC also does not permit the use of SQLGetCol() to retrieve data for a column that resides before the last bound column, (if any columns in the row have been bound).

DB2 UDB CLI has relaxed both of these rules by allowing the value of *icol* to be specified in any order and before a bound column, provided that *icol* does not specify a bound column.

Example

Refer to the SQLFetch() "Example" on page 102 for a comparison between using bound columns and using SQLGetCol().

Refer to "Example: Interactive SQL and the equivalent DB2 UDB CLI function calls" on page 268 for a listing of the check_error, initialize, and terminate functions used in the following example.

```
/************************************************************************
** file = getcol.c
**
** Example of directly executing an SQL statement.
** Getcol is used to retrieve information from the result set.
** Compare to fetch.c
**
** Functions used:
**
**        SQLAllocConnect      SQLFreeConnect
**        SQLAllocEnv          SQLFreeEnv
**        SQLAllocStmt         SQLFreeStmt
**        SQLConnect           SQLDisconnect
**
**        SQLBindCol           SQLFetch
**        SQLTransact          SQLError
**        SQLExecDirect        SQLGetCursor
************************************************************************/

#include <stdio.h>
#include <string.h>
#include "sqlcli.h"

#define MAX_STMT_LEN 255

int initialize(SQLHENV *henv,
               SQLHDBC *hdbc);

int terminate(SQLHENV henv,
              SQLHDBC hdbc);

int print_error (SQLHENV    henv,
                 SQLHDBC    hdbc,
                 SQLHSTMT   hstmt);

int check_error (SQLHENV    henv,
                 SQLHDBC    hdbc,
                 SQLHSTMT   hstmt,
                 SQLRETURN  frc);

/*****************************************************************
** main
** - initialize
** - terminate
*****************************************************************/
int main()
{
    SQLHENV     henv;
```

```
    SQLHDBC     hdbc;
    SQLCHAR     sqlstmt[MAX_STMT_LEN + 1]="";
    SQLRETURN   rc;

    rc = initialize(&henv, &hdbc);
    if (rc != SQL_SUCCESS) return(terminate(henv, hdbc));

    {SQLHSTMT   hstmt;
     SQLCHAR    sqlstmt[]="SELECT deptname, location from org where division = 'Eastern'";
     SQLCHAR    deptname[15],
                location[14];
     SQLINTEGER rlength;

        rc = SQLAllocStmt(hdbc, &hstmt);
        if (rc != SQL_SUCCESS )
            check_error (henv, hdbc, SQL_NULL_HSTMT, rc);

        rc = SQLExecDirect(hstmt, sqlstmt, SQL_NTS);
        if (rc != SQL_SUCCESS )
            check_error (henv, hdbc, hstmt, rc);

        printf("Departments in Eastern division:\n");
        printf("DEPTNAME       Location\n");
        printf("-------------- -------------\n");

        while ((rc = SQLFetch(hstmt)) == SQL_SUCCESS)
        {
            rc = SQLGetCol(hstmt, 1, SQL_CHAR, (SQLPOINTER) deptname, 15, &rlength);
            rc = SQLGetCol(hstmt, 2, SQL_CHAR, (SQLPOINTER) location, 14, &rlength);
            printf("%-14.14s %-13.13s \n", deptname, location);
        }
        if (rc != SQL_NO_DATA_FOUND )
            check_error (henv, hdbc, hstmt, rc);
    }

    rc = SQLTransact(henv, hdbc, SQL_COMMIT);
    if (rc != SQL_SUCCESS )
        check_error (henv, hdbc, SQL_NULL_HSTMT, rc);

    terminate(henv, hdbc);
    return (SQL_SUCCESS);

}/* end main */
```

References

- “SQLBindCol - Bind a Column to an Application Variable” on page 33
- “SQLFetch - Fetch Next Row” on page 101

SQLGetConnectAttr - Get the Value of a Connection Attribute

Purpose

SQLGetConnectAttr() returns the current settings for the specified connection option.

These options are set using the SQLSetConnectAttr() function.

Syntax

```
SQLRETURN SQLGetConnectAttr(   SQLHDBC      hdbc,
                               SQLINTEGER   fAttr,
                               SQLPOINTER   pvParam),;
                               SQLINTEGER   bLen,
                               SQLINTEGER   *sLen);
```

Function Arguments

Table 77. SQLGetConnectAttr Arguments

Data Type	Argument	Use	Description
SQLHDBC	*hdbc*	Input	Connection handle
SQLINTEGER	*fAttr*	Input	Attribute to retrieve. Refer to Table 147 on page 209 for more information.
SQLPOINTER	*pvParam*	Output	Value associated with *fAttr* Depending on the value of *fAttr*, this can be a 32-bit integer value, or a pointer to a null terminated character string.
SQLINTEGER	*bLen*	Input	Maximum number of bytes to store in pvParm, if the value is a character string; otherwise, unused.
SQLINTEGER *	*sLen*	Output	Length of the output data, if the attribute is a character string; otherwise, unused.

Usage

If SQLGetConnectAttr() is called, and the specified *fAttr* has not been set through SQLSetConnectAttr and does not have a default, then SQLGetConnectAttr() returns SQL_NO_DATA_FOUND.

Statement options settings cannot be retrieved through SQLGetConnectAttr().

Diagnostics

Table 78. SQLGetConnectAttr SQLSTATEs

SQLSTATE	Description	Explanation
08003	Connection not open	An *fAttr* was specified that required an open connection.
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Attribute type out of range	An invalid *fAttr* value was specified. The argument *pvParam* was a null pointer.
HYC00	Driver not capable	The *fAttr* was recognized, but is not supported.

SQLGetConnectOption - Returns Current Setting of A Connect Option

Purpose

`SQLGetConnectOption()` returns the current settings for the specified connection option.

These options are set using the `SQLSetConnectOption()` function.

Syntax

```
SQLRETURN SQLGetConnectOption( HDBC         hdbc,
                              SQLSMALLINT   fOption,
                              SQLPOINTER    pvParam);
```

Function Arguments

Table 79. SQLGetConnectOption Arguments

Data Type	Argument	Use	Description
HDBC	*hdbc*	Input	Connection handle
SQLSMALLINT	*fOption*	Input	Option to retrieve. Refer to Table 147 on page 209 for more information.
SQLPOINTER	*pvParam*	Output	Value associated with *fOption* Depending on the value of *fOption*, this can be a 32-bit integer value, or a pointer to a null terminated character string. The maximum length of any character string returned is SQL_MAX_OPTION_STRING_LENGTH bytes (excluding the null-terminating byte).

Usage

`SQLGetConnectOption()` provides the same function as `SQLGetConnectAttr()`, both functions are supported for compatibility reasons.

If `SQLGetConnectOption()` is called, and the specified *fOption* has not been set through `SQLSetConnectOption` and does not have a default, then `SQLGetConnectOption()` returns SQL_NO_DATA_FOUND.

Statement options settings cannot be retrieved through `SQLGetConnectOption()`.

Diagnostics

Table 80. SQLGetConnectOption SQLSTATEs

SQLSTATE	Description	Explanation
08003	Connection not open	An *fOption* was specified that required an open connection.
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Option type out of range	An invalid *fOption* value was specified. The argument *pvParam* was a null pointer.
HYC00	Driver not capable	The *fOption* was recognized, but is not supported.

SQLGetCursorName - Get Cursor Name

Purpose

SQLGetCursorName() returns the cursor name associated with the input statement handle. If a cursor name was explicitly set by calling SQLSetCursorName(), this name is returned, otherwise, an implicitly generated name is returned.

Syntax

```
SQLRETURN SQLGetCursorName (SQLHSTMT       hstmt,
                            SQLCHAR        *szCursor,
                            SQLSMALLINT    cbCursorMax,
                            SQLSMALLINT    *pcbCursor);
```

Function Arguments

Table 81. SQLGetCursorName Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle
SQLCHAR *	*szCursor*	Output	Cursor name
SQLSMALLINT	*cbCursorMax*	Input	Length of buffer *szCursor*
SQLSMALLINT *	*pcbCursor*	Output	Amount of bytes available to return for *szCursor*

Usage

SQLGetCursorName() returns a cursor name if a name was set using SQLSetCursorName(), or if a SELECT statement was executed on the statement handle. If neither of these is true, then calling SQLGetCusorName() results in an error.

If a name is set explicitly using SQLSetCursorName(), this name is returned until the statement is dropped, or until another explicit name is set.

If an explicit name is not set, an implicit name is generated when a SELECT statement is executed, and this name is returned. Implicit cursor names always begin with SQLCUR.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 82. SQLGetCursorName SQLSTATEs

SQLSTATE	Description	Explanation
01004	Data truncated	The cursor name returned in *szCursor* was longer than the value in *cbCursorMax*, and is truncated to *cbCursorMax* - 1 bytes. The argument *pcbCursor* contains the length of the full cursor name available for return. The function returns SQL_SUCCESS_WITH_INFO.

Table 82. SQLGetCursorName SQLSTATEs (continued)

SQLSTATE	Description	Explanation
40003 *	Statement completion unknown	The communication link between the CLI and the data source failed before the function completed processing.
58004	System error	Unrecoverable system error
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	The argument *szCursor* or *pcbCursor* was a null pointer. The value specified for the argument *cbCursorMax* is less than 1.
HY010	Function sequence error	The statement *hstmt* is not in execute state. Call `SQLExecute()`, `SQLExecDirect()` or `SQLSetCursorName()` before calling `SQLGetCursorName()`.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.
HY015	No cursor name available.	There was no open cursor on the *hstmt* and no cursor name had been set with `SQLSetCursorName()`. The statement associated with *hstmt* does not support the use of a cursor.

Restrictions

ODBC's generated cursor names start with SQL_CUR and X/Open CLI generated cursor names begin with SQLCUR. DB2 UDB CLI uses SQLCUR.

Example

Refer to "Example: Interactive SQL and the equivalent DB2 UDB CLI function calls" on page 268 for a listing of the `check_error`, `initialize`, and `terminate` functions used in the following example.

```
/************************************************************************
** file = getcurs.c
**
** Example of directly executing a SELECT and positioned UPDATE SQL statement.
** Two statement handles are used, and SQLGetCursor is used to retrieve the
** generated cursor name.
**
** Functions used:
**
**        SQLAllocConnect      SQLFreeConnect
**        SQLAllocEnv          SQLFreeEnv
**        SQLAllocStmt         SQLFreeStmt
**        SQLConnect           SQLDisconnect
**
**        SQLBindCol           SQLFetch
**        SQLTransact          SQLError
**        SQLExecDirect        SQLGetCursorName
************************************************************************/
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include "sqlcli.h"

#define MAX_STMT_LEN 255

int initialize(SQLHENV *henv,
               SQLHDBC *hdbc);

int terminate(SQLHENV henv,
```

```
              SQLHDBC hdbc);

int print_error (SQLHENV    henv,
                 SQLHDBC    hdbc,
                 SQLHSTMT   hstmt);

int check_error (SQLHENV    henv,
                 SQLHDBC    hdbc,
                 SQLHSTMT   hstmt,
                 SQLRETURN  frc);

/*********************************************************************
** main
** - initialize
** - terminate
*********************************************************************/
int main()
{
    SQLHENV     henv;
    SQLHDBC     hdbc;
    SQLRETURN   rc,
                rc2;

    rc = initialize(&henv, &hdbc);
    if (rc != SQL_SUCCESS) return(terminate(henv, hdbc));

    {SQLHSTMT   hstmt1,
                hstmt2;
     SQLCHAR    sqlstmt[]="SELECT name, job from staff for update of job";
     SQLCHAR    updstmt[MAX_STMT_LEN + 1];
     SQLCHAR    name[10],
                job[6],
                newjob[6],
                cursor[19];

     SQLINTEGER     rlength, attr;
     SQLSMALLINT    clength;

        rc = SQLAllocStmt(hdbc, &hstmt1);
        if (rc != SQL_SUCCESS )
            check_error (henv, hdbc, SQL_NULL_HSTMT, rc);

        /* make sure the statement is update-capable */
        attr = SQL_FALSE;
        rc = SQLSetStmtAttr(hstmt1,SQL_ATTR_FOR_FETCH_ONLY, &attr, 0);

        /* allocate second statement handle for update statement */
        rc2 = SQLAllocStmt(hdbc, &hstmt2);
        if (rc2 != SQL_SUCCESS )
            check_error (henv, hdbc, SQL_NULL_HSTMT, rc);

        rc = SQLExecDirect(hstmt1, sqlstmt, SQL_NTS);
        if (rc != SQL_SUCCESS )
            check_error (henv, hdbc, hstmt1, rc);

        /* Get Cursor of the SELECT statement's handle */
        rc = SQLGetCursorName(hstmt1, cursor, 19, &clength);
        if (rc != SQL_SUCCESS )
            check_error (henv, hdbc, hstmt1, rc);

        /* bind name to first column in the result set */
        rc = SQLBindCol(hstmt1, 1, SQL_CHAR, (SQLPOINTER) name, 10,
                        &rlength);
        if (rc != SQL_SUCCESS )
            check_error (henv, hdbc, hstmt1, rc);

        /* bind job to second column in the result set */
```

```
        rc = SQLBindCol(hstmt1, 2, SQL_CHAR, (SQLPOINTER) job, 6,
                        &rlength);
        if (rc != SQL_SUCCESS )
            check_error (henv, hdbc, hstmt1, rc);


        printf("Job Change for all clerks\n");

        while ((rc = SQLFetch(hstmt1)) == SQL_SUCCESS)
        {
            printf("Name: %-9.9s Job: %-5.5s \n", name, job);
            printf("Enter new job or return to continue\n");
            gets(newjob);
            if (newjob[0] != '\0')
            {
                sprintf( updstmt,
                    "UPDATE staff set job = '%s' where current of %s",
                    newjob, cursor);
                rc2 = SQLExecDirect(hstmt2, updstmt, SQL_NTS);
                if (rc2 != SQL_SUCCESS )
                    check_error (henv, hdbc, hstmt2, rc);
            }
        }
        if (rc != SQL_NO_DATA_FOUND )
            check_error (henv, hdbc, hstmt1, rc);
        SQLFreeStmt(hstmt1, SQL_CLOSE);
    }

    printf("Commiting Transaction\n");
    rc = SQLTransact(henv, hdbc, SQL_COMMIT);
    if (rc != SQL_NO_DATA_FOUND )
        check_error (henv, hdbc, SQL_NULL_HSTMT, rc);

    terminate(henv, hdbc);
    return (0);
}/* end main */
```

References

- “SQLExecute - Execute a Statement” on page 96
- “SQLExecDirect - Execute a Statement Directly” on page 94
- “SQLSetCursorName - Set Cursor Name” on page 215

SQLGetData - Get Data From a Column

Purpose

SQLGetData() retrieves data for a single column in the current row of the result set. This is an alternative to SQLBindCol(), which transfers data directly into application variables on a call to SQLFetch(). SQLGetData() can also be used to retrieve large character based data in pieces.

SQLFetch() must be called before SQLGetData().

After calling SQLGetData() for each column, SQLFetch() is called to retrieve the next row.

SQLGetData() is identical to SQLGetCol(), both functions are supported for compatibility reasons.

Syntax

```
SQLRETURN SQLGetData (SQLHSTMT       hstmt,
                      SQLSMALLINT    icol,
                      SQLSMALLINT    fCType,
                      SQLPOINTER     rgbValue,
                      SQLINTEGER     cbValueMax,
                      SQLINTEGER     *pcbValue);
```

Note: Refer to “SQLGetCol - Retrieve one column of a row of the result set” on page 119 for a description of the applicable sections.

SQLGetDescField - Get Descriptor Field

Purpose

SQLGetDescField() obtains a value from a descriptor. SQLGetDescField() is a more extensible alternative to the SQLGetDescRec() function.

This function is similar to that of SQLDescribeCol() but SQLGetDescField() can retrieve data from parameter descriptors as well as row descriptors.

Syntax

```
SQLRETURN SQLGetDescField  (SQLHDESC       hdesc,
                            SQLSMALLINT    irec,
                            SQLSMALLINT    fDescType,
                            SQLPOINTER     rgbDesc,
                            SQLINTEGER     bLen,
                            SQLINTEGER     *sLen);
```

Function Arguments

Table 83. SQLGetDescField Arguments

Data Type	Argument	Use	Description
SQLHDESC	*hdesc*	Input	Descriptor handle
SQLSMALLINT	*irec*	Input	Record number from which the specified field is to be retrieved.
SQLSMALLINT	*fDescType*	Input	See Table 84.
SQLPOINTER	*rgbDesc*	Output	Pointer to buffer
SQLINTEGER	*bLen*	Input	Length of descriptor buffer (*rgbDesc*)
SQLINTEGER *	*sLen*	Output	Actual number of bytes in the descriptor to return. If this argument contains a value equal to or higher than the length *rgbDesc* buffer, truncation will have occurred.

Table 84. fDescType descriptor types

Descriptor	Type	Description
SQL_DESC_COUNT	SMALLINT	The number of records in the descriptor is returned in *rgbDesc*.
SQL_DESC_ALLOC_TYPE	SMALLINT	Either SQL_DESC_ALLOC_USER if the application explicitly allocated the descriptor, or SQL_DESC_ALLOC_AUTO if the implementation automatically allocated the descriptor.
SQL_DESC_NAME	CHAR(128)	Retrieve the NAME field of *irec*.
SQL_DESC_TYPE	SMALLINT	Retrieve the TYPE field of *irec*.

Table 84. fDescType descriptor types (continued)

Descriptor	Type	Description
SQL_DESC_DATETIME_INTERVAL_CODE	SMALLINT	Retrieve the interval code for records with a type of SQL_DATETIME. The interval code further defines the SQL_DATETIME data type. The code values are SQL_CODE_DATE, SQL_CODE_TIME, and SQL_CODE_TIMESTAMP.
SQL_DESC_LENGTH	INTEGER	Retrieve the LENGTH field of *irec*.
SQL_DESC_PRECISION	SMALLINT	Retrieve the PRECISION field of *irec*.
SQL_DESC_SCALE	SMALLINT	Retrieve the SCALE field of *irec*.
SQL_DESC_NULLABLE	SMALLINT	If *irec* can contain nulls, then SQL_NULLABLE is returned in *rgbDesc*. Otherwise, SQL_NO_NULLS is returned in *rgbDesc*.
SQL_DESC_UNNAMED	SMALLINT	This is SQL_NAMED if the NAME field is an actual name, or SQL_UNNAMED if the NAME field is an implementation-generated name.
SQL_DESC_DATA_PTR	SQLPOINTER	Retrieve the data pointer field for *irec*.
SQL_DESC_LENGTH_PTR	SQLPOINTER	Retrieve the length pointer field for *irec*.
SQL_DESC_INDICATOR_PTR	SQLPOINTER	Retrieve the indicator pointer field for *irec*.

Usage

The number of records in the descriptor corresponds to the number of columns in the result set, if the descriptor is row descriptor, or the number of parameters, for a parameter descriptor.

Calling `SQLGetDescField()` with *fDescType* set to SQL_DESC_COUNT is an alternative to calling `SQLNumResultCols()` to determine whether any columns can be returned.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE
- SQL_NO_DATA_FOUND

Diagnostics

Table 85. SQLGetDescField SQLSTATEs

SQLSTATE	Description	Explanation
HY009	Invalid argument value	The value specified for the argument *fDescType* or *irec* was not valid. The argument *rgbDesc* or *sLen* was a null pointer.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.

References

- “SQLBindCol - Bind a Column to an Application Variable” on page 33
- “SQLDescribeCol - Describe Column Attributes” on page 76
- “SQLExecDirect - Execute a Statement Directly” on page 94
- “SQLExecute - Execute a Statement” on page 96
- “SQLPrepare - Prepare a Statement” on page 189

SQLGetDescRec - Get Descriptor Record

Purpose

SQLGetDescRec() obtains an entire record from a descriptor. SQLGetDescRec() is a more concise alternative to the SQLDescField() function.

Syntax

```
SQLRETURN SQLGetDescRec    (SQLHDESC       hdesc,
                            SQLSMALLINT    irec,
                            SQLCHAR        *rgbDesc,
                            SQLSMALLINT    cbDescMax,
                            SQLSMALLINT    *pcbDesc,
                            SQLSMALLINT    *type,
                            SQLSMALLINT    *subtype,
                            SQLINTEGER     *length,
                            SQLSMALLINT    *prec,
                            SQLSMALLINT    *scale,
                            SQLSMALLINT    *nullable);
```

Function Arguments

Table 86. SQLGetDescRec Arguments

Data Type	Argument	Use	Description
SQLHDESC	*hdesc*	Input	Descriptor handle
SQLSMALLINT	*irec*	Input	Record number from which the information is to be retrieved.
SQLCHAR *	*rgbDesc*	Output	NAME field for the record.
SQLSMALLINT	*cbDescMax*	Input	Maximum number of bytes to store in *rgbDesc*.
SQLSMALLINT *	*pcbDesc*	Output	Total length of the output data.
SQLSMALLINT *	*type*	Output	TYPE field for the record.
SQLSMALLINT *	*subtype*	Output	DATETIME_INTERVAL_CODE, for records whose TYPE is SQL_DATETIME.
SQLINTEGER *	*length*	Output	LENGTH field for the record.
SQLSMALLINT *	*prec*	Output	PRECISION field for the record.
SQLSMALLINT *	*scale*	Output	SCALE field for the record.
SQLSMALLINT *	*nullable*	Output	NULLABLE field for the record.

Usage

Calling SQLGetDescRec() retrieves all the data from a descriptor record in one call. It still may be necessary to call SQLGetDescField() with SQL_DESC_COUNT to determine the number of records in the descriptor.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE
- SQL_NO_DATA_FOUND

Diagnostics

Table 87. SQLGetDescRec SQLSTATEs

SQLSTATE	Description	Explanation
HY009	Invalid argument value	The value specified for the argument *irec* was not valid. The argument *rgbDesc*, *pcbDesc*, *type*,*subtype*, *length*, *prec*, *scale*, or *nullable* was a null pointer.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.

References

- “SQLBindCol - Bind a Column to an Application Variable” on page 33
- “SQLDescribeCol - Describe Column Attributes” on page 76
- “SQLExecDirect - Execute a Statement Directly” on page 94
- “SQLExecute - Execute a Statement” on page 96
- “SQLPrepare - Prepare a Statement” on page 189

SQLGetDiagField - Return Diagnostic Information (extensible)

Purpose

SQLGetDiagField() returns the diagnostic information associated with the most recently called DB2 UDB CLI function for a particular statement, connection or environment handle.

The information consists of a standardized SQLSTATE, native error code, and a text message. Refer to “Diagnostics in a DB2 UDB CLI application” on page 15 for more information.

Call SQLGetDiagField() after receiving a return code of SQL_ERROR or SQL_SUCCESS_WITH_INFO from another function call.

Note: Some database servers may provide product-specific diagnostic information after returning SQL_NO_DATA_FOUND from the execution of a statement.

Syntax

```
SQLRETURN SQLGetDiagField (SQLSMALLINT      htype,
                           SQLINTEGER       handle,
                           SQLSMALLINT      recNum,
                           SQLSMALLINT      diagId,
                           SQLPOINTER       diagInfo,
                           SQLSMALLINT      bLen,
                           SQLSMALLINT      *sLen);
```

Function Arguments

Table 88. SQLDiagField Arguments

Data Type	Argument	Use	Description
SQLSMALLINT	*hType*	Input	Handle type
SQLINTEGER	*handle*	Input	Handle for which the diagnostic information is desired.
SQLSMALLINT	*recNum*	Input	If there are multiple errors, this indicates which one should be retrieved. If header information is requested, this must be 0. The first error record is number 1.
SQLSMALLINT	*diagId*	Input	See Table 89.
SQLPOINTER	*diagInfo*	Output	Buffer for diagnostic information.
SQLSMALLINT	*bLen*	Input	Length of *diagInfo*, if requested data is a character string; otherwise, unused.
SQLSMALLINT *	*sLen*	Output	Length of complete diagnostic information, If the requested data is a character string; otherwise, unused.

Table 89. diagId types

Descriptor	Type	Description
SQL_DIAG_RETURNCODE	SMALLINT	Return code of the underlying function. May be SQL_SUCCESS, SQL_SUCCESS_WITH_INFO, SQL_NO_DATA_FOUND, or SQL_ERROR.

Table 89. diagId types (continued)

Descriptor	Type	Description
SQL_DIAG_NUMBER	INTEGER	The number of diagnostic records available for the specified handle.
SQL_DIAG_ROW_COUNT	INTEGER	The number of rows for the specified handle, if the handle is a statement handle.
SQL_DIAG_SQLSTATE	CHAR(5)	The 5-character SQLSTATE code relating to the diagnostic record. The SQLSTATE code provides a portable diagnostic indication.
SQL_DIAG_NATIVE	INTEGER	The implementation-defined error code relating to the diagnostic record. Portable applications should not base their behavior on this value.
SQL_DIAG_MESSAGE_TEXT	CHAR(254)	The implementation-defined message text relating to the diagnostic record.
SQL_DIAG_SERVER_NAME	CHAR(128)	The server name that the diagnostic record relates to, as it was supplied on the `SQLConnect()` statement that established the connection.

Usage

The SQLSTATEs are those defined by the X/OPEN SQL CAE and the X/Open SQL CLI snapshot, augmented with IBM specific and product specific SQLSTATE values.

If diagnostic information generated by one DB2 UDB CLI function is not retrieved before a function other than `SQLGetDiagField()` is called with the same handle, the information for the previous function call is lost. This is true whether or not diagnostic information is generated for the second DB2 UDB CLI function call.

Multiple diagnostic messages may be available after a given DB2 UDB CLI function call. These messages can be retrieved one at a time by repeatedly calling `SQLGetDiagField()`. For each message retrieved, `SQLGetDiagField()` returns SQL_SUCCESS and removes it from the list of messages available. When there are no more messages to retrieve, SQL_NO_DATA_FOUND is returned.

Diagnostic information stored under a given handle is cleared when a call is made to `SQLGetDiagField()` with that handle, or when another DB2 UDB CLI function call is made with that handle. However, information associated with a given handle type is not cleared by a call to `SQLGetDiagField()` with an associated but different handle type. For example, a call to `SQLGetDiagField()` with a connection handle input does not clear errors associated with any statement handles under that connection.

SQL_SUCCESS is returned even if the buffer for the error message (*szDiagFieldMsg*) is too short. This is because the application is not able to retrieve the same error message by calling `SQLGetDiagField()` again. The actual length of the message text is returned in the *pcbDiagFieldMsg*.

To avoid truncation of the error message, declare a buffer length of SQL_MAX_MESSAGE_LENGTH + 1. The message text will never be longer than this.

Return Codes

- SQL_SUCCESS
- SQL_ERROR
- SQL_INVALID_HANDLE
- SQL_NO_DATA_FOUND

SQL_NO_DATA_FOUND is returned if no diagnostic information is available for the input handle, or if all of the messages have been retrieved through calls to `SQLGetDiagField()`.

SQL_ERROR is returned if the argument diagInfo or sLen was a null pointer.

Diagnostics

SQLSTATEs are not defined, since `SQLGetDiagField()` does not generate diagnostic information for itself.

Restrictions

Although ODBC also returns X/Open SQL CAE SQLSTATEs, only DB2 UDB CLI returns the additional IBM defined SQLSTATEs. The ODBC Driver Manager also returns SQLSTATE values in addition to the standard ones. For more information on ODBC specific SQLSTATEs refer to *Microsoft ODBC Programmer's Reference*.

Because of this, you should only build dependencies on the standard SQLSTATEs. This means any branching logic in the application should only rely on the standard SQLSTATEs. The augmented SQLSTATEs are most useful for debugging purposes.

SQLGetDiagRec - Return Diagnostic Information (concise)

Purpose

SQLGetDiagRec() returns the diagnostic information associated with the most recently called DB2 UDB CLI function for a particular statement, connection or environment handle.

The information consists of a standardized SQLSTATE, native error code, and a text message. Refer to "Diagnostics in a DB2 UDB CLI application" on page 15 for more information.

Call SQLGetDiagRec() after receiving a return code of SQL_ERROR or SQL_SUCCESS_WITH_INFO from another function call.

Note: Some database servers may provide product-specific diagnostic information after returning SQL_NO_DATA_FOUND from the execution of a statement.

Syntax

```
SQLRETURN SQLGetDiagRec (SQLSMALLINT  hType,
                         SQLINTEGER   handle,
                         SQLSMALLINT  recNum,
                         SQLCHAR      *szSqlState,
                         SQLINTEGER   *pfNativeError,
                         SQLCHAR      *szErrorMsg,
                         SQLSMALLINT  cbErrorMsgMax,
                         SQLSMALLINT  *pcbErrorMsg);
```

Function Arguments

Table 90. SQLGetDiagRec Arguments

Data Type	Argument	Use	Description
SQLSMALLINT	*hType*	Input	Handle type
SQLINTEGER	*handle*	Input	Handle for which the diagnostic information is desired.
SQLSMALLINT	*recNum*	Input	If there are multiple errors, this indicates which one should be retrieved. If header information is requested, this must be 0. The first error record is number 1.
SQLCHAR *	*szSqlState*	Output	SQLSTATE as a string of 5 characters terminated by a null character. The first 2 characters indicate error class; the next 3 indicate subclass. The values correspond directly to SQLSTATE values defined in the X/Open SQL CAE specification and the ODBC specification, augmented with IBM specific and product specific SQLSTATE values.
SQLINTEGER *	*pfNativeError*	Output	Native error code. In DB2 UDB CLI, the *pfNativeError* argument contains the SQLCODE value returned by the DBMS. If the error is generated by DB2 UDB CLI and not the DBMS, then this field is set to -99999.

Table 90. SQLGetDiagRec Arguments (continued)

Data Type	Argument	Use	Description
SQLCHAR *	*szErrorMsg*	Output	Pointer to buffer to contain the implementation defined message text. In DB2 UDB CLI, only the DBMS generated messages are returned; DB2 UDB CLI itself does not return any message text describing the problem.
SQLSMALLINT	*cbErrorMsgMax*	Input	Maximum (that is, the allocated) length of the buffer *szErrorMsg*. The recommended length to allocate is SQL_MAX_MESSAGE_LENGTH + 1.
SQLSMALLINT *	*pcbErrorMsg*	Output	Pointer to total number of bytes available to return to the *szErrorMsg* buffer. This does not include the null termination character.

Usage

The SQLSTATEs are those defined by the X/OPEN SQL CAE and the X/Open SQL CLI snapshot, augmented with IBM specific and product specific SQLSTATE values.

If diagnostic information generated by one DB2 UDB CLI function is not retrieved before a function other than `SQLGetDiagRec()` is called with the same handle, the information for the previous function call is lost. This is true whether or not diagnostic information is generated for the second DB2 UDB CLI function call.

Multiple diagnostic messages may be available after a given DB2 UDB CLI function call. These messages can be retrieved one at a time by repeatedly calling `SQLGetDiagRec()`. For each message retrieved, `SQLGetDiagRec()` returns SQL_SUCCESS and removes it from the list of messages available. When there are no more messages to retrieve, SQL_NO_DATA_FOUND is returned, the SQLSTATE is set to ″00000″, *pfNativeError* is set to 0, and *pcbErrorMsg* and *szErrorMsg* are undefined.

Diagnostic information stored under a given handle is cleared when a call is made to `SQLGetDiagRec()` with that handle, or when another DB2 UDB CLI function call is made with that handle. However, information associated with a given handle type is not cleared by a call to `SQLGetDiagRec()` with an associated but different handle type. For example, a call to `SQLGetDiagRec()` with a connection handle input does not clear errors associated with any statement handles under that connection.

SQL_SUCCESS is returned even if the buffer for the error message (*szErrorMsg*) is too short since the application is not able to retrieve the same error message by calling `SQLGetDiagRec()` again. The actual length of the message text is returned in the *pcbErrorMsg*.

To avoid truncation of the error message, declare a buffer length of SQL_MAX_MESSAGE_LENGTH + 1. The message text is never be longer than this.

Return Codes

- SQL_SUCCESS
- SQL_ERROR
- SQL_INVALID_HANDLE
- SQL_NO_DATA_FOUND

SQL_NO_DATA_FOUND is returned if no diagnostic information is available for the input handle, or if all of the messages have been retrieved through calls to `SQLGetDiagRec()`.

SQL_ERROR is returned if the argument szSqlState, pfNativeError, szErrorMsg , or pcbErrorMsg was a null pointer.

Diagnostics

SQLSTATEs are not defined since SQLGetDiagRec() does not generate diagnostic information for itself.

Restrictions

Although ODBC also returns X/Open SQL CAE SQLSTATEs, only DB2 UDB CLI returns the additional IBM defined SQLSTATEs. The ODBC Driver Manager also returns SQLSTATE values in addition to the standard ones. For more information on ODBC specific SQLSTATEs refer to *Microsoft ODBC Programmer's Reference*.

Because of this, you should only build dependencies on the standard SQLSTATEs. This means any branching logic in the application should only rely on the standard SQLSTATEs. The augmented SQLSTATEs are most useful for debugging purposes.

References

- "SQLGetDiagField - Return Diagnostic Information (extensible)" on page 136

SQLGetEnvAttr - Returns Current Setting of An Environment Attribute

Purpose

SQLGetEnvAttr() returns the current settings for the specified environment attribute.

These options are set using the SQLSetEnvAttr() function.

Syntax

```
SQLRETURN SQLGetEnvAttr (SQLHENV      henv,
                         SQLINTEGER   Attribute,
                         SQLPOINTER   Value,
                         SQLINTEGER   BufferLength,
                         SQLINTEGER   *StringLength);
```

Function Arguments

Table 91. SQLGetEnvAttr Arguments

Data Type	Argument	Use	Description
SQLHENV	*henv*	Input	Environment handle
SQLINTEGER	*Attribute*	Input	Attribute to retrieve. Refer to Table 159 on page 221 for more information.
SQLPOINTER	*Value*	Output	Current value associated with *Attribute*. The type of the value returned depends on *Attribute*.
SQLINTEGER	*BufferLength*	Input	Maximum size of buffer pointed to by *Value*, if the attribute value is a character string; otherwise, unused.
SQLINTEGER *	*StringLength*	Output	Length in bytes of the output data if the attribute value is a character string; otherwise, unused.

If *Attribute* does not denote a string, then DB2 UDB CLI ignores *BufferLength* and does not set *StringLength*.

Usage

SQLGetEnvAttr() can be called at any time between the allocation and freeing of the environment handle. It obtains the current value of the environment attribute.

Diagnostics

Table 92. SQLGetEnvAttr SQLSTATEs

SQLSTATE	Description	Explanation
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Attribute out of range	An invalid *Attribute* value was specified. The argument *Value* or *StringLength* was a null pointer.

SQLGetFunctions - Get Functions

Purpose

SQLGetFunctions() queries whether a specific function is supported. This allows applications to adapt to varying levels of support when using different drivers.

SQLConnect() must be called, and a connection to the data source (database server) must exist before calling this function.

Syntax

```
SQLRETURN SQLGetFunctions (SQLHDBC        hdbc,
                           SQLSMALLINT    fFunction,
                           SQLSMALLINT    *pfSupported);
```

Function Arguments

Table 93. SQLGetFunctions Arguments

Data Type	Argument	Use	Description
SQLHDBC	*hdbc*	Input	Database connection handle
SQLSMALLINT	*fFunction*	Input	Function being queried
SQLSMALLINT *	*pfSupported*	Output	Pointer to location where this function returns SQL_TRUE or SQL_FALSE depending on whether the function being queried is supported.

Usage

Figure 4 shows the valid for the *fFunction* argument and whether the corresponding function is supported.

Note: The values marked with an asterisk are not supported when connected to a remote server.

```
SQL_API_ALLOCCONNECT      = TRUE
SQL_API_ALLOCENV          = TRUE
SQL_API_ALLOCHANDLE       = TRUE
SQL_API_ALLOCSTMT         = TRUE
SQL_API_BINDCOL           = TRUE
SQL_API_BINDFILETOCOL     = TRUE
SQL_API_BINDFILETOPARAM   = TRUE
SQL_API_BINDPARAM         = TRUE
SQL_API_BINDPARAMETER     = TRUE
SQL_API_CANCEL            = TRUE
SQL_API_CLOSECURSOR       = TRUE
```

Figure 4. Functions Supported (Part 1 of 2)

SQLGetFunctions

```
SQL_API_COLATTRIBUTES     = TRUE
SQL_API_COLUMNS           = TRUE
SQL_API_CONNECT           = TRUE
SQL_API_COPYDESC          = TRUE
SQL_API_DATASOURCES       = TRUE
SQL_API_DESCRIBECOL       = TRUE
SQL_API_DESCRIBEPARAM     = TRUE
SQL_API_DISCONNECT        = TRUE
SQL_API_DRIVERCONNECT     = TRUE
SQL_API_ENDTRAN           = TRUE
SQL_API_ERROR             = TRUE
SQL_API_EXECDIRECT        = TRUE
SQL_API_EXECUTE           = TRUE
SQL_API_EXTENDEDFETCH     = TRUE
SQL_API_FETCH             = TRUE
SQL_API_FOREIGNKEYS       = TRUE
SQL_API_FREECONNECT       = TRUE
SQL_API_FREEENV           = TRUE
SQL_API_FREEHANDLE        = TRUE
SQL_API_FREESTMT          = TRUE
SQL_API_GETCOL            = TRUE
SQL_API_GETCONNECTATTR    = TRUE
SQL_API_GETCONNECTOPTION  = TRUE
SQL_API_GETCURSORNAME     = TRUE
SQL_API_GETDATA           = TRUE
SQL_API_GETDESCFIELD      = TRUE
SQL_API_GETDESCREC        = TRUE
SQL_API_GETDIAGFIELD      = TRUE
SQL_API_GETDIAGREC        = TRUE
SQL_API_GETENVATTR        = TRUE
SQL_API_GETFUNCTIONS      = TRUE
SQL_API_GETINFO           = TRUE
SQL_API_GETLENGTH         = TRUE
SQL_API_GETPOSITION       = TRUE
SQL_API_GETSTMTATTR       = TRUE
SQL_API_GETSTMTOPTION     = TRUE
SQL_API_GETSUBSTRING      = TRUE
SQL_API_GETTYPEINFO       = TRUE
SQL_API_LANGUAGES         = TRUE
SQL_API_MORERESULTS       = TRUE
SQL_API_NATIVESQL         = TRUE
SQL_API_NUMPARAMS         = TRUE
SQL_API_NUMRESULTCOLS     = TRUE
SQL_API_PARAMDATA         = TRUE
SQL_API_PARAMOPTIONS      = TRUE
SQL_API_PREPARE           = TRUE
SQL_API_PRIMARYKEYS       = TRUE
SQL_API_PROCEDURECOLUMNS  = TRUE
SQL_API_PROCEDURES        = TRUE
SQL_API_PUTDATA           = TRUE
SQL_API_RELEASEENV        = TRUE
SQL_API_ROWCOUNT          = TRUE
SQL_API_SETCONNECTATTR    = TRUE
SQL_API_SETCONNECTOPTION  = TRUE
SQL_API_SETCURSORNAME     = TRUE
SQL_API_SETDESCFIELD      = TRUE
SQL_API_SETDESCREC        = TRUE
SQL_API_SETENVATTR        = TRUE
SQL_API_SETPARAM          = TRUE
SQL_API_SETSTMTATTR       = TRUE
SQL_API_SETSTMTOPTION     = TRUE
SQL_API_SPECIALCOLUMNS    = TRUE *
SQL_API_STATISTICS        = TRUE *
SQL_API_TABLES            = TRUE
SQL_API_TRANSACT          = TRUE
```

Figure 4. Functions Supported (Part 2 of 2)

Return Codes

- SQL_SUCCESS
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 94. SQLGetFunctions SQLSTATEs

SQLSTATE	Description	Explanation
40003 *	Statement completion unknown	The communication link between the CLI and the data source failed before the function completed processing.
58004	System error	Unrecoverable system error
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value.	The argument *pfSupported* was a null pointer.
HY010	Function sequence error. Connection handles must not be allocated yet.	SQLGetFunctions was called before SQLConnect.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.

SQLGetInfo - Get General Information

Purpose

SQLGetInfo() returns general information, (including supported data conversions) about the DBMS that the application is currently connected to.

Syntax

```
SQLRETURN SQLGetInfo (SQLHDBC        hdbc,
                      SQLSMALLINT    fInfoType,
                      SQLPOINTER     rgbInfoValue,
                      SQLSMALLINT    cbInfoValueMax,
                      SQLSMALLINT    *pcbInfoValue);
```

Function Arguments

Table 95. SQLGetInfo Arguments

Data Type	Argument	Use	Description
SQLHDBC	*hdbc*	Input	Database connection handle
SQLSMALLINT	*fInfoType*	Input	Type of information desired
SQLPOINTER	*rgbInfoValue*	Output (also input)	Pointer to buffer where this function stores the desired information. Depending on the type of information being retrieved, 4 types of information can be returned: • 16-bit integer value • 32-bit integer value • 32-bit binary value • Null-terminated character string
SQLSMALLINT	*cbInfoValueMax*	Input	Maximum length of the buffer pointed by *rgbInfoValue* pointer.
SQLSMALLINT *	*pcbInfoValue*	Output	Pointer to location where this function returns the total number of bytes available to return the desired information. If the value in the location pointed to by *pcbInfoValue* is greater than the size of the *rgbInfoValue* buffer as specified in *cbInfoValueMax*, then the string output information would be truncated to *cbInfoValueMax* - 1 bytes and the function would return with SQL_SUCCESS_WITH_INFO.

Usage

Table 96 on page 147 lists the possible values of *fInfoType* and a description of the information that SQLGetInfo() would return for that value.

Table 96. Information Returned By SQLGetInfo

fInfoType	**Format**	**Description and Notes**
SQL_ACTIVE_CONNECTIONS	Short int	The maximum number of active connections supported per application. Zero is returned, indicating that the limit is dependent on system resources.
SQL_ACTIVE_STATEMENTS	Short int	Maximum number of active statements per connection. Zero is returned, indicating that the limit is dependent on system resources.
SQL_AGGREGATE_FUNCTIONS	32–bit mask	A bitmask enumerating support for aggregation functions: • SQL_AF_ALL • SQL_AF_AVG • SQL_AF_COUNT • SQL_AF_DISTINCT • SQL_AF_MAX • SQL_AF_MIN • SQL_AF_SUM
SQL_CATALOG_NAME	string	A character string of ″Y″ indicates that the server supports catalog names. ″N″ indicates that catalog names are not supported.
SQL_COLUMN_ALIAS	String	Whether the connection supports column aliases. The value ″Y″ is returned if the connection supports the concept of a column alias.

Table 96. Information Returned By SQLGetInfo (continued)

fInfoType	**Format**	**Description and Notes**
SQL_CONVERT_BIGINT SQL_CONVERT_BINARY SQL_CONVERT_BLOB SQL_CONVERT_CHAR SQL_CONVERT_CLOB SQL_CONVERT_DATE SQL_CONVERT_DBCLOB SQL_CONVERT_DECIMAL SQL_CONVERT_DOUBLE SQL_CONVERT_FLOAT SQL_CONVERT_INTEGER SQL_CONVERT_LONGVARBINARY SQL_CONVERT_LONGVARCHAR SQL_CONVERT_NUMERIC SQL_CONVERT_REAL SQL_CONVERT_SMALLINT SQL_CONVERT_TIME SQL_CONVERT_TIMESTAMP SQL_CONVERT_VARBINARY SQL_CONVERT_VARCHAR SQL_CONVERT_WCHAR SQL_CONVERT_WLONGVARCHAR SQL_CONVERT_WVARCHAR	32–bit mask	Indicates the conversions supported by the data source with the CONVERT scalar function for data of the type named in the infoType. If the bitmask equals zero, the data source does not support any conversions for the data of the named type, including conversions to the same data type. For example, to find out if a data source supports the conversion of SQL_INTEGER data to the SQL_DECIMAL data type, an application calls SQLGetInfo() with finfoType of SQL_CONVERT_INTEGER. The application then ANDs the returned bitmask with SQL_CVT_DECIMAL. If the resulting value is nonzero then the conversion is supported. The following bitmasks are used to determine which conversions are supported: • SQL_CVT_BIGINT • SQL_CVT_BINARY • SQL_CONVERT_BLOB • SQL_CVT_CHAR • SQL_CONVERT_CLOB • SQL_CVT_DATE • SQL_CONVERT_DBCLOB • SQL_CVT_DECIMAL • SQL_CVT_DOUBLE • SQL_CVT_FLOAT • SQL_CVT_INTEGER • SQL_CVT_LONGVARBINARY • SQL_CVT_LONGVARCHAR • SQL_CVT_NUMERIC • SQL_CVT_REAL • SQL_CONVERT_SMALLINT • SQL_CONVERT_TIME • SQL_CONVERT_TIMESTAMP • SQL_CONVERT_VARBINARY • SQL_CONVERT_VARCHAR • SQL_CONVERT_WCHAR • SQL_CONVERT_WLONGVARCHAR • SQL_CONVERT_WVARCHAR
SQL_CONVERT_FUNCTIONS	32 bit-mask	Indicates the scalar conversion functions supported by the driver and associated data source: • SQL_FN_CVT_CONVERT – used to determine which conversion functions are supported. • SQL_FN_CVT_CAST – used to determine which cast functions are supported.

Table 96. Information Returned By SQLGetInfo (continued)

fInfoType	**Format**	**Description and Notes**
SQL_CORRELATION_NAME	Short int	Indicates the degree of correlation name support by the server: • SQL_CN_ANY – supported and can be any valid user-defined name. • SQL_CN_NONE – correlation name not supported. • SQL_CN_DIFFERENT – correlation name supported but it must be different than the name of the table that it represents.
SQL_CURSOR_COMMIT_BEHAVIOR	16–bit integer	Indicates how a COMMIT operation affects cursors. A value of: • SQL_CB_DELETE – destroys cursors and drops access plans for dynamic SQL statements. • SQL_CB_CLOSE – destroys cursors, but retains access plans for dynamic SQL statements (including non-query statements) • SQL_CB_PRESERVE – retains cursors and access plans for dynamic statements (including non-query statements). Applications can continue to fetch data, or close the cursor and re-execute the query without re-preparing the statement. Note: After COMMIT – a FETCH must be issued to reposition the cursor before actions such as positioned updates or deletes can be taken.
SQL_CURSOR_ROLLBACK_BEHAVIOR	16–bit integer	Indicates how a ROLLBACK operation affects cursors. A value of: • SQL_CB_DELETE – destroys cursors and drops access plans for dynamic SQL statements. • SQL_CB_CLOSE – destroys cursors, but retains access plans for dynamic SQL statements (including non-query statements) • SQL_CB_PRESERVE – retains cursors and access plans for dynamic statements (including non-query statements). Applications can continue to fetch data, or close the cursor and re-execute the query without re-preparing the statement. Note: DB2 servers do not have the SQL_CB_PRESERVE property.
SQL_DATA_SOURCE_NAME	String	Name of the connected data source for the connection handle.
SQL_DATA_SOURCE_READ_ONLY	String	A character string of ″Y″ indicates that the database is set to READ ONLY mode; an ″N″ indicates that it is not set to READ ONLY mode.

Table 96. Information Returned By SQLGetInfo (continued)

fInfoType	**Format**	**Description and Notes**
SQL_DBMS_NAME	String	Name of the DBMS product being accessed. For example: • QSQ for ″DB2 UDB for iSeries″ • SQL for ″DB2 UDB for OS/2″ • DSN for ″DB2 UDB for zOS and OS/390″
SQL_DBMS_VER	String	Version of the DBMS product accessed.
SQL_DEFAULT_TXN_ISOLATION	32–bit mask	The default transaction isolation level supported. One of the following masks are returned: • SQL_TXN_READ_UNCOMMITTED – Changes are immediately perceived by all transactions (dirty read, non-repeatable read, and phantoms are possible). This is equivalent to UR level. • SQL_TXN_READ_COMMITTED – Row read by transaction 1 can be altered and committed by transaction 2 (non-repeatable read and phantoms are possible) This is equivalent to CS level. • SQL_TXN_REPEATABLE_READ – A transaction can add or remove rows matching the search condition or a pending transaction (repeatable read, but phantoms are possible) This is equivalent to RS level. • SQL_TXN_SERIALIZABLE – Data affected by pending transaction is not available to other transactions (repeatable read, phantoms are not possible) This is equivalent to RR level. • SQL_TXN_VERSIONING – Not applicable to IBM DBMSs. • SQL_TXN_NOCOMMIT – Any chnages are effectively committed at the end of a successful operation; no explicit commit or rollback is allowed. This is a DB2 UDB for iSeries isolation level. In IBM terminology, • SQL_TXN_READ_UNCOMMITTED is uncommitted read; • SQL_TXN_READ_COMMITTED is cursor stability; • SQL_TXN_REPEATABLE_READ is read stability; • SQL_TXN_SERIALIZABLE is repeatable read.
SQL_DESCRIBE_PARAMETER	String	Y if parameters can be described; N if not.
SQL_DRIVER_NAME	String	File name of the driver used to access the data source.
SQL_DRIVER_ODBC_VER	String	The version number of ODBC that the Driver supports. DB2 ODBC returns `2.1`.

Table 96. Information Returned By SQLGetInfo (continued)

fInfoType	**Format**	**Description and Notes**
SQL_GROUP_BY	16–bit integer	Indicates the degree of support for the GROUP BY clause by the server: • SQL_GB_NO_RELATION – there is no relationship between the columns in the GROUP BY and in the SELECT list. • SQL_GB_NOT_SUPPORTED – GROUP BY not supported. • SQL_GB_GROUP_BY_EQUALS_SELECT – GROUP BY must include all non-aggregated columns in the select list. • SQL_GB_GROUP_BY_CONTAINS_SELECT – the GROUP BY clause must contain all non-aggregated columns in the SELECT list.
SQL_IDENTIFIER_CASE	16–bit integer	Indicates case sensitivity of object names (such as table-name). A value of: • SQL_IC_UPPER – identifier names are stored in upper case in the system catalog. • SQL_IC_LOWER – identifier names are stored in lower case in the system catalog. • SQL_IC_SENSITIVE – identifier names are case sensitive, and are stored in mixed case in the system catalog. • SQL_IC_MIXED – identifier names are not case sensitive, and are stored in mixed case in the system catalog. Note: Identifier names in IBM DBMSs are not case sensitive.
SQL_IDENTIFIER_QUOTE_CHAR	String	Character used as the delimiter of a quoted string.
SQL_LIKE_ESCAPE_CLAUSE	string	A character string that indicates if an escape character is supported for the metacharacters percent and underscore in a LIKE predicate.
SQL_MAX_CATALOG_NAME_LEN	16–bit integer	The maximum length of a catalog qualifier name; first part of a 3 part table name (in bytes).
SQL_MAX_COLUMN_NAME_LEN	Short int	Maximum length of a column name.
SQL_MAX_COLUMNS_IN_GROUP_BY	Short int	Maximum number of columns in a GROUP BY clause.
SQL_MAX_COLUMNS_IN_INDEX	Short int	Maximum number of columns in an SQL index.
SQL_MAX_COLUMNS_IN_ORDER_BY	Short int	Maximum number of columns in an ORDER BY clause.
SQL_MAX_COLUMNS_IN_SELECT	Short int	Maximum number of columns in a SELECT statement.
SQL_MAX_COLUMNS_IN_TABLE	Short int	Maximum number of columns in an SQL table.
SQL_MAX_CURSOR_NAME_LEN	Short int	Maximum length of a cursor name.
SQL_MAX_OWNER_NAME_LEN	Short int	Maximum length of an owner name.
SQL_MAX_ROW_SIZE	32–bit unsigned integer	Specifies the maximum length in bytes that the server supports in single row of a base table. Zero if no limit.

Table 96. Information Returned By SQLGetInfo (continued)

fInfoType	**Format**	**Description and Notes**
SQL_MAX_SCHEMA_NAME_LEN	Int	Maximum length of a schema name.
SQL_MAX_STATEMENT_LEN	32–bit unsigned integer	Indicates the maximum length of an SQL statement string in bytes, including the number of white spaces in the statement.
SQL_MAX_TABLE_NAME	Short int	Maximum length of a table name.
SQL_MAX_TABLES_IN_SELECT	Short int	Maximum number of tables in a SELECT statement.
SQL_MULTIPLE_ACTIVE_TXN	String	The character string ″Y″ indicates that active transactions on multiple connections are allowed. ″N″ indicates that only one connection at a time can have an active transaction.
SQL_NON_NULLABLE_COLUMNS	16–bit integer	Indicates whether non-nullable columns are supported: • SQL_NNC_NON_NULL – columns can be defined as NOT NULL. • SQL_NNC_NULL – columns can not be defined as NOT NULL.
SQL_NUMERIC_FUNCTIONS	32–bit mask	Indicates the scalar numeric functions supported. The following bit-masks are used to determine which numeric functions are supported: • SQL_FN_NUM_ABS • SQL_FN_NUM_ACOS • SQL_FN_NUM_ASIN • SQL_FN_NUM_ATAN • SQL_FN_NUM_ATAN2 • SQL_FN_NUM_CEILING • SQL_FN_NUM_COS • SQL_FN_NUM_COT • SQL_FN_NUM_DEGREES • SQL_FN_NUM_EXP • SQL_FN_NUM_FLOOR • SQL_FN_NUM_LOG • SQL_FN_NUM_LOG10 • SQL_FN_NUM_MOD • SQL_FN_NUM_PI • SQL_FN_NUM_POWER • SQL_FN_NUM_RADIANS • SQL_FN_NUM_RAND • SQL_FN_NUM_ROUND • SQL_FN_NUM_SIGN • SQL_FN_NUM_SIN • SQL_FN_NUM_SQRT • SQL_FN_NUM_TAN • SQL_FN_NUM_TRUNCATE
SQL_ODBC_API_CONFORMANCE	16–bit integer	The level of ODBC conformance: • SQL_OAC_NONE • SQL_OAC_LEVEL1 • SQL_OAC_LEVEL2

Table 96. Information Returned By SQLGetInfo (continued)

fInfoType	**Format**	**Description and Notes**
SQL_ODBC_SQL_CONFORMANCE	16–bit integer	A value of: • SQL_OSC_MINIMUM – means minimum ODBC SQL grammar supported • SQL_OSC_CORE – means core ODBC SQL Grammar supported • SQL_OSC_EXTENDED – means extended ODBC SQL Grammar supported For the definition of the above 3 types of ODBC SQL grammar, see Microsoft ODBC 3.0 Software Development Kit and Programmer's Reference.
SQL_ORDER_BY_COLUMNS_IN_SELECT	String	Set to ″Y″ if columns in the ORDER BY clauses must be in the select list; otherwise set to ″N″.
SQL_OUTER_JOINS	string	The character string: • ″Y″ indicates that outer joins are supported, and DB2 ODBC supports the ODBC outer join request syntax. • ″N″ indicates that it is not supported.
SQL_OWNER_TERM or SQL_SCHEMA_TERM	String	The database vendors terminology for a schema (owner).
SQL_OWNER_USAGE or SQL_SCHEMA_USAGE	32–bit mask	Indicates the type of SQL statements that have schema (owners) associated with them when these statements are executed. Schema qualifiers (owners) are: • SQL_OU_DML_STATEMENTS – supported in all DML statements. • SQL_OU_PROCEDURE_INVOCATION – supported in the procedure invocation statement. • SQL_OU_TABLE_DEFINITION – supported in all table definition statements. • SQL_OU_INDEX_DEFINITION – supported in all index definition statements. • SQL_OU_PRIVILEGE_DEFINITION – supported in all privilege definition statements (that is grant and revoke statements).
SQL_POSITIONED_STATEMENTS	32–bit mask	Indicates the degree of support for positioned UPDATE and positioned DELETE statements: • SQL_PS_POSITIONED_DELETE • SQL_PS_POSITIONED_UPDATE • SQL_PS_SELECT_FOR_UPDATE, indicates whether or not the server requires the FOR UPDATE clause to be specified on a <query expression> in order for a column to be updateable via the cursor.
SQL_PROCEDURE_TERM	String	Data source name for a procedure.
SQL_PROCEDURES	String	Whether the current server supports SQL procedures. The value ″Y″ is returned if the connection supports SQL procedures.

Table 96. Information Returned By SQLGetInfo (continued)

fInfoType	**Format**	**Description and Notes**
SQL_QUALIFIER_LOCATION or SQL_CATALOG_LOCATION	16–bit integer	A 16-bit integer value indicated the position of the qualifier in a qualified table name. Zero indicates that qualified names are not supported.
SQL_QUALIFIER_NAME_SEPARATOR or SQL_CATALOG_NAME_SEPARATOR	String	The characters used as a separator between a catalog name and the qualified name element that follows it.
SQL_QUALIFIER_TERM or SQL_CATALOG_TERM	String	The database vendor terminology for a qualifier. The name that the vendor uses for the high order part of a three part name. Since DB2 ODBC does not support three part names, a zero-length string is returned. For non-ODBC applications, the SQL_CATALOG_TERM symbolic name should be used instead of SQL_QUALIFIER_NAME.
SQL_QUALIFIER_USAGE or SQL_CATALOG_USAGE	32–bit mask	This is similar to SQL_OWNER_USAGE except that this is used for catalog.
SQL_QUOTED_IDENTIFIER_CASE	16–bit integer	Returns: • SQL_IC_UPPER – quoted identifiers in SQL are case insensitive and stored in upper case in the system catalog. • SQL_IC_LOWER – quoted identifiers in SQL are case insensitive and are stored in lower case in the system catalog. • SQL_IC_SENSITIVE – quoted identifiers (delimited identifiers) in SQL are case sensitive and are stored in mixed case in the system catalog. • SQL_IC_MIXED – quoted identifiers in SQL are case insensitive and are stored in mixed case in the system catalog. This should be contrasted with the SQL_IDENTIFIER_CASE fInfoType which is used to determine how (unquoted) identifiers are stored in the system catalog.
SQL_SEARCH_PATTERN_ESCAPE	string	Used to specify what the driver supports as an escape character for catalog functions such as (`SQLTables()`, `SQLColumns()`).

Table 96. Information Returned By SQLGetInfo (continued)

fInfoType	**Format**	**Description and Notes**
SQL_SQL92_PREDICATES	32–bit mask	Indicates the predicates supported in a SELECT statement that SQL-92 defines. • SQL_SP_BETWEEN • SQL_SP_COMPARISON • SQL_SP_EXISTS • SQL_SP_IN • SQL_SP_ISNOTNULL • SQL_SP_ISNULL • SQL_SP_LIKE • SQL_SP_MATCH_FULL • SQL_SP_MATCH_PARTIAL • SQL_SP_MATCH_UNIQUE_FULL • SQL_SP_MATCH_UNIQUE_PARTIAL • SQL_SP_OVERLAPS • SQL_SP_QUANTIFIED_COMPARISON • SQL_SP_UNIQUE
SQL_SQL92_VALUE_EXPRESSIONS	32–bit mask	Indicates the value expressions supported that SQL-92 defines. • SQL_SVE_CASE • SQL_SVE_CAST • SQL_SVE_COALESCE • SQL_SVE_NULLIF
SQL_STRING_FUNCTIONS	32–bit bitmask	Indicates which string functions are supported. The following bit-masks are used to determine which string functions are supported: • SQL_FN_STR_ASCII • SQL_FN_STR_CHAR • SQL_FN_STR_CONCAT • SQL_FN_STR_DIFFERENCE • SQL_FN_STR_INSERT • SQL_FN_STR_LCASE • SQL_FN_STR_LEFT • SQL_FN_STR_LENGTH • SQL_FN_STR_LOCATE • SQL_FN_STR_LOCATE_2 • SQL_FN_STR_LTRIM • SQL_FN_STR_REPEAT • SQL_FN_STR_REPLACE • SQL_FN_STR_RIGHT • SQL_FN_STR_RTRIM • SQL_FN_STR_SOUNDEX • SQL_FN_STR_SPACE • SQL_FN_STR_SUBSTRING • SQL_FN_STR_UCASE If an application can call the LOCATE scalar function with the string1, string2, and start arguments, the SQL_FN_STR_LOCATE bitmask is returned. If an application can only call the LOCATE scalar function with the string1 and string2, the SQL_FN_STR_LOCATE_2 bitmask is returned. If the LOCATE scalar function is fully supported, both bitmasks are returned.

Table 96. Information Returned By SQLGetInfo (continued)

fInfoType	**Format**	**Description and Notes**
SQL_TIMEDATE_FUNCTIONS	32–bit mask	Indicates which time and date functions are supported. The following bit-masks are used to determine which date functions are supported: • SQL_FN_TD_CURDATE • SQL_FN_TD_CURTIME • SQL_FN_TD_DAYNAME • SQL_FN_TD_DAYOFMONTH • SQL_FN_TD_DAYOFWEEK • SQL_FN_TD_DAYOFYEAR • SQL_FN_TD_HOUR • SQL_FN_TD_JULIAN_DAY • SQL_FN_TD_MINUTE • SQL_FN_TD_MONTH • SQL_FN_TD_MONTHNAME • SQL_FN_TD_NOW • SQL_FN_TD_QUARTER • SQL_FN_TD_SECOND • SQL_FN_TD_SECONDS_SINCE_MIDNIGHT • SQL_FN_TD_TIMESTAMPADD • SQL_FN_TD_TIMESTAMPDIFF • SQL_FN_TD_WEEK • SQL_FN_TD_YEAR
SQL_TXN_CAPABLE	Short int	Indicates whether transactions can contain DDL or DML or both: • SQL_TC_NONE – transactions not supported. • SQL_TC_DML – transactions can only contain DML statements (SELECT, INSERT, UPDATE, DELETE, etc.) DDL statements (CREATE TABLE, DROP INDEX, etc.) encountered in a transaction cause an error. • SQL_TC_DDL_COMMIT – transactions can only contain DML statements. DDL statements encountered in a transaction cause the transaction to be committed. • SQL_TC_DDL_IGNORE – transactions can only contain DML statements. DDL statements encountered in a transaction are ignored. • SQL_TC_ALL – transactions can contain DDL and DML statements in any order.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 97. SQLGetInfo SQLSTATEs

SQLSTATE	Description	Explanation
01004	Data truncated	The requested information was returned as a null-terminated string and its length exceeded the length of the application buffer as specified in *cbInfoValueMax*. The argument *pcbInfoValue* contains the actual (not truncated) length of the requested information.
08003	Connection not open	The type of information requested in *fInfoType* requires an open connection. Only SQL_ODBC_VER does not require an open connection.
40003 *	Statement completion unknown	The communication link between the CLI and the data source failed before the function completed processing.
58004	System error	Unrecoverable system error
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	The argument *rgbInfoValue* was a null pointer An invalid *fInfoType* was specified.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.

SQLGetLength - Retrieve Length of A String Value

Purpose

SQLGetLength() is used to retrieve the length of a large object value, referenced by a large object locator that has been returned from the server (as a result of a fetch, or an SQLGetSubString() call) during the current transaction.

Syntax

```
SQLRETURN  SQLGetLength      (SQLHSTMT          StatementHandle,
                              SQLSMALLINT       LocatorCType,
                              SQLINTEGER        Locator,
                              SQLINTEGER        *StringLength,
                              SQLINTEGER        *IndicatorValue);
```

Function Arguments

Table 98. SQLGetLength Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*StatementHandle*	input	Statement handle. This can be any statement handle which has been allocated but which does not currently have a prepared statement assigned to it.
SQLSMALLINT	*LocatorCType*	input	The C type of the source LOB locator. This may be: • SQL_C_BLOB_LOCATOR • SQL_C_CLOB_LOCATOR • SQL_C_DBCLOB_LOCATOR
SQLINTEGER	*Locator*	input	Must be set to the LOB locator value.
SQLINTEGER *	*StringLength*	output	The length of the specified locator.[a] If the pointer is set to NULL then the SQLSTATE **HY**009 is returned.
SQLINTEGER *	*IndicatorValue*	output	Always set to zero.

Note: a. This is in bytes even for DBCLOB data.

Usage

SQLGetLength() can be used to determine the length of the data value represented by a LOB locator. It is used by applications to determine the overall length of the referenced LOB value so that the appropriate strategy to obtain some or all of the LOB value can be chosen.

The Locator argument can contain any valid LOB locator which has not been explicitly freed using a FREE LOCATOR statement nor implicitly freed because the transaction during which it was created has terminated.

The statement handle must not have been associated with any prepared statements or catalog function calls.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_STILL_EXECUTING
- SQL_ERROR
- SQL_INVALID_HANDLE

Error Conditions

Table 99. SQLGetLength SQLSTATEs

SQLSTATE	Description	Explanation
07006	Invalid conversion	The combination of *LocatorCType* and *Locator* is not valid.
58004	Unexpected system failure	Unrecoverable system error.
HY003	Program type out of range	*LocatorCType* is not one of SQL_C_CLOB_LOCATOR, SQL_C_BLOB_LOCATOR, or SQL_C_DBCLOB_LOCATOR.
HY009	Invalid argument value	The argument *StringLength* or *IndicatorValue* was a null pointer.
HY010	Function sequence error	The specified *StatementHandle* is not in an *allocated* state.
HYC00	Driver not capable	The application is currently connected to a data source that does not support large objects.
0F001	Invalid LOB variable	The value specified for *Locator* has not been associated with a LOB locator.

Restrictions

This function is not available when connected to a DB2 server that does not support Large Objects.

References

- "SQLBindCol - Bind a Column to an Application Variable" on page 33
- "SQLFetch - Fetch Next Row" on page 101
- "SQLGetPosition - Return Starting Position of String" on page 160
- "SQLGetSubString - Retrieve Portion of A String Value" on page 166

SQLGetPosition - Return Starting Position of String

Purpose

SQLGetPosition() is used to return the starting position of one string within a LOB value (the source). The source value must be a LOB locator, the search string can be a LOB locator or a literal string.

The source and search LOB locators can be any that have been returned from the database from a fetch or a SQLGetSubString() call during the current transaction.

Syntax

```
SQLRETURN   SQLGetPosition   (SQLHSTMT          StatementHandle,
                              SQLSMALLINT       LocatorCType,
                              SQLINTEGER        SourceLocator,
                              SQLINTEGER        SearchLocator,
                              SQLCHAR           *SearchLiteral,
                              SQLINTEGER        SearchLiteralLength,
                              SQLINTEGER        FromPosition,
                              SQLINTEGER        *LocatedAt,
                              SQLINTEGER        *IndicatorValue);
```

Function Arguments

Table 100. SQLGetPosition Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*StatementHandle*	input	Statement handle. This can be any statement handle which has been allocated but which does not currently have a prepared statement assigned to it.
SQLSMALLINT	*LocatorCType*	input	The C type of the source LOB locator. This may be: • SQL_C_BLOB_LOCATOR • SQL_C_CLOB_LOCATOR • SQL_C_DBCLOB_LOCATOR
SQLINTEGER	*SourceLocator*	input	*SourceLocator* must be set to the source LOB locator.
SQLINTEGER	*SearchLocator*	input	If the *SearchLiteral* pointer is NULL and if *SearchLiteralLength* is set to 0, then *SearchLocator* must be set to the LOB locator associated with the search string; otherwise, this argument is ignored.
SQLCHAR *	*SearchLiteral*	input	This argument points to the area of storage that contains the search string literal. If *SearchLiteralLength* is 0, this pointer must be NULL.
SQLINTEGER	*SearchLiteralLength*	input	The length of the string in *SearchLiteral*(in bytes).[a] If this argument value is 0, then the argument *SearchLocator* is meaningful.
SQLINTEGER	*FromPosition*	input	For BLOBs and CLOBs, this is the position of the first byte within the source string at which the search is to start. to be returned by the function. For DBCLOBs, this is the first character. The start byte or character is numbered 1.

Table 100. SQLGetPosition Arguments (continued)

Data Type	Argument	Use	Description
SQLINTEGER *	*LocatedAt*	output	For BLOBs and CLOBs, this is the byte position at which the string was located or, if not located, the value zero. For DBCLOBs, this is the character position. If the length of the source string is zero, the value 1 is returned.
SQLINTEGER *	*IndicatorValue*	output	Always set to zero.

Note:

a This is in bytes even for DBCLOB data.

Usage

`SQLGetPosition()` is used in conjunction with `SQLGetSubString()` in order to obtain any portion of a string in a random manner. In order to use `SQLGetSubString()`, the location of the substring within the overall string must be known in advance. In situations where the start of that substring can be found by a search string, `SQLGetPosition()` can be used to obtain the starting position of that substring.

The *Locator* and *SearchLocator* (if used) arguments can contain any valid LOB locator which has not been explicitly freed using a FREE LOCATOR statement or implicitly freed because the transaction during which it was created has terminated.

The *Locator* and *SearchLocator* must have the same LOB locator type.

The statement handle must not have been associated with any prepared statements or catalog function calls.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_STILL_EXECUTING
- SQL_ERROR
- SQL_INVALID_HANDLE

Error Conditions

Table 101. SQLGetPosition SQLSTATEs

SQLSTATE	Description	Explanation
07006	Invalid conversion	The combination of *LocatorCType* and either of the LOB locator values is not valid.
42818	Invalid length	The length of the pattern is too long.
58004	Unexpected system failure	Unrecoverable system error.
HY009	Invalid argument value	The argument *LocatedAt* or *IndicatorValue* was a null pointer. The argument value for *FromPosition* was not greater than 0. *LocatorCType* is not one of SQL_C_CLOB_LOCATOR, SQL_C_BLOB_LOCATOR, or SQL_C_DBCLOB_LOCATOR.
HY010	Function sequence error	The specified *StatementHandle* is not in an *allocated* state.

Table 101. SQLGetPosition SQLSTATEs (continued)

SQLSTATE	Description	Explanation
HY090	Invalid string or buffer length	The value of *SearchLiteralLength* was less than 1, and not SQL_NTS.
HYC00	Driver not capable	The application is currently connected to a data source that does not support large objects.
0F001	Invalid LOB variable	The value specified for *Locator* or *SearchLocator* is not currently a LOB locator.

Restrictions

This function is not available when connected to a DB2 server that does not support Large Objects.

References

- "SQLBindCol - Bind a Column to an Application Variable" on page 33
- "SQLExtendedFetch - Fetch Array of Rows" on page 98
- "SQLFetch - Fetch Next Row" on page 101
- "SQLGetLength - Retrieve Length of A String Value" on page 158
- "SQLGetSubString - Retrieve Portion of A String Value" on page 166

SQLGetStmtAttr - Get the Value of a Statement Attribute

Purpose

SQLGetStmtAttr() returns the current settings of the specified statement attribute.

These options are set using the SQLSetStmtAttr() function. This function is similar to SQLGetStmtOption(), both functions are supported for compatibility reasons.

Syntax

```
SQLRETURN SQLGetStmtAttr( SQLHSTMT        hstmt,
                          SQLINTEGER      fAttr,
                          SQLPOINTER      pvParam,
                          SQLINTEGER      bLen,
                          SQLINTEGER      *sLen);
```

Function Arguments

Table 102. SQLGetStmtAttr Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle
SQLINTEGER	*fAttr*	Input	Attribute to retrieve. Refer to Table 103 for more information.
SQLPOINTER	*pvParam*	Output	Pointer to buffer for requested attribute.
SQLINTEGER	*bLen*	Input	Maximum number of bytes to store in *pvParam*, if the attribute is a character string; otherwise, unused.
SQLINTEGER *	*sLen*	Output	Length of output data if the attribute is a character string; otherwise, unused.

Usage

Table 103. Statement Attributes

fAttr	Data Type	Contents
SQL_ATTR_FOR_FETCH_ONLY	Integer	Indicates if cursors opened for this statement handle should be read-only. • SQL_FALSE - Cursors can be used for positioned updates and deletes. This is the default. • SQL_TRUE - Cursors are read-only and cannot be used for positioned updates or deletes.
SQL_ATTR_APP_ROW_DESC	Integer	The descriptor handle for the application to retrieve row data using the statement handle.
SQL_ATTR_APP_PARAM_DESC	Integer	The descriptor handle used by the application to provide parameter values for this statement handle.

Table 103. Statement Attributes (continued)

fAttr	Data Type	Contents
SQL_ATTR_CURSOR_SCROLLABLE	Integer	A 32-bit integer value that specifies if cursors opened for this statement handle should be scrollable. • SQL_FALSE – Cursors are not scrollable, and `SQLFetchScroll()` cannot be used against them. This is the default. • SQL_TRUE – Cursors are scrollable. `SQLFetchScroll()` can be used to retrieve data from these cursors.
SQL_ATTR_CURSOR_TYPE	Integer	A 32-bit integer value that specifies the behavior of cursors opened for this statement handle. • SQL_CURSOR_FORWARD_ONLY – Cursors are not scrollable, and `SQLFetchScroll()` cannot be used against them. This is the default. • SQL_DYNAMIC – Cursors are scrollable. `SQLFetchScroll()` can be used to retrieve data from these cursors.
SQL_ATTR_IMP_ROW_DESC	Integer	The descriptor handle used by the CLI implementation to retrieve row data using this statement handle.
SQL_ATTR_IMP_PARAM_DESC	Integer	The descriptor handle used by the CLI implementation to provide parameter values for this statement handle.
SQL_ATTR_ROWSET_SIZE	Integer	A 32–bit integer value that specifies the number of rows in the rowset. This is the number of rows returned by each call to `SQLExtendedFetch()`. The default value is 1.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 104. SQLStmtOption SQLSTATEs

SQLSTATE	Description	Explanation
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	The argument *pvParam* was a null pointer. An invalid *fAttr* value was specified.
HYC00	Driver not capable	DB2 UDB CLI recognizes the option but does not support it.

SQLGetStmtOption - Returns Current Setting of A Statement Option

Purpose

SQLGetStmtOption() returns the current settings of the specified statement option.

These options are set using the SQLSetStmtOption() function.

Syntax

```
SQLRETURN SQLGetStmtOption( SQLHSTMT        hstmt,
                            SQLSMALLINT     fOption,
                            SQLPOINTER      pvParam);
```

Function Arguments

Table 105. SQLStmtOption Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Connection handle
SQLSMALLINT	*fOption*	Input	Option to retreive. Refer to Table 103 on page 163 for more information.
SQLPOINTER	*pvParam*	Output	Value of the option. Depending on the value of *fOption* this can be a 32-bit integer value, or a pointer to a null terminated character string.

Usage

SQLGetStmtOption() provides the same function as SQLGetStmtAttr(), both functions are supported for compatibility reasons.

See Table 103 on page 163 for a list of statement options.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 106. SQLStmtOption SQLSTATEs

SQLSTATE	Description	Explanation
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	The argument *pvParam* was a null pointer. An invalid *fOption* value was specified.
HYC00	Driver not capable	DB2 UDB CLI recognizes the option but does not support it.

SQLGetSubString - Retrieve Portion of A String Value

Purpose

SQLGetSubString() is used to retrieve a portion of a large object value, referenced by a large object locator that has been returned from the server (returned by a fetch or a previous SQLGetSubString() call) during the current transaction.

Syntax

```
SQLRETURN  SQLGetSubString   (
                SQLHSTMT          StatementHandle,
                SQLSMALLINT       LocatorCType,
                SQLINTEGER        SourceLocator,
                SQLINTEGER        FromPosition,
                SQLINTEGER        ForLength,
                SQLSMALLINT       TargetCType,
                SQLPOINTER        DataPtr,
                SQLINTEGER        BufferLength,
                SQLINTEGER        *StringLength,
                SQLINTEGER        *IndicatorValue);
```

Function Arguments

Table 107. SQLGetSubString Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*StatementHandle*	input	Statement handle. This can be any statement handle which has been allocated but which does not currently have a prepared statement assigned to it.
SQLSMALLINT	*LocatorCType*	input	The C type of the source LOB locator. This may be: • SQL_C_BLOB_LOCATOR • SQL_C_CLOB_LOCATOR • SQL_C_DBCLOB_LOCATOR
SQLINTEGER	*SourceLocator*	input	*SourceLocator* must be set to the source LOB locator value.
SQLINTEGER	*FromPosition*	input	For BLOBs and CLOBs, this is the position of the first byte to be returned by the function. For DBCLOBs, this is the first character. The start byte or character is numbered 1.
SQLINTEGER	*ForLength*	input	This is the length of the string to be returned by the function. For BLOBs and CLOBs, this is the length in bytes. For DBCLOBs, this is the length in characters. If *FromPosition* is less than the length of the source string but *FromPosition* + *ForLength* - 1 extends beyond the end of the source string, the result is padded on the right with the necessary number of characters (X'00' for BLOBs, single byte blank character for CLOBs, and double byte blank character for DBCLOBs).
SQLSMALLINT	*TargetCType*	input	The C data type of the *DataPtr*. The target must be a C string variable (SQL_C_CHAR, SQL_C_WCHAR, SQL_C_BINARY, or SQL_C_DBCHAR).
SQLPOINTER	*DataPtr*	output	Pointer to the buffer where the retrieved string value or a LOB locator is to be stored.

Table 107. SQLGetSubString Arguments (continued)

Data Type	Argument	Use	Description
SQLINTEGER	*BufferLength*	input	Maximum size of the buffer pointed to by *DataPtr* in bytes.
SQLINTEGER *	*StringLength*	output	The length of the returned information in *DataPtr* in bytes[a] if the target C buffer type is intended for a binary or character string variable and not a locator value. If the pointer is set to NULL, nothing is returned.
SQLINTEGER *	*IndicatorValue*	output	Always set to zero.

Note:

a This is in bytes even for DBCLOB data.

Usage

`SQLGetSubString()` is used to obtain any portion of the string that is represented by the LOB locator. There are two choices for the target:

- The target can be an appropriate C string variable.
- A new LOB value can be created on the server and the LOB locator for that value can be assigned to a target application variable on the client.

`SQLGetSubString()` can be used as an alternative to `SQLGetData` for getting data in pieces. In this case a column is first bound to a LOB locator, which is then used to fetch the LOB as a whole or in pieces.

The Locator argument can contain any valid LOB locator which has not been explicitly freed using a FREE LOCATOR statement nor implicitly freed because the transaction during which it was created has terminated.

The statement handle must not have been associated with any prepared statements or catalog function calls.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_STILL_EXECUTING
- SQL_ERROR
- SQL_INVALID_HANDLE

Error Conditions

Table 108. SQLGetSubString SQLSTATEs

SQLSTATE	Description	Explanation
01004	Data truncated	The amount of data to be returned is longer than *BufferLength*. Actual length available for return is stored in *StringLength*.
07006	Invalid conversion	The value specified for *TargetCType* was not SQL_C_CHAR, SQL_C_BINARY, SQL_C_DBCHAR or a LOB locator. The value specified for *TargetCType* is inappropriate for the source (for example SQL_C_DBCHAR for a BLOB column).
22011	Substring error occurred	*FromPosition* is greater than the of length of the source string.

Table 108. SQLGetSubString SQLSTATEs (continued)

SQLSTATE	Description	Explanation
58004	Unexpected system failure	Unrecoverable system error.
HY003	Program type out of range	*LocatorCType* is not one of SQL_C_CLOB_LOCATOR, SQL_C_BLOB_LOCATOR, or SQL_C_DBCLOB_LOCATOR.
HY009	Invalid argument value	The value specified for *FromPosition* or *ForLength* was not a positive integer. The argument *DataPtr*, *StringLength*, or *IndicatorValue* was a null pointer
HY010	Function sequence error	The specified *StatementHandle* is not in an *allocated* state.
HY090	Invalid string or buffer length	The value of *BufferLength* was less than 0.
HYC00	Driver not capable	The application is currently connected to a data source that does not support large objects.
0F001	No locator currently assigned	The value specified for *Locator* is not currently a LOB locator.

Restrictions

This function is not available when connected to a DB2 server that does not support Large Objects.

References

- “SQLBindCol - Bind a Column to an Application Variable” on page 33
- “SQLFetch - Fetch Next Row” on page 101
- “SQLGetData - Get Data From a Column” on page 130
- “SQLGetLength - Retrieve Length of A String Value” on page 158
- “SQLGetPosition - Return Starting Position of String” on page 160

SQLGetTypeInfo - Get Data Type Information

Purpose

SQLGetTypeInfo() returns information about the data types that are supported by the DBMSs associated with DB2 UDB CLI. The information is returned in an SQL result set. The columns can be received using the same functions that are used to process a query.

Syntax

```
SQLRETURN   SQLGetTypeInfo   (SQLHSTMT          StatementHandle,
                              SQLSMALLINT       DataType);
```

Function Arguments

Table 109. SQLGetTypeInfo Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*StatementHandle*	input	Statement handle.
SQLSMALLINT	*DataType*	input	The SQL data type being queried. The supported types are: • SQL_ALL_TYPES • SQL_BIGINT • SQL_CHAR • SQL_DATE • SQL_DECIMAL • SQL_DOUBLE • SQL_FLOAT • SQL_GRAPHIC • SQL_INTEGER • SQL_NUMERIC • SQL_REAL • SQL_SMALLINT • SQL_TIME • SQL_TIMESTAMP • SQL_VARCHAR • SQL_VARGRAPHIC If SQL_ALL_TYPES is specified, information about all supported data types would be returned in ascending order by TYPE_NAME. All unsupported data types would be absent from the result set.

Usage

Since SQLGetTypeInfo() generates a result set and is equivalent to executing a query, it will generate a cursor and begin a transaction. To prepare and execute another statement on this statement handle, the cursor must be closed.

If SQLGetTypeInfo() is called with a *DataType* that is not valid, an empty result set is returned.

The columns of the result set that is generated by this function are described below.

SQLGetTypeInfo

Although new columns might be added and the names of the existing columns might be changed in future releases, the position of the current columns will not change. The data types that are returned are those that can be used in a CREATE TABLE, ALTER TABLE, DDL statement. Non-persistent data types are not part of the returned result set. User-defined data types are not returned either.

Table 110. Columns Returned by SQLGetTypeInfo

Column Number/Name	Data Type	Description
1 TYPE_NAME	VARCHAR(128) NOT NULL	Character representation of the SQL data type name (for example, VARCHAR, DATE, INTEGER).
2 DATA_TYPE	SMALLINT NOT NULL	SQL data type define values (for example, SQL_VARCHAR, SQL_DATE, SQL_INTEGER).
3 COLUMN_SIZE	INTEGER	If the data type is a character or binary string, then this column contains the maximum length in bytes; if it is a graphic (DBCS) string, this is the number of double byte characters for the column. For date, time, timestamp data types, this is the total number of characters required to display the value when converted to character. For numeric data types, this is the total number of digits.
4 LITERAL_PREFIX	VARCHAR(128)	Character that DB2 recognizes as a prefix for a literal of this data type. This column is null for data types where a literal prefix is not applicable.
5 LITERAL_SUFFIX	VARCHAR(128)	Character that DB2 recognizes as a suffix for a literal of this data type. This column is null for data types where a literal prefix is not applicable.
6 CREATE_PARAMS	VARCHAR(128)	The text of this column contains a list of keywords, separated by commas, corresponding to each parameter the application may specify in parenthesis when using the name in the TYPE_NAME column as a data type in SQL. The keywords in the list can be any of the following: LENGTH, PRECISION, SCALE. They appear in the order that the SQL syntax requires that they be used. A NULL indicator is returned if there are no parameters for the data type definition, (such as INTEGER). **Note:** The intent of CREATE_PARAMS is to enable an application to customize the interface for a *DDL builder*. An application should expect, using this, only to be able to determine the number of arguments required to define the data type and to have localized text that could be used to label an edit control.
7 NULLABLE	SMALLINT NOT NULL	Indicates whether the data type accepts a NULL value • Set to SQL_NO_NULLS if NULL values are disallowed. • Set to SQL_NULLABLE if NULL values are allowed.
8 CASE_SENSITIVE	SMALLINT NOT NULL	Indicates whether the data type can be treated as case sensitive for collation purposes; valid values are SQL_TRUE and SQL_FALSE.

Table 110. Columns Returned by SQLGetTypeInfo (continued)

Column Number/Name	Data Type	Description
9 SEARCHABLE	SMALLINT NOT NULL	Indicates how the data type is used in a WHERE clause. Valid values are: • SQL_UNSEARCHABLE – if the data type cannot be used in a WHERE clause. • SQL_LIKE_ONLY – if the data type can be used in a WHERE clause only with the LIKE predicate. • SQL_ALL_EXCEPT_LIKE – if the data type can be used in a WHERE clause with all comparison operators except LIKE. • SQL_SEARCHABLE – if the data type can be used in a WHERE clause with any comparison operator.
10 UNSIGNED_ATTRIBUTE	SMALLINT	Indicates where the data type is unsigned. The valid values are: SQL_TRUE, SQL_FALSE or NULL. A NULL indicator is returned if this attribute is not applicable to the data type.
11 FIXED_PREC_SCALE	SMALLINT NOT NULL	Contains the value SQL_TRUE if the data type is exact numeric and always has the same precision and scale; otherwise, it contains SQL_FALSE.
12 AUTO_INCREMENT	SMALLINT	Contains SQL_TRUE if a column of this data type is automatically set to a unique value when a row is inserted; otherwise, contains SQL_FALSE.
13 LOCAL_TYPE_NAME	VARCHAR(128)	This column contains any localized (native language) name for the data type that is different from the regular name of the data type. If there is no localized name, this column is NULL. This column is intended for display only. The character set of the string is locale-dependent and is typically the default character set of the database.

Return Codes

- SQL_SUCCESS
- SQL_ERROR
- SQL_INVALID_HANDLE

Error Conditions

Table 111. SQLGetTypeInfo SQLSTATEs

SQLSTATE	Description	Explanation
24000	Invalid cursor state	A cursor was already opened on the statement handle. *StatementHandle* had not been closed.
40003 **08**S01	Communication link failure	The communication link between the application and data source failed before the function completed.
HY001	Memory allocation failure	DB2 UDB CLI is unable to allocate memory required to support execution or completion of the function.
HY004	SQL data type out of range	An invalid *DataType* was specified.
HY010	Function sequence error	The function was called while in a data-at-execute (`SQLParamData()`, `SQLPutData()`) operation.
HYT00	Timeout expired	

Restrictions

The following ODBC specified SQL data types (and their corresponding *DataType* define values) are not supported by any IBM RDBMS:

Data Type	*DataType*
TINY INT	SQL_TINYINT
BIT	SQL_BIT

Example

```
/* From CLI sample typeinfo.c */
/* ... */
    rc = SQLGetTypeInfo(hstmt, SQL_ALL_TYPES);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 1, SQL_C_CHAR, (SQLPOINTER) typename.s, 128, &typename.ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 2, SQL_C_DEFAULT, (SQLPOINTER) & datatype,
                    sizeof(datatype), &datatype_ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 3, SQL_C_DEFAULT, (SQLPOINTER) & precision,
                    sizeof(precision), &precision_ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 7, SQL_C_DEFAULT, (SQLPOINTER) & nullable,
                    sizeof(nullable), &nullable_ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 8, SQL_C_DEFAULT, (SQLPOINTER) & casesens,
                    sizeof(casesens), &casesens_ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    printf("Datatype                  Datatype Precision  Nullable   Case\n");
    printf("Typename                   (int)                      Sensitive\n");
    printf("------------------------- -------- ---------- -------- ---------\n");
    /* LONG VARCHAR FOR BIT DATA      99  2147483647   FALSE    FALSE */
    /* Fetch each row, and display */
    while ((rc = SQLFetch(hstmt)) == SQL_SUCCESS) {
        printf("%-25s ", typename.s);
        printf("%8d ", datatype);
        printf("%10ld ", precision);
        printf("%-8s ", truefalse[nullable]);
        printf("%-9s\n", truefalse[casesens]);
    }                           /* endwhile */

    if ( rc != SQL_NO_DATA_FOUND )
       CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;
```

References

- “SQLBindCol - Bind a Column to an Application Variable” on page 33
- “SQLGetInfo - Get General Information” on page 146

SQLLanguages - Get SQL Dialect or Conformance Information

Purpose

SQLLanguages() returns SQL dialect or conformance information. The information is returned in an SQL result set, which can be retrieved using the same functions that are used to fetch a result set generated by a SELECT statement.

Syntax

```
SQLRETURN SQLLanguages  (SQLHSTMT       hstmt);
```

Function Arguments

Table 112. SQLLanguages Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle

Usage

The function returns dialect and conformance information, in the form of a result set on StatementHandle. This contains a row for every conformance claim the SQL product makes (including subsets defined for ISO and vendor-specific versions). For a product that claims to comply with this specification, the result set thus contains at least one row.

Rows defining ISO standard and vendor-specific languages may exist in the same table. Each row has at least these columns and, if it makes an X/Open SQL conformance claim, the columns contains these values.

Table 113. Columns Returned By SQLLanguages

Column Name	Data Type	Description
SOURCE	VARCHAR(254), NOT NULL	The organization that defined this SQL version.
SOURCE_YEAR	VARCHAR(254)	The year the relevant source document was approved.
CONFORMANCE	VARCHAR(254)	The conformance level to the relevant document that the implementation claims.
INTEGRITY	VARCHAR(254)	An indication of whether the implementation supports the Integrity Enhancement Feature (IEF).
IMPLEMENTATION	VARCHAR(254)	A character string, defined by the vendor, that uniquely identifies the vendor's SQL product.
BINDING_SYTLE	VARCHAR(254)	Either 'EMBEDDED', 'DIRECT', OR 'CLI'.
PROGRAMMING_LANG	VARCHAR(254)	The host language for which the binding style is supported.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

SQLLanguages

Diagnostics

Table 114. SQLLanguages SQLSTATEs

SQLSTATE	Description	Explanation
24000	Invalid cursor state	Cursor related information was requested, but no cursor was open.
40003 *	Statement completion unknown	The communication link between the CLI and the data source failed before the function completed processing.
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid string or buffer length	The value of one of the name length arguments was less than 0, but not equal SQL_NTS.
HYC00	Driver not capable	DB2 UDB CLI does not support *catalog* as a qualifier for table name.

SQLMoreResults - Determine If There Are More Result Sets

Purpose

SQLMoreResults() determines whether there is more information available on the statement handle which has been associated with a stored procedure that is returning result sets.

Syntax

```
SQLRETURN   SQLMoreResults   (SQLHSTMT          StatementHandle);
```

Function Arguments

Table 115. SQLMoreResults Arguments

Data Type	Argument	Use	Description
SQLHSTMT	StatementHandle	input	Statement handle.

Usage

This function is used to return multiple results that are set in a sequential manner upon the execution of a stored procedure that contains SQL queries. The cursors have been left open so that the result sets remain accessible when the stored procedure has finished execution.

After completely processing the first result set, the application can call SQLMoreResults() to determine if another result set is available. If the current result set has unfetched rows, SQLMoreResults() discards them by closing the cursor and, if another result set is available, returns SQL_SUCCESS.

If all the result sets have been processed, SQLMoreResults() returns SQL_NO_DATA_FOUND.

If SQLFreeStmt() is called with the SQL_CLOSE or SQL_DROP option, all pending result sets on this statement handle are discarded.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_STILL_EXECUTING
- SQL_ERROR
- SQL_INVALID_HANDLE
- SQL_NO_DATA_FOUND

Error Conditions

Table 116. SQLMoreResults SQLSTATEs

SQLSTATE	Description	Explanation
40003 **08**S01	Communication link failure	The communication link between the application and data source failed before the function completed.
58004	Unexpected system failure	Unrecoverable system error.
HY001	Memory allocation failure	DB2 UDB CLI is unable to allocate memory required to support execution or completion of the function.
HY010	Function sequence error	The function was called while in a data-at-execute (SQLParamData(), SQLPutData()) operation.

Table 116. SQLMoreResults SQLSTATEs (continued)

SQLSTATE	Description	Explanation
HY013	Unexpected memory handling error	DB2 UDB CLI was unable to access memory required to support execution or completion of the function.
HYT00	Timeout expired	

In addition `SQLMoreResults()` can return the SQLSTATEs associated with `SQLExecute()`.

Restrictions

The ODBC specification of `SQLMoreResults()` also allow counts associated with the execution of parameterized INSERT, UPDATE, and DELETE statements with arrays of input parameter values to be returned. However, DB2 UDB CLI does not support the return of such count information.

References

- “SQLBindCol - Bind a Column to an Application Variable” on page 33
- “SQLBindParameter - Bind A Parameter Marker to a Buffer” on page 48

SQLNativeSql - Get Native SQL Text

Purpose

SQLNativeSql() is used to show how DB2 UDB CLI interprets vendor escape clauses. If the original SQL string passed in by the application contained vendor escape clause sequences, then DB2 UDB CLI will return the transformed SQL string that would be seen by the data source (with vendor escape clauses either converted or discarded, as appropriate).

Syntax

```
SQLRETURN   SQLNativeSql     (SQLHDBC           ConnectionHandle,
                              SQLCHAR           *InStatementText,
                              SQLINTEGER        TextLength1,
                              SQLCHAR           *OutStatementText,
                              SQLINTEGER        BufferLength,
                              SQLINTEGER        *TextLength2Ptr);
```

Function Arguments

Table 117. SQLNativeSql Arguments

Data Type	Argument	Use	Description
SQLHDBC	ConnectionHandle	input	Connection handle
SQLCHAR *	InStatementText	input	Input SQL string
SQLINTEGER	TextLength1	input	Length of *InStatementText*
SQLCHAR *	OutStatementText	output	Pointer to buffer for the transformed output string
SQLINTEGER	BufferLength	input	Size of buffer pointed by *OutStatementText*
SQLINTEGER *	TextLength2Ptr	output	The total number of bytes available to return in *OutStatementText*. If the number of bytes available to return is greater than or equal to *BufferLength*, the output SQL string in *OutStatementText* is truncated to *BufferLength - 1* bytes. The value SQL_NULL_DATA will be returned if no output string is generated.

Usage

This function is called when the application wishes to examine or display the transformed SQL string that would be passed to the data source by DB2 UDB CLI. Translation (mapping) would only occur if the input SQL statement string contains vendor escape clause sequences.

There are no vendor escape sequences on iSeries; this procedure is provided for compatibility purposes. Also, note that this procedure can be used to evaluate an SQL string for syntax errors.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Error Conditions

Table 118. SQLNativeSql SQLSTATEs

SQLSTATE	Description	Explanation
01004	Data truncated	The buffer *OutStatementText* was not large enough to contain the entire SQL string, so truncation occurred. The argument *TextLength2Ptr* contains the total length of the untruncated SQL string. (Function returns with SQL_SUCCESS_WITH_INFO)
08003	Connection is closed	The *ConnectionHandle* does not reference an open database connection.
37000	Invalid SQL syntax	The input SQL string in *InStatementText* contained a syntax error.
HY001	Memory allocation failure	DB2 UDB CLI is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	The argument *InStatementText*, *OutStatementText*, or *TextLength2Ptr* was a null pointer.
HY090	Invalid string or buffer length	The argument *TextLength1* was less than 0, but not equal to SQL_NTS. The argument *BufferLength* was less than 0.

Restrictions

None.

Example

```
/* From CLI sample native.c */
/* ... */
    SQLCHAR in_stmt[1024], out_stmt[1024] ;
    SQLSMALLINT pcPar ;
    SQLINTEGER indicator ;
/* ... */
    /* Prompt for a statement to prepare */
    printf("Enter an SQL statement: \n");
    gets((char *)in_stmt);

    /* prepare the statement */
    rc = SQLPrepare(hstmt, in_stmt, SQL_NTS);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    SQLNumParams(hstmt, &pcPar);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    SQLNativeSql(hstmt, in_stmt, SQL_NTS, out_stmt, 1024, &indicator);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    if ( indicator == SQL_NULL_DATA ) printf( "Invalid statement\n" ) ;
    else {
       printf( "Input Statement: \n %s \n", in_stmt ) ;
       printf( "Output Statement: \n %s \n", in_stmt ) ;
       printf( "Number of Parameter Markers = %d\n", pcPar ) ;
    }

    rc = SQLFreeHandle( SQL_HANDLE_STMT, hstmt ) ;
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;
```

References

None.

SQLNextResult - Process the Next Result Set

Purpose

SQLNextResult() determines whether there is more information available on the statement handle which has been associated with a stored procedure that is returning result sets.

Syntax

```
SQLRETURN   SQLNextResult   (SQLHSTMT          StatementHandle,
                             SQLHSTMT          NextResultHandle);
```

Function Arguments

Table 119. SQLNextResult Arguments

Data Type	Argument	Use	Description
SQLHSTMT	StatementHandle	Input	Statement handle.
SQLHSTMT	NextResultHandle	Input	Statement handle for next result set.

Usage

This function is used to associate the next result set from StatementHandle with NextResultHandle. This differs from SQLMoreResults() since it allows both statement handles to process their result sets simultaneously.

If all the result sets have been processed, SQLNextResult() returns SQL_NO_DATA_FOUND.

If SQLFreeStmt() is called with the SQL_CLOSE or SQL_DROP option, all pending result sets on this statement handle are discarded.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE
- SQL_NO_DATA_FOUND

Error Conditions

Table 120. SQLNextResult SQLSTATEs

SQLSTATE	Description	Explanation
40003 **08**S01	Communication link failure	The communication link between the application and data source failed before the function completed.
58004	Unexpected system failure	Unrecoverable system error.
HY001	Memory allocation failure	DB2 UDB CLI is unable to allocate memory required to support execution or completion of the function.
HY010	Function sequence error	The function was called while in a data-at-execute (SQLParamData(), SQLPutData()) operation.
HY013	Unexpected memory handling error	DB2 UDB CLI was unable to access memory required to support execution or completion of the function.
HYT00	Timeout expired	

References

- “SQLMoreResults - Determine If There Are More Result Sets” on page 175

SQLNumParams - Get Number of Parameters in A SQL Statement

Purpose

SQLNumParams() returns the number of parameter markers in an SQL statement.

Syntax

```
SQLRETURN   SQLNumParams     (SQLHSTMT          StatementHandle,
                              SQLSMALLINT       *ParameterCountPtr);
```

Function Arguments

Table 121. SQLNumParams Arguments

Data Type	Argument	Use	Description
SQLHSTMT	StatementHandle	Input	Statement handle.
SQLSMALLINT *	ParameterCountPtr	Output	Number of parameters in the statement.

Usage

This function can only be called after the statement that is associated with *StatementHandle* has been prepared. If the statement does not contain any parameter markers, *ParameterCountPtr* is set to 0.

An application can call this function to determine how many SQLBindParameter() calls are necessary for the SQL statement associated with the statement handle.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_STILL_EXECUTING
- SQL_ERROR
- SQL_INVALID_HANDLE

Error Conditions

Table 122. SQLNumParams SQLSTATEs

SQLSTATE	Description	Explanation
40003 **08**S01	Communication link failure	The communication link between the application and data source failed before the function completed.
HY001	Memory allocation failure	DB2 UDB CLI is unable to allocate memory required to support execution or completion of the function.
HY008	Operation canceled.	
HY009	Invalid argument value	*ParameterCountPtr* is null.
HY010	Function sequence error	This function was called before SQLPrepare() was called for the specified *StatementHandle* The function was called while in a data-at-execute (SQLParamData(), SQLPutData()) operation.
HY013	Unexpected memory handling error	DB2 UDB CLI was unable to access memory required to support execution or completion of the function.
HYT00	Timeout expired	

SQLNumParams

Restrictions

None.

Example

Refer to the `SQLNativeSql()` "Example" on page 178.

References

- "SQLBindParam - Binds A Buffer To A Parameter Marker" on page 43
- "SQLPrepare - Prepare a Statement" on page 189

SQLNumResultCols - Get Number of Result Columns

Purpose

SQLNumResultCols() returns the number of columns in the result set associated with the input statement handle.

SQLPrepare() or SQLExecDirect() must be called before calling this function.

After calling this function, you can call SQLDescribeCol(), SQLColAttributes(), SQLBindCol() or SQLGetData().

Syntax

```
SQLRETURN SQLNumResultCols (SQLHSTMT       hstmt,
                            SQLSMALLINT    *pccol);
```

Function Arguments

Table 123. SQLNumResultCols Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle
SQLSMALLINT *	*pccol*	Output	Number of columns in the result set

Usage

The function sets the output argument to zero if the last statement executed on the input statement handle is not a SELECT.

Return Codes

- SQL_SUCCESS
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 124. SQLNumResultCols SQLSTATEs

SQLSTATE	Description	Explanation
40003 *	Statement completion unknown	The communication link between the CLI and the data source failed before the function completed processing.
58004	System error	Unrecoverable system error
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	*pcbCol* was a null pointer.
HY010	Function sequence error	The function was called prior to calling SQLPrepare or SQLExecDirect for the *hstmt*.
S1013 *	Memory management problem.	The driver was unable to access memory required to support execution or completion of the function.

References

- “SQLBindCol - Bind a Column to an Application Variable” on page 33
- “SQLColAttributes - Column Attributes” on page 58
- “SQLDescribeCol - Describe Column Attributes” on page 76
- “SQLExecDirect - Execute a Statement Directly” on page 94
- “SQLGetCol - Retrieve one column of a row of the result set” on page 119
- “SQLPrepare - Prepare a Statement” on page 189

SQLParamData - Get Next Parameter For Which A Data Value Is Needed

Purpose

SQLParamData() is used with SQLPutData() to send long data in pieces. It can also be used to send fixed length data.

Syntax

```
SQLRETURN SQLParamData  (SQLHSTMT     hstmt,
                         SQLPOINTER   *prgbValue);
```

Function Arguments

Table 125. SQLParamData Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle
SQLPOINTER *	*prgbValue*	Output	Pointer to the value of the *rgbValue* argument specified on the SQLSetParam call.

Usage

SQLParamData() returns SQL_NEED_DATA if there is at least one SQL_DATA_AT_EXEC parameter for which data still has not been assigned. This function returns an application defined value in *prgbValue* supplied by the application during the previous SQLBindParam() call. SQLPutData() is called one or more times to send the parameter data. SQLParamData() is called to signal that all the data has been sent for the current parameter and to advance to the next SQL_DATA_AT_EXEC parameter. SQL_SUCCESS is returned when all the parameters have been assigned data values and the associated statement has been executed successfully. If any errors occur during or before actual statement execution, SQL_ERROR is returned.

If SQLParamData() returns SQL_NEED_DATA, then only SQLPutData() or SQLCancel() calls can be made. All other function calls using this statement handle will fail. In addition, all function calls referencing the parent *hdbc* of *hstmt* will fail if they involve changing any attribute or state of that connection. Those following function calls on the parent *hdbc* are also not permitted:

- SQLAllocConnect()
- SQLAllocHandle()
- SQLAllocStmt()
- SQLSetConnectOption()

Should they be called during an SQL_NEED_DATA sequence, these functions return SQL_ERROR with SQLSTATE of **HY**010 and the processing of the SQL_DATA_AT_EXEC parameters is not affected.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE
- SQL_NEED_DATA

Diagnostics

SQLParamData() can return any SQLSTATE returned by the SQLExecDirect() and SQLExecute() functions. In addition, the following diagnostics can also be generated:

Table 126. SQLParamData SQLSTATEs

SQLSTATE	Description	Explanation
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	The argument *prgbValue* was a null pointer.
HY010	Function sequence error	SQLParamData() was called out of sequence. This call is only valid after an SQLExecDirect() or an SQLExecute(), or after an SQLPutData() call.
HYDE0	No data at execution values pending	Even though this function was called after an SQLExecDirect() or an SQLExecute() call, there were no SQL_DATA_AT_EXEC parameters (left) to process.

SQLParamOptions - Specify an Input Array for a Parameter

Purpose

SQLParamOptions() provides the ability to set multiple values for each parameter set by SQLBindParameter(). This allows the application to insert multiple rows into a table on a single call to SQLExecute() or SQLExecDirect().

Syntax

```
SQLRETURN   SQLParamOptions  (SQLHSTMT          StatementHandle,
                              SQLINTEGER        Crow,
                              SQLINTEGER        *FetchOffsetPtr);
```

Function Arguments

Table 127. SQLParamOptions Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*StatementHandle*	Input	Statement handle.
SQLINTEGER	*Crow*	Input	Number of values for each parameter. If this is greater than 1, then the *rgbValue* argument in SQLBindParameter() points to an array of parameter values, and *pcbValue* points to an array of lengths.
SQLINTEGER *	*FetchOffsetPtr*	Output (deferred)	Not currently used..

Usage

This function can be used with SQLBindParameter() to set up a multiple-row INSERT statement. In order to accomplish this, the application must allocate storage for all of the data being inserted. This data must be organized in a row-wise fashion. This means that all of the data for the first row is contiguous, followed by all the data for the next row, etc. The SQLBindParameter() function should be used to bind all of the input parameter types and lengths. In the case of a multiple-row INSERT statement, the addresses provided on SQLBindParameter() will be used to reference the first row of data. All subsequent rows of data will be referenced by incrementing those addresses by the length of the entire row.

For instance, the application intends to insert 100 rows of data into a table, and each row contains a 4-byte integer value, followed by a 10-byte character value. The application would allocate 1400 bytes of storage, and fill each 14-byte piece of storage with the approriate data for the row.

Also, the indicator pointer passed on the SQLBindParameter() must reference an 800-byte piece of storage. This is used to pass in any null indicator values. This storage is also row-wise, so the first 8 bytes are the 2 indicators for the first row, followed by the 2 indicators for the next row, etc. The SQLParamOptions() function is used by the application to specify how many rows will be inserted on the next execute of an INSERT statement using the statement handle. The INSERT statement must be of the multiple-row form.

For example: INSERT INTO CORPDATA.NAMES ? ROWS VALUES(?, ?)

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Error Conditions

Table 128. SQLParamOptions SQLSTATEs

SQLSTATE	Description	Explanation
HY009	Invalid argument value	The value in the argument *Crow* was less than 1.
HY010	Function sequence error	The function was called while in a data-at-execute (`SQLParamData()`, `SQLPutData()`) operation.

Restrictions

None.

References

- “SQLBindParam - Binds A Buffer To A Parameter Marker” on page 43
- “SQLMoreResults - Determine If There Are More Result Sets” on page 175

SQLPrepare - Prepare a Statement

Purpose

SQLPrepare() associates an SQL statement with the input statement handle and sends the statement to the DBMS to be prepared. The application can reference this prepared statement by passing the statement handle to other functions.

If the statement handle has been used with a SELECT statement, SQLFreeStmt() must be called to close the cursor, before calling SQLPrepare().

Syntax

```
SQLRETURN SQLPrepare (SQLHSTMT       hstmt,
                      SQLCHAR        *szSqlStr,
                      SQLINTEGER     cbSqlStr);
```

Function Arguments

Table 129. SQLPrepare Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle. There must not be an open cursor associated with *hstmt*.
SQLCHAR *	*szSqlStr*	Input	SQL statement string
SQLINTEGER	*cbSqlStr*	Input	Length of contents of *szSqlStr* argument. This must be set to either the exact length of the SQL statement in *szSqlstr*, or to SQL_NTS if the statement text is null-terminated.

Usage

Once a statement has been prepared using SQLPrepare(), the application can request information about the format of the result set (if it was a SELECT statement) by calling:

- SQLNumResultCols()
- SQLDescribeCol()
- SQLColAttributes()

A prepared statement may be executed once, or multiple times by calling SQLExecute(). The SQL statement remains associated with the statement handle until the handle is used with another SQLPrepare(), SQLExecDirect(), SQLColumns(), SQLSpecialColumns(), SQLStatistics(), or SQLTables().

The SQL statement string may contain parameter markers. A parameter marker is represented by a "?" character, and indicates a position in the statement where the value of an application variable is to be substituted, when SQLExecute() is called. SQLBindParam() is used to bind (or associate) an application variable to each parameter marker, and to indicate if any data conversion should be performed at the time the data is transferred.

The SQL statement cannot be a COMMIT or ROLLBACK. SQLTransact() must be called to issue COMMIT or ROLLBACK.

If the SQL statement is a positioned DELETE or a Positioned UPDATE, the cursor referenced by the statement must be defined on a separate statement handle under the same connection handle.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 130. SQLPrepare SQLSTATEs

SQLSTATE	Description	Explanation
24000	Invalid cursor state	There was an open cursor on the specified *hstmt*.
37xxx	Syntax error or access violation	*szSqlStr* contained one or more of the following: • A COMMIT • A ROLLBACK • An SQL statement that the connected database server could not prepare • A statement containing a syntax error
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	*szSqlStr* was a null pointer. The argument *cbSqlStr* was less than 1, but not equal to SQL_NTS.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.

Note: Not all DBMSs report all of the above diagnostic messages at prepare time. Therefore an application must also be able to handle these conditions when calling `SQLExecute()`.

Example

Refer to “Example: Interactive SQL and the equivalent DB2 UDB CLI function calls” on page 268 for a listing of the `check_error`, `initialize`, and `terminate` functions used in the following example.

```
/*****************************************************************************
** file = prepare.c
**
** Example of preparing then repeatedly executing an SQL statement.
**
** Functions used:
**
**        SQLAllocConnect      SQLFreeConnect
**        SQLAllocEnv          SQLFreeEnv
**        SQLAllocStmt         SQLFreeStmt
**        SQLConnect           SQLDisconnect
**
**        SQLBindCol           SQLFetch
**        SQLTransact          SQLError
**        SQLPrepare           SQLSetParam
**        SQLExecute
*****************************************************************************/

#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include "sqlcli.h"
```

```
#define MAX_STMT_LEN 255

int initialize(SQLHENV *henv,
               SQLHDBC *hdbc);

int terminate(SQLHENV henv,
              SQLHDBC hdbc);

int print_error (SQLHENV    henv,
                 SQLHDBC    hdbc,
                 SQLHSTMT   hstmt);

int check_error (SQLHENV    henv,
                 SQLHDBC    hdbc,
                 SQLHSTMT   hstmt,
                 SQLRETURN  rc);

/*****************************************************************
** main
** - initialize
** - terminate
*****************************************************************/
int main()
{
    SQLHENV     henv;
    SQLHDBC     hdbc;
    SQLCHAR     sqlstmt[MAX_STMT_LEN + 1]="";
    SQLRETURN   rc;

    rc = initialize(&henv, &hdbc);
    if (rc == SQL_ERROR) return(terminate(henv, hdbc));

    {SQLHSTMT   hstmt;
     SQLCHAR    sqlstmt[]="SELECT deptname, location from org where division = ?";
     SQLCHAR    deptname[15],
                location[14],
                division[11];

     SQLINTEGER rlength,
                plength;

        rc = SQLAllocStmt(hdbc, &hstmt);
        if (rc != SQL_SUCCESS )
            check_error (henv, hdbc, SQL_NULL_HSTMT, rc);

        /* prepare statement for multiple use */
        rc = SQLPrepare(hstmt, sqlstmt, SQL_NTS);
        if (rc != SQL_SUCCESS )
            check_error (henv, hdbc, hstmt, rc);

        /* bind division to parameter marker in sqlstmt */
        rc = SQLSetParam(hstmt, 1, SQL_CHAR, SQL_CHAR, 10, 10, division,
                    &plength);
        if (rc != SQL_SUCCESS )
            check_error (henv, hdbc, hstmt, rc);

        /* bind deptname to first column in the result set */
        rc = SQLBindCol(hstmt, 1, SQL_CHAR, (SQLPOINTER) deptname, 15,
                        &rlength);
        if (rc != SQL_SUCCESS )
            check_error (henv, hdbc, hstmt, rc);
        rc = SQLBindCol(hstmt, 2, SQL_CHAR, (SQLPOINTER) location, 14,
                         &rlength);
        if (rc != SQL_SUCCESS )
            check_error (henv, hdbc, hstmt, rc);

        printf("\nEnter Division Name or 'q' to quit:\n");
```

```
        printf("(Eastern, Western, Midwest, Corporate)\n");
        gets(division);
        plength = SQL_NTS;

        while(division[0] != 'q')
        {
            rc = SQLExecute(hstmt);
            if (rc != SQL_SUCCESS )
                check_error (henv, hdbc, hstmt, rc);

            printf("Departments in %s Division:\n", division);
            printf("DEPTNAME       Location\n");
            printf("-------------- -------------\n");

            while ((rc = SQLFetch(hstmt)) == SQL_SUCCESS)
            {
                printf("%-14.14s %-13.13s \n", deptname, location);
            }
            if (rc != SQL_NO_DATA_FOUND )
                check_error (henv, hdbc, hstmt, rc);
            SQLFreeStmt(hstmt, SQL_CLOSE);
            printf("\nEnter Division Name or 'q' to quit:\n");
            printf("(Eastern, Western, Midwest, Corporate)\n");
            gets(division);
        }
    }

    rc = SQLTransact(henv, hdbc, SQL_ROLLBACK);
    if (rc != SQL_SUCCESS )
        check_error (henv, hdbc, SQL_NULL_HSTMT, rc);

    terminate(henv, hdbc);
    return (0);
}/* end main */
```

References

- “SQLColAttributes - Column Attributes” on page 58
- “SQLDescribeCol - Describe Column Attributes” on page 76
- “SQLExecDirect - Execute a Statement Directly” on page 94
- “SQLExecute - Execute a Statement” on page 96
- “SQLNumResultCols - Get Number of Result Columns” on page 183

SQLPrimaryKeys - Get Primary Key Columns of A Table

Purpose

SQLPrimaryKeys() returns a list of column names that comprise the primary key for a table. The information is returned in an SQL result set, which can be retrieved using the same functions that are used to process a result set that is generated by a query.

Syntax

```
SQLRETURN   SQLPrimaryKeys   (SQLHSTMT          StatementHandle,
                              SQLCHAR           *CatalogName,
                              SQLSMALLINT       NameLength1,
                              SQLCHAR           *SchemaName,
                              SQLSMALLINT       NameLength2,
                              SQLCHAR           *TableName,
                              SQLSMALLINT       NameLength3);
```

Function Arguments

Table 131. SQLPrimaryKeys Arguments

Data Type	Argument	Use	Description
SQLHSTMT	StatementHandle	input	Statement handle.
SQLCHAR *	CatalogName	input	Catalog qualifier of a 3 part table name. This must be a NULL pointer or a zero length string.
SQLSMALLINT	NameLength1	input	Length of *CatalogName*
SQLCHAR *	SchemaName	input	Schema qualifier of table name.
SQLSMALLINT	NameLength2	input	Length of *SchemaName*
SQLCHAR *	TableName	input	Table name.
SQLSMALLINT	NameLength3	input	Length of *TableName*

Usage

SQLPrimaryKeys() returns the primary key columns from a single table, Search patterns cannot be used to specify the schema qualifier or the table name.

The result set contains the columns that are listed in Table 132, ordered by TABLE_CAT, TABLE_SCHEM, TABLE_NAME, and ORDINAL_POSITION.

Since calls to SQLPrimaryKeys() in many cases map to a complex and, thus, expensive query against the system catalog, they should be used sparingly, and the results saved rather than repeating calls.

Although new columns might be added and the names of the existing columns might be changed in future releases, the position of the current columns will not change.

Table 132. Columns Returned By SQLPrimaryKeys

Column Number/Name	Data Type	Description
1 TABLE_CAT	VARCHAR(128)	The current server.
2 TABLE_SCHEM	VARCHAR(128)	The name of the schema containing TABLE_NAME.
3 TABLE_NAME	VARCHAR(128) not NULL	Name of the specified table.

Table 132. Columns Returned By SQLPrimaryKeys (continued)

Column Number/Name	Data Type	Description
4 COLUMN_NAME	VARCHAR(128) not NULL	Primary Key column name.
5 ORDINAL_POSITION	SMALLINT not NULL	Column sequence number in the primary key, starting with 1.
6 PK_NAME	VARCHAR(128)	Primary key identifier. NULL if not applicable to the data source.

Note: The column names used by DB2 UDB CLI follow the X/Open CLI CAE specification style. The column types, contents and order are identical to those defined for the `SQLPrimaryKeys()` result set in ODBC.

If the specified table does not contain a primary key, an empty result set is returned.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_STILL_EXECUTING
- SQL_ERROR
- SQL_INVALID_HANDLE

Error Conditions

Table 133. SQLPrimaryKeys SQLSTATEs

SQLSTATE	Description	Explanation
24000	Invalid cursor state	A cursor was already opened on the statement handle.
40003 **08**S01	Communication link failure	The communication link between the application and data source failed before the function completed.
HY001	Memory allocation failure	DB2 UDB CLI is unable to allocate memory required to support execution or completion of the function.
HY008	Operation canceled.	
HY010	Function sequence error	The function was called while in a data-at-execute (`SQLParamData()`, `SQLPutData()`) operation.
HY014	No more handles	DB2 UDB CLI was unable to allocate a handle due to internal resources.
HY090	Invalid string or buffer length	The value of one of the name length arguments was less than 0, but not equal SQL_NTS.
HYC00	Driver not capable	DB2 UDB CLI does not support *catalog* as a qualifier for table name.
HYT00	Timeout expired	

Restrictions

None.

References

- “SQLForeignKeys - Get the List of Foreign Key Columns” on page 109
- “SQLStatistics - Get Index and Statistics Information For A Base Table” on page 235

SQLProcedureColumns - Get Input/Output Parameter Information for A Procedure

Purpose

SQLProcedureColumns() returns a list of input and output parameters associated with a procedure. The information is returned in an SQL result set, which can be retrieved using the same functions that are used to process a result set that is generated by a query.

Syntax

```
SQLRETURN SQLProcedureColumns(SQLHSTMT          StatementHandle,
                              SQLCHAR           *CatalogName,
                              SQLSMALLINT       NameLength1,
                              SQLCHAR           *SchemaName,
                              SQLSMALLINT       NameLength2,
                              SQLCHAR           *ProcName,
                              SQLSMALLINT       NameLength3,
                              SQLCHAR           *ColumnName,
                              SQLSMALLINT       NameLength4);
```

Function Arguments

Table 134. SQLProcedureColumns Arguments

Data Type	Argument	Use	Description
SQLHSTMT	StatementHandle	input	Statement handle.
SQLCHAR *	CatalogName	input	Catalog qualifier of a 3 part procedure name. This must be a NULL pointer or a zero length string.
SQLSMALLINT	NameLength1	input	Length of *CatalogName*. This must be set to 0.
SQLCHAR *	SchemaName	input	Buffer that may contain a *pattern-value* to qualify the result set by schema name. For DB2 UDB for zOS and OS/390 V 4.1, all the stored procedures are in one schema; the only acceptable value for the *SchemaName* argument is a null pointer. For DB2 Universal Database™, *SchemaName* can contain a valid pattern value.
SQLSMALLINT	NameLength2	input	Length of *SchemaName*
SQLCHAR *	ProcName	input	Buffer that may contain a *pattern-value* to qualify the result set by procedure name.
SQLSMALLINT	NameLength3	input	Length of *ProcName*
SQLCHAR *	ColumnName	input	Buffer that may contain a *pattern-value* to qualify the result set by parameter name. This argument is to be used to further qualify the result set already restricted by specifying a non-empty value for ProcName or SchemaName.
SQLSMALLINT	NameLength4	input	Length of *ColumnName*

Usage

DB2 UDB CLI will return information on the input, input and output, and output parameters associated with the stored procedure, but cannot return information on the descriptor information for any result sets returned.

SQLProcedureColumns

SQLProcedureColumns() returns the information in a result set, ordered by PROCEDURE_CAT, PROCEDURE_SCHEM, PROCEDURE_NAME, and COLUMN_TYPE. Table 135 lists the columns in the result set. Applications should be aware that columns beyond the last column may be defined in future releases.

Since calls to SQLProcedureColumns() in many cases map to a complex and thus expensive query against the system catalog, they should be used sparingly, and the results saved rather than repeating calls.

Table 135. Columns Returned By SQLProcedureColumns

Column Number/Name		Data Type	Description
1	PROCEDURE_CAT	VARCHAR(128)	The current server.
2	PROCEDURE_SCHEM	VARCHAR(128)	The name of the schema containing PROCEDURE_NAME.
3	PROCEDURE_NAME	VARCHAR(128)	Name of the procedure.
4	COLUMN_NAME	VARCHAR(128)	Name of the parameter.
5	COLUMN_TYPE	SMALLINT not NULL	Identifies the type information associated with this row. The values can be: • SQL_PARAM_TYPE_UNKNOWN – the parameter type is unknown. **Note:** This is not returned. • SQL_PARAM_INPUT – this parameter is an input parameter. • SQL_PARAM_INPUT_OUTPUT – this parameter is an input / output parameter. • SQL_PARAM_OUTPUT – this parameter is an output parameter. • SQL_RETURN_VALUE – the procedure column is the return value of the procedure. **Note:** This is not returned. • SQL_RESULT_COL – this parameter is actually a column in the result set. **Note:** This is not returned.
6	DATA_TYPE	SMALLINT not NULL	SQL data type.
7	TYPE_NAME	VARCHAR(128) not NULL	Character string representing the name of the data type corresponding to DATA_TYPE.
8	COLUMN_SIZE	INTEGER	If the DATA_TYPE column value denotes a character or binary string, then this column contains the maximum length in bytes; if it is a graphic (DBCS) string, this is the number of double byte characters for the parameter. For date, time, timestamp data types, this is the total number of bytes required to display the value when converted to character. For numeric data types, this is either the total number of digits, or the total number of bits allowed in the column, depending on the value in the NUM_PREC_RADIX column in the result set.
9	BUFFER_LENGTH	INTEGER	The maximum number of bytes for the associated C buffer to store data from this parameter if SQL_C_DEFAULT were specified on the SQLBindCol(), SQLGetData() and SQLBindParameter() calls. This length excludes any null-terminator. For exact numeric data types, the length accounts for the decimal and the sign.

Table 135. Columns Returned By SQLProcedureColumns (continued)

Column Number/Name	Data Type	Description
10 DECIMAL_DIGITS	SMALLINT	The scale of the parameter. NULL is returned for data types where scale is not applicable.
11 NUM_PREC_RADIX	SMALLINT	Either 10 or 2 or NULL. If DATA_TYPE is an approximate numeric data type, this column contains the value 2, then the COLUMN_SIZE column contains the number of bits allowed in the parameter. If DATA_TYPE is an exact numeric data type, this column contains the value 10 and the COLUMN_SIZE and DECIMAL_DIGITS columns contain the number of decimal digits allowed for the parameter. For numeric data types, the DBMS can return a NUM_PREC_RADIX of either 10 or 2. NULL is returned for data types where radix is not applicable.
12 NULLABLE	VARCHAR(3)	'NO' if the parameter does not accept NULL values. 'YES' if the parameter accepts NULL values.
13 REMARKS	VARCHAR(254)	May contain descriptive information about the parameter.
14 COLUMN_DEF	VARCHAR	The default value of the column. If NULL was specified as the default value, then this column is the word NULL, not enclosed in quotation marks. If the default value cannot be represented without truncation, then this column contains TRUNCATED, with no enclosing single quotation marks. If no default value was specified, then this column is NULL. The value of COLUMN_DEF can be used in generating a new column definition, except when it contains the value TRUNCATED.
15 SQL_DATA_TYPE	SMALLINT not NULL	The value of the SQL data type as it appears in the SQL_DESC_TYPE field of the descriptor. This column is the same as the DATA_TYPE column except for datetime data types (DB2 UDB CLI does not support interval data types). For datetime data types, the SQL_DATA_TYPE field in the result set will be SQL_DATETIME, and the SQL_DATETIME_SUB field will return the subcode for the specific datetime data type (SQL_CODE_DATE, SQL_CODE_TIME or SQL_CODE_TIMESTAMP).
16 SQL_DATETIME_SUB	SMALLINT	The subtype code for datetime data types. For all other data types this column returns a NULL (including interval data types which DB2 UDB CLI does not support).
17 CHAR_OCTET_LENGTH	INTEGER	The maximum length in bytes of a character data type column. For all other data types, this column returns a NULL.
18 ORDINAL_POSITION	INTEGER NOT NULL	Contains the ordinal position of the parameter given by COLUMN_NAME in this result set. This is the ordinal position of the argument to be provided on the CALL statement. The leftmost argument has an ordinal position of 1.

Table 135. Columns Returned By SQLProcedureColumns (continued)

Column Number/Name	Data Type	Description
19 IS_NULLABLE	VARCHAR	• "NO" if the column does not include NULLs. • "YES" if the column can include NULLs. • zero-length string if nullability is unknown. ISO rules are followed to determine nullability. An ISO SQL-compliant DBMS cannot return an empty string. The value returned for this column is different than the value returned for the NULLABLE column. (See the description of the NULLABLE column.)

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_STILL_EXECUTING
- SQL_ERROR
- SQL_INVALID_HANDLE

Error Conditions

Table 136. SQLProcedureColumns SQLSTATEs

SQLSTATE	Description	Explanation
24000	Invalid cursor state	A cursor was already opened on the statement handle.
40003 **08**S01	Communication link failure	The communication link between the application and data source failed before the function completed.
42601	PARMLIST syntax error	The PARMLIST value in the stored procedures catalog table contains a syntax error.
HY001	Memory allocation failure	DB2 UDB CLI is unable to allocate memory required to support execution or completion of the function.
HY008	Operation canceled	
HY010	Function sequence error	
HY014	No more handles	DB2 UDB CLI was unable to allocate a handle due to internal resources.
HY090	Invalid String or Buffer Length	The value of one of the name length arguments was less than 0, but not equal SQL_NTS.
HYC00	Driver not capable	DB2 UDB CLI does not support *catalog* as a qualifier for procedure name. The connected server does not support *schema* as a qualifier for procedure name.
HYT00	Timeout expired	

Restrictions

`SQLProcedureColumns()` does not return information about the attributes of result sets that may be returned from stored procedures.

If an application is connected to a DB2 server that does not provide support for a stored procedure catalog, or does not provide support for stored procedures, SQLProcedureColumns() will return an empty result set.

Example

```
/* From CLI sample proccols.c */
/* ... */

    printf("Enter Procedure Schema Name Search Pattern:\n");
    gets((char *)proc_schem.s);

    printf("Enter Procedure Name Search Pattern:\n");
    gets((char *)proc_name.s);

    rc = SQLProcedureColumns(hstmt, NULL, 0, proc_schem.s, SQL_NTS,
                             proc_name.s, SQL_NTS, (SQLCHAR *)"%", SQL_NTS);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 2, SQL_C_CHAR, (SQLPOINTER) proc_schem.s, 129,
                    &proc_schem.ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 3, SQL_C_CHAR, (SQLPOINTER) proc_name.s, 129,
                    &proc_name.ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 4, SQL_C_CHAR, (SQLPOINTER) column_name.s, 129,
                    &column_name.ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 5, SQL_C_SHORT, (SQLPOINTER) &arg_type,
                    0, &arg_type_ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 7, SQL_C_CHAR, (SQLPOINTER) type_name.s, 129,
                    &type_name.ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 8, SQL_C_LONG, (SQLPOINTER) & length,
                    0, &length_ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 10, SQL_C_SHORT, (SQLPOINTER) &scale,
                    0, &scale_ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 13, SQL_C_CHAR, (SQLPOINTER) remarks.s, 255,
                    &remarks.ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    /* Fetch each row, and display */
    while ((rc = SQLFetch(hstmt)) == SQL_SUCCESS) {
        sprintf((char *)cur_name, "%s.%s", proc_schem.s, proc_name.s);
        if (strcmp((char *)cur_name, (char *)pre_name) != 0) {
            printf("\n%s\n", cur_name);
        }
        strcpy((char *)pre_name, (char *)cur_name);
        printf("   %s", column_name.s);
        switch (arg_type)
        { case SQL_PARAM_INPUT : printf(", Input"); break;
          case SQL_PARAM_OUTPUT : printf(", Output"); break;
          case SQL_PARAM_INPUT_OUTPUT : printf(", Input_Output"); break;
        }
        printf(", %s", type_name.s);
        printf(" (%ld", length);
```

```
        if (scale_ind != SQL_NULL_DATA) {
            printf(", %d)\n", scale);
        } else {
            printf(")\n");
        }
        if (remarks.ind > 0 ) {
            printf("(remarks), %s)\n", remarks.s);
        }
    }                           /* endwhile */
```

References

- “SQLProcedures - Get List of Procedure Names” on page 201

SQLProcedures - Get List of Procedure Names

Purpose

SQLProcedures() returns a list of procedure names that have been registered at the server, and which match the specified search pattern.

The information is returned in an SQL result set, which can be retrieved using the same functions that are used to process a result set that is generated by a query.

Syntax

```
SQLRETURN   SQLProcedures    (SQLHSTMT         StatementHandle,
                              SQLCHAR          *CatalogName,
                              SQLSMALLINT      NameLength1,
                              SQLCHAR          *SchemaName,
                              SQLSMALLINT      NameLength2,
                              SQLCHAR          *ProcName,
                              SQLSMALLINT      NameLength3);
```

Function Arguments

Table 137. SQLTables Arguments

Data Type	Argument	Use	Description
SQLHSTMT	StatementHandle	Input	Statement handle.
SQLCHAR *	CatalogName	Input	Catalog qualifier of a 3 part procedure name. This must be a NULL pointer or a zero length string.
SQLSMALLINT	NameLength1	Input	Length of *CatalogName*. This must be set to 0.
SQLCHAR *	SchemaName	Input	Buffer that may contain a *pattern-value* to qualify the result set by schema name. For DB2 UDB for zOS and OS/390 V 4.1, all the stored procedures are in one schema; the only acceptable value for the *SchemaName* argument is a null pointer. For DB2 Universal Database, *SchemaName* can contain a valid pattern value.
SQLSMALLINT	NameLength2	Input	Length of *SchemaName*.
SQLCHAR *	ProcName	Input	Buffer that may contain a *pattern-value* to qualify the result set by procedure name.
SQLSMALLINT	NameLength3	Input	Length of *ProcName*.

Usage

The result set returned by SQLProcedures() contains the columns listed in Table 138 in the order given. The rows are ordered by PROCEDURE_CAT, PROCEDURE_SCHEMA, and PROCEDURE_NAME.

Since calls to SQLProcedures() in many cases map to a complex and thus expensive query against the system catalog, use them sparingly, and save the results rather than repeating calls.

Although new columns might be added and the names of the existing columns might be changed in future releases, the position of the current columns will not change.

Table 138. Columns Returned By SQLProcedures

1	PROCEDURE_CAT	VARCHAR(128)	The current server.

Table 138. Columns Returned By SQLProcedures (continued)

2	PROCEDURE_SCHEM	VARCHAR(128)	The name of the schema containing PROCEDURE_NAME.
3	PROCEDURE_NAME	VARCHAR(128) NOT NULL	The name of the procedure.
4	NUM_INPUT_PARAMS	INTEGER not NULL	Number of input parameters. This column should not be used, it is reserved for future use by ODBC. It was used in versions of DB2 UDB CLI before version 5. For backward compatibility it can be used with the old DB2CLI.PROCEDURES pseudo catalog table (by setting the PATCH1 CLI/ODBC Configuration keyword).
5	NUM_OUTPUT_PARAMS	INTEGER not NULL	Number of output parameters. This column should not be used, it is reserved for future use by ODBC. It was used in versions of DB2 UDB CLI before version 5. For backward compatibility it can be used with the old DB2CLI.PROCEDURES pseudo catalog table (by setting the PATCH1 CLI/ODBC Configuration keyword).
6	NUM_RESULT_SETS	INTEGER not NULL	Number of result sets returned by the procedure. This column should not be used, it is reserved for future use by ODBC. It was used in versions of DB2 UDB CLI before version 5. For backward compatibility it can be used with the old DB2CLI.PROCEDURES pseudo catalog table (by setting the PATCH1 CLI/ODBC Configuration keyword).
7	REMARKS	VARCHAR(254)	Contains the descriptive information about the procedure.

Note: The column names used by DB2 UDB CLI follow the X/Open CLI CAE specification style. The column types, contents and order are identical to those defined for the `SQLProcedures()` result set in ODBC.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_STILL_EXECUTING
- SQL_ERROR
- SQL_INVALID_HANDLE

Error Conditions

Table 139. SQLProcedures SQLSTATEs

SQLSTATE	Description	Explanation
24000	Invalid cursor state	A cursor was already opened on the statement handle.
40003 **08**S01	Communication link failure	The communication link between the application and data source failed before the function completed.
HY001	Memory allocation failure	DB2 UDB CLI is unable to allocate memory required to support execution or completion of the function.
HY008	Operation canceled.	

Table 139. SQLProcedures SQLSTATEs (continued)

SQLSTATE	Description	Explanation
HY010	Function sequence error	
HY014	No more handles	DB2 UDB CLI was unable to allocate a handle due to internal resources.
HY090	Invalid string or buffer length	The value of one of the name length arguments was less than 0, but not equal to SQL_NTS.
HYC00	Driver not capable	DB2 UDB CLI does not support *catalog* as a qualifier for procedure name. The connected server does not supported schema as a qualifier for procedure name.
HYT00	Timeout expired	

Restrictions

If an application is connected to a DB2 server that does not provide support for a stored procedure catalog, or does not provide support for stored procedures, `SQLProcedureColumns()` will return an empty result set.

Example

```
/* From CLI sample procs.c */
/* ... */

    printf("Enter Procedure Schema Name Search Pattern:\n");
    gets((char *)proc_schem.s);

    rc = SQLProcedures(hstmt, NULL, 0, proc_schem.s, SQL_NTS, (SQLCHAR *)"%", SQL_NTS);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 2, SQL_C_CHAR, (SQLPOINTER) proc_schem.s, 129,
                    &proc_schem.ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 3, SQL_C_CHAR, (SQLPOINTER) proc_name.s, 129,
                    &proc_name.ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    rc = SQLBindCol(hstmt, 7, SQL_C_CHAR, (SQLPOINTER) remarks.s, 255,
                    &remarks.ind);
    CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

    printf("PROCEDURE SCHEMA          PROCEDURE NAME            \n");
    printf("------------------------ ------------------------ \n");
    /* Fetch each row, and display */
    while ((rc = SQLFetch(hstmt)) == SQL_SUCCESS) {
        printf("%-25s %-25s\n", proc_schem.s, proc_name.s);
        if (remarks.ind != SQL_NULL_DATA) {
            printf("  (Remarks) %s\n", remarks.s);
        }
    }                           /* endwhile */
```

References

- “SQLProcedureColumns - Get Input/Output Parameter Information for A Procedure” on page 195

SQLPutData - Passing Data Value for A Parameter

Purpose

SQLPutData() is called following an SQLParamData() call returning SQL_NEED_DATA to supply parameter data values. This function can be used to send large parameter values in pieces.

Syntax

```
SQLRETURN SQLPutData  (SQLHSTMT     hstmt,
                       SQLPOINTER   rgbValue,
                       SQLINTEGER   cbValue);
```

Function Arguments

Table 140. SQLPutData Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle
SQLPOINTER	*rgbValue*	Input	Pointer to the actual data, or portion of data, for a parameter. The data must be in the form specified in the SQLBindParam() call that the application used when specifying the parameter.
SQLINTEGER	*cbValue*	Input	Length of *rgbValue*. Specifies the amount of data sent in a call to SQLPutData(). The amount of data can vary with each call for a given parameter. The application can also specify SQL_NTS or SQL_NULL_DATA for *cbValue*. *cbValue* is ignored for all date, time, timestamp data types, and all numeric data types except SQL_NUMERIC and SQL_DECIMAL. For cases where the C buffer type is SQL_CHAR or SQL_BINARY, or if SQL_DEFAULT is specified as the C buffer type and the C buffer type default is SQL_CHAR or SQL_BINARY, this is the number of bytes of data in the *rgbValue* buffer.

Usage

The application calls SQLPutData() after calling SQLParamData() on a statement in the SQL_NEED_DATA state to supply the data values for an SQL_DATA_AT_EXEC parameter. Long data can be sent in pieces through repeated calls to SQLPutData(). After all the pieces of data for the parameter have been sent, the application again calls SQLParamData(). SQLParamData(). proceeds to the next SQL_DATA_AT_EXEC parameter, or, if all parameters have data values, executes the statement.

SQLPutData() cannot be called more than once for a fixed length parameter.

After an SQLPutData() call, the only legal function calls are SQLParamData(), SQLCancel(), or another SQLPutData() if the input data is character or binary data. As with SQLParamData(), all other function calls using this statement handle will fail. In addition, all function calls referencing the parent *hdbc* of *hstmt* will

fail if they involve changing any attribute or state of that connection. For a list of these functions, see the Usage section for “SQLParamData - Get Next Parameter For Which A Data Value Is Needed” on page 185.

If one or more calls to SQLPutData() for a single parameter result in SQL_SUCCESS, attempting to call SQLPutData() with *cbValue* set to SQL_NULL_DATA for the same parameter results in an error with SQLSTATE of **HY**011. This error does not result in a change of state; the statement handle is still in a *Need Data* state and the application can continue sending parameter data.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Some of the following diagnostics conditions may be reported on the final SQLParamData() call rather than at the time the SQLPutData() is called.

Table 141. SQLPutData SQLSTATEs

SQLSTATE	Description	Explanation
22001	Too much data	The size of the data supplied to the current parameter by SQLPutData() exceeds the size of the parameter. The data supplied by the last call to SQLPutData() will be ignored.
01004	Data truncated	The data sent for a numeric parameter was truncated without the loss of significant digits. Timestamp data sent for a date or time column was truncated. Function returns with SQL_SUCCESS_WITH_INFO.
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	The argument *rgbValue* was a NULL pointer. The argument *rgbValue* was not a NULL pointer and the argument *cbValue* was less than 0, but not equal to SQL_NTS or SQL_NULL_DATA.
HY010	Function sequence error	The statement handle *hstmt* must be in a **need data** state and must have been positioned on an SQL_DATA_AT_EXEC parameter through a previous SQLParamData() call.

SQLReleaseEnv - Release all Environment Resources

Purpose

SQLReleaseEnv() invalidates and frees the environment handle. All DB2 UDB CLI resources associated with the environment handle are freed.

SQLFreeConnect() must be called before calling this function.

This function is the last DB2 UDB CLI step an application needs to do before terminating.

Syntax

```
SQLRETURN SQLReleaseEnv (SQLHENV    henv);
```

Function Arguments

Table 142. SQLReleaseEnv Arguments

Data Type	Argument	Use	Description
SQLHENV	*henv*	Input	Environment handle

Usage

If this function is called when there is still a valid connection handle, SQL_ERROR is returned, and the environment handle remains valid.

Return Codes

- SQL_SUCCESS
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 143. SQLReleaseEnv SQLSTATEs

SQLSTATE	Description	Explanation
58004	System error	Unrecoverable system error
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY010	Function sequence error	There is an *hdbc* which is in allocated or connected state. Call SQLDisconnect and SQLFreeConnect for the *hdbc* before calling SQLReleaseEnv.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.

Example

Refer to the SQLAllocEnv() “Example” on page 27.

References

- “SQLFreeConnect - Free Connection Handle” on page 114

SQLRowCount - Get Row Count

Purpose

SQLRowCount() returns the number of rows in a table affected by an UPDATE, INSERT, or DELETE statement executed against the table, or a view based on the table.

SQLExecute() or SQLExecDirect() must be called before calling this function.

Syntax

```
SQLRETURN SQLRowCount (SQLHSTMT      hstmt,
                       SQLINTEGER    *pcrow);
```

Function Arguments

Table 144. SQLRowCount Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle
SQLINTEGER *	*pcrow*	Output	Pointer to location where the number of rows affected is stored.

Usage

If the last executed statement referenced by the input statement handle was not an UPDATE, INSERT, or DELETE statement, or if it did not execute successfully, then the function sets the contents of *pcrow* to 0.

Any rows in other tables that may have been affected by the statement (for example, cascading deletes) are not included in the count.

Return Codes

- SQL_SUCCESS
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 145. SQLRowCount SQLSTATEs

SQLSTATE	Description	Explanation
40003 *****	Statement completion unknown	The communication link between the CLI and the data source failed before the function completed processing.
58004	System error	Unrecoverable system error
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	*pcrow* was a null pointer
HY010	Function sequence error	The function was called prior to calling SQLExecute or SQLExecDirect for the *hstmt*.
HY013 *****	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.

References

- “SQLExecDirect - Execute a Statement Directly” on page 94
- “SQLExecute - Execute a Statement” on page 96
- “SQLNumResultCols - Get Number of Result Columns” on page 183

SQLSetConnectAttr - Set a Connection Attribute

Purpose

SQLSetConnectAttr() sets connection attributes for a particular connection.

Syntax

```
SQLRETURN SQLSetConnectAttr  (SQLHDBC     hdbc,
                              SQLINTEGER  fAttr,
                              SQLPOINTER  vParam,
                              SQLINTEGER  sLen);
```

Function Arguments

Table 146. SQLSetConnectAttr Arguments

Data Type	Argument	Use	Description
SQLHDBC	*hdbc*	Input	Connection handle
SQLINTEGER	*fAttr*	Input	Connect attribute to set, refer to Table 147 for more information.
SQLPOINTER	*vParam*	Input	Value associated with *fAttr*. Depending on the option, this can be a pointer to a 32-bit integer value, or a character string.
SQLINTEGER	*sLen*	Input	Length of input value, if it is a character string; otherwise, unused.

Usage

All connection and statement options set through the SQLSetConnectAttr() persist until SQLFreeConnect() is called or the next SQLSetConnectAttr() call.

The format of information set through *vParam* depends on the specified *fAttr*. The option information can be either a 32-bit integer or a pointer to a null-terminated character string.

Table 147. Connect Options

fAttr	Contents
SQL_ATTR_AUTOCOMMIT	A 32–bit value that sets the commit behavior for the connection. The following are possible values: • SQL_TRUE – Each SQL statement is automatically committed as it is executed. • SQL_FALSE – The SQL statements are not automatically committed. If running with commitment control, changes must be explicitly committed or rolled back using either SQLEndTran() or SQLTransact().

Table 147. Connect Options (continued)

fAttr	**Contents**
SQL_ATTR_COMMIT or SQL_TXN_ISOLATION	A 32-bit value that sets the transaction isolation level for the current connection referenced by *hdbc*. The following values are accepted by DB2 UDB CLI, but each server may only support some of these isolation levels: • SQL_TXN_NO_COMMIT – Commitment control is not used. • SQL_TXN_READ_UNCOMMITTED – Dirty reads, nonrepeatable reads, and phantoms are possible. • SQL_TXN_READ_COMMITTED – Dirty reads are not possible. Nonrepeatable reads, and phantoms are possible. • SQL_TXN_REPEATABLE_READ – Dirty reads and nonrepeatable reads are not possible. Phantoms are possible. • SQL_TXN_SERIALIZABLE – Transactions are serializable. Dirty reads, non-repeatable reads, and phantoms are not possible. In IBM terminology, • SQL_TXN_READ_UNCOMMITTED is Uncommitted Read; • SQL_TXN_READ_COMMITTED is Cursor Stability; • SQL_TXN_REPEATABLE_READ is Read Stability; • SQL_TXN_SERIALIZABLE is Repeatable Read. For a detailed explanation of Isolation Levels, refer to the IBM SQL Reference. The SQL_ATTR_COMMIT attribute should be set prior to the `SQLConnect()`. If the value is changed after the connection has been established, and the connection is to a remote data source, the change will not take effect until the next successful `SQLConnect()` for the connection handle.
SQL_ATTR_DATE_FMT	A 32–bit integer value that can be: • SQL_FMT_ISO – The International Organization for Standardization (ISO) date format yyyy-mm-dd is used. This is the default. • SQL_FMT_USA – The United States date format mm/dd/yyyy is used. • SQL_FMT_EUR – The European date format dd.mm.yyyy is used. • SQL_FMT_JIS – The Japanese Industrial Standard date format yyyy-mm-dd is used. • SQL_FMT_MDY – The date format mm/dd/yyyy is used. • SQL_FMT_DMY – The date format dd/mm/yyyy is used. • SQL_FMT_YMD – The date format yy/mm/dd is used. • SQL_FMT_JUL – The Julian date format yy/ddd is used. • SQL_FMT_JOB – The job default is used.

Table 147. Connect Options (continued)

fAttr	**Contents**
SQL_ATTR_DATE_SEP	A 32–bit integer value that can be: • SQL_SEP_SLASH – A slash (/) is used as the date separator. This is the default. • SQL_SEP_DASH – A dash (-) is used as the date separator. • SQL_SEP_PERIOD – A period (.) is used as the date separator. • SQL_SEP_COMMA – A comma (,) is used as the date separator. • SQL_SEP_BLANK – A blank is used as the date separator. • SQL_SEP_JOB – The job default is used.
SQL_ATTR_DBC_DEFAULT_LIB	A character value that indicates the default library that will be used for resolving unqualified file references. This is not valid if the connection is using system naming mode.
SQL_ATTR_DBC_SYS_NAMING	A 32–bit integer value that can be either: • SQL_TRUE – DB2 UDB CLI uses the iSeries system naming mode. Files are qualified using the slash (/) delimiter. Unqualified files are resolved using the library list for the job. • SQL_FALSE – DB2 UDB CLI uses the default naming mode, which is SQL naming. Files are qualified using the period (.) delimiter. Unqualified files are resolved using either the default library or the current user ID.
SQL_ATTR_DECIMAL_SEP	A 32–bit integer value that can be: • SQL_SEP_PERIOD – A period (.) is used as the decimal separator. This is the default. • SQL_SEP_COMMA – A comma (,) is used as the date separator. • SQL_SEP_JOB – The job default is used.
SQL_ATTR_EXTENDED_COL_INFO	A 32–bit integer value that can be either: • SQL_TRUE – Statement handles allocated against this connection handle can be used on `SQLColAttributes()` to retrieve extended column information, such as Base Table, Base Schema, Base Column, and Label. • SQL_FALSE – Statement handles allocated against this connection handle cannot be used on the `SQLColAttributes()` function to retrieve extended column information. This is the default.
SQL_ATTR_TIME_FMT	A 32–bit integer value that can be: • SQL_FMT_ISO – The International Organization for Standardization (ISO) time format hh.mm.ss is used. This is the default. • SQL_FMT_USA – The United States time format hh:mmxx is used, where xx is AM or PM. • SQL_FMT_EUR – The European time format hh.mm.ss is used. • SQL_FMT_JIS – The Japanese Industrial Standard time format hh:mm:ss is used. • SQL_FMT_HMS – The hh:mm:ss format is used.

Table 147. Connect Options (continued)

fAttr	**Contents**
SQL_ATTR_TIME_SEP	A 32–bit integer value that can be: • SQL_SEP_COLON – A colon (:) is used as the time separator. This is the default. • SQL_SEP_PERIOD – A period (.) is used as the time separator. • SQL_SEP_COMMA – A comma (,) is used as the time separator. • SQL_SEP_BLANK – A blank is used as the time separator. • SQL_SEP_JOB – The job default is used.
SQL_SAVEPOINT_NAME	A character value that indicates the savepoint name to be used by `SQLEndTran()` on the functions SQL_SAVEPOINT_NAME_ROLLBACK or SQL_SAVEPOINT_NAME_RELEASE.
SQL_2ND_LEVEL_TEXT	A 32–bit integer value that can be either: • SQL_TRUE – Error text obtained by calling `SQLError()` will contain the complete text description of the error. • SQL_FALSE – Error text obtained by calling `SQLError()` will contain the first level description of the error only. This is the default.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 148. SQLSetConnectAttr SQLSTATEs

SQLSTATE	**Description**	**Explanation**
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid Argument Value	Given the *fAttr* value, an invalid value was specified for the argument *vParam*. An invalid *fAttr* value was specified.

SQLSetConnectOption - Set Connection Option

Purpose

SQLSetConnectOption() sets connection attributes for a particular connection.

Syntax

```
SQLRETURN SQLSetConnectOption  (SQLHDBC hdbc,
                                SQLSMALLINT fOption,
                                SQLPOINTER  vParam);
```

Function Arguments

Table 149. SQLSetConnectOption Arguments

Data Type	Argument	Use	Description
SQLHDBC	*hdbc*	Input	Connection handle
SQLSMALLINT	*fOption*	Input	Connect option to set, refer to Table 147 on page 209 for more information.
SQLPOINTER	*vParam*	Input	Value associated with *fOption*. Depending on the option, this can be a pointer to a 32-bit integer value, or a character string.

Usage

The SQLSetConnectOption() provides the same function as SQLSetConnectAttr(), both functions are supported for compatibility reasons.

All connection and statement options set through the SQLSetConnectOption() persist until SQLFreeConnect() is called or the next SQLSetConnectOption() call.

The format of information set through *vParam* depends on the specified *fOption*. The option information can be either a 32-bit integer or a pointer to a null-terminated character string.

Refer to Table 147 on page 209 for the appropriate connect options.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 150. SQLSetConnectOption SQLSTATEs

SQLSTATE	Description	Explanation
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid Argument Value	Given the *fOption* value, an invalid value was specified for the argument *vParam*. An invalid *fOption* value was specified.

Table 150. SQLSetConnectOption SQLSTATEs (continued)

SQLSTATE	Description	Explanation
HYC00	Driver not capable	The specified *fOption* is not supported by DB2 UDB CLI or the server. Given specified *fOption*value, the value specified for the argument *vParam* is not supported.

SQLSetCursorName - Set Cursor Name

Purpose

SQLSetCursorName() associates a cursor name with the statement handle. This function is optional since DB2 UDB CLI implicitly generates a cursor name when needed.

Syntax

```
SQLRETURN SQLSetCursorName (SQLHSTMT       hstmt,
                            SQLCHAR        *szCursor,
                            SQLSMALLINT    cbCursor);
```

Function Arguments

Table 151. SQLSetCursorName Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle
SQLCHAR *	*szCursor*	Input	Cursor name
SQLSMALLINT	*cbCursor*	Input	Length of contents of *szCursor* argument

Usage

DB2 UDB CLI always generates and uses an internally generated cursor name when a SELECT statement is prepared or executed directly. SQLSetCursorName() allows an application-defined cursor name to be used in an SQL statement (a Positioned UPDATE or DELETE). DB2 UDB CLI maps this name to an internal name. SQLSetCursorName() must be called before an internal name is generated. The name remains associated with the statement handle, until the handle is dropped. The name also remains after the transaction has ended, but at this point SQLSetCursorName() can be called to set a different name for this statement handle.

Cursor names must follow the following rules:

- All cursor names within the connection must be unique.
- Each cursor name must be less than or equal to 18 bytes in length. Any attempt to set a cursor name longer than 18 bytes results in truncation of that cursor name to 18 bytes. (No warning is generated.)
- Since a cursor name is considered an identifier in SQL, it must begin with an English letter (a-z, A-Z) followed by any combination of digits (0-9), English letters or the underscore character (_).
- Unless the input cursor name is enclosed in double quotes, all leading and trailing blanks from the input cursor name string is removed.

Return Codes

- SQL_SUCCESS
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 152. SQLSetCursorName SQLSTATEs

SQLSTATE	Description	Explanation
34000	Invalid cursor name	The cursor name specified by the argument *szCursor* was invalid. The cursor name either begins with ″SQLCUR″ or ″SQL_CUR″ or violates either the driver or the data source cursor naming rules (Must begin with a-z or A-Z followed by any combination of English letters, digits, or the '_' character. The cursor name specified by the argument *szCursor* exists.
58004	System error	Unrecoverable system error
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	*szCursor* was a null pointer. The argument *cbCursor* was less than 1, but not equal to SQL_NTS.
HY010	Function sequence error	The statement handle is not in allocated state. `SQLPrepare()` or `SQLExecDirect()` was called prior to `SQLSetCursorName()`.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.

References

- "SQLGetCursorName - Get Cursor Name" on page 126

SQLSetDescField - Set a Descriptor Field

Purpose

SQLSetDescField() sets a field in a descriptor. SQLSetDescField() is a more extensible alternative to the SQLSetDescRec() function.

Syntax

```
SQLRETURN SQLSetDescField  (SQLHDESC       hdesc,
                            SQLSMALLINT    irec,
                            SQLSMALLINT    fDescType,
                            SQLPOINTER     rgbDesc,
                            SQLINTEGER     bLen);
```

Function Arguments

Table 153. SQLSetDescField Arguments

Data Type	Argument	Use	Description
SQLHDESC	*hdesc*	Input	Descriptor handle
SQLSMALLINT	*irec*	Input	Record number from which the specified field is to be retrieved.
SQLSMALLINT	*fDescType*	Input	See Table 154.
SQLPOINTER	*rgbDesc*	Input	Pointer to buffer
SQLINTEGER	*bLen*	Input	Length of descriptor buffer (*rgbDesc*)

Table 154. fDescType descriptor types

Descriptor	Type	Description
SQL_DESC_COUNT	SMALLINT	Set the number of records in the descriptor. *irec* is ignored.
SQL_DESC_TYPE	SMALLINT	Set the type field of *irec*.
SQL_DESC_DATETIME_INTERVAL_CODE	SMALLINT	Set the interval code for records with a type of SQL_DATETIME
SQL_DESC_LENGTH	INTEGER	Set the length field of *irec*.
SQL_DESC_PRECISION	SMALLINT	Set the precision field of *irec*.
SQL_DESC_SCALE	SMALLINT	Set the scale field of *irec*.
SQL_DESC_DATA_PTR	SQLPOINTER	Set the data pointer field for *irec*.
SQL_DESC_LENGTH_PTR	SQLPOINTER	Set the length pointer field for *irec*.
SQL_DESC_INDICATOR_PTR	SQLPOINTER	Set the indicator pointer field for *irec*.

Usage

Instead of requiring an entire set of arguments like SQLSetDescRec(), SQLSetDescField() specifies which attribute you want to set for a specific descriptor record.

Although SQLSetDescField() allows for future extensions, it requires more calls to set the same information than SQLSetDescRec() for each descriptor record.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 155. SQLGetDescField SQLSTATEs

SQLSTATE	Description	Explanation
HY009	Invalid argument value	The value specified for the argument *fDescType* or *irec* was not valid. The argument *rgbValue* was a null pointer.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.

References

- “SQLBindCol - Bind a Column to an Application Variable” on page 33
- “SQLDescribeCol - Describe Column Attributes” on page 76
- “SQLExecDirect - Execute a Statement Directly” on page 94
- “SQLExecute - Execute a Statement” on page 96
- “SQLPrepare - Prepare a Statement” on page 189

SQLSetDescRec - Set a Descriptor Record

Purpose

SQLSetDescRec() sets all the attributes for a descriptor record. SQLSetDescRec() is a more concise alternative to the SQLDescField() function.

Syntax

```
SQLRETURN SQLSetDescRec (SQLHDESC       hdesc,
                         SQLSMALLINT    irec,
                         SQLSMALLINT    type,
                         SQLSMALLINT    subtype,
                         SQLINTEGER     length,
                         SQLSMALLINT    prec,
                         SQLSMALLINT    scale,
                         SQLPOINTER     data,
                         SQLINTEGER     *sLen,
                         SQLINTEGER    *indic);
```

Function Arguments

Table 156. SQLSetDescRec Arguments

Data Type	Argument	Use	Description
SQLDESC	*hdesc*	Input	Descriptor handle
SQLSMALLINT	*irec*	Input	Record number within the descriptor.
SQLSMALLINT	*type*	Input	TYPE field for the record.
SQLSMALLINT	*subtype*	Input	DATETIME_INTERVAL_CODE field for records whose TYPE is SQL_DATETIME.
SQLINTEGER	*length*	Input	LENGTH field for the record.
SQLSMALLINT	*prec*	Input	PRECISION field for the record.
SQLSMALLINT	*scale*	Input	SCALE field for the record.
SQLPOINTER	*data*	Input (deferred)	DATA_PTR field for the record.
SQLINTEGER *	*sLen*	Input (deferred)	LENGTH_PTR field for the record.
SQLINTEGER *	*indic*	Input (deferred)	INDICATOR_PTR field for the record.

Usage

Calling SQLSetDescRec() sets all the fields in a descriptor record in one call.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 157. SQLSetDescRec SQLSTATEs

SQLSTATE	Description	Explanation
HY009	Invalid argument value	The value specified for the argument *irec* was less than 1. An invalid value for another argument was specified.
HY016	Invalid descriptor	The descriptor handle referred to an implementation row descriptor.

References

- "SQLBindCol - Bind a Column to an Application Variable" on page 33
- "SQLDescribeCol - Describe Column Attributes" on page 76
- "SQLExecDirect - Execute a Statement Directly" on page 94
- "SQLExecute - Execute a Statement" on page 96
- "SQLPrepare - Prepare a Statement" on page 189

SQLSetEnvAttr - Set Environment Attribute

Purpose

SQLSetEnvAttr() sets an environment attribute for the current environment.

Syntax

```
SQLRETURN SQLSetEnvAttr  (SQLHENV      henv,
                          SQLINTEGER   Attribute,
                          SQLPOINTER   Value,
                          SQLINTEGER   StringLength);
```

Function Arguments

Table 158. SQLSetEnvAttr Arguments

Data Type	Argument	Use	Description
SQLHENV	*henv*	Input	Environment handle
SQLINTEGER	*Attribute*	Input	Environment attribute to set, refer to Table 159 for more information.
SQLPOINTER	*pValue*	Input	Desired value for *Attribute*.
SQLINTEGER	*StringLength*	Input	Length of *Value* in bytes if the attribute value is a character string; if *Attribute* does not denote a string, then DB2 UDB CLI ignores *StringLength*.Must not be any connection handles hnadled yet or error HY010 will error.

Usage

Table 159. Environment Attributes

Attribute	**Contents**
SQL_ATTR_DATE_FMT	A 32–bit integer value that can be: • SQL_FMT_ISO – The International Organization for Standardization (ISO) date format yyyy-mm-dd is used. This is the default. • SQL_FMT_USA – The United States date format mm/dd/yyyy is used. • SQL_FMT_EUR – The European date format dd.mm.yyyy is used. • SQL_FMT_JIS – The Japanese Industrial Standard date format yyyy-mm-dd is used. • SQL_FMT_MDY – The date format mm/dd/yyyy is used. • SQL_FMT_DMY – The date format dd/mm/yyyy is used. • SQL_FMT_YMD – The date format yy/mm/dd is used. • SQL_FMT_JUL – The Julian date format yy/ddd is used. • SQL_FMT_JOB – The job default is used.

Table 159. Environment Attributes (continued)

Attribute	**Contents**
SQL_ATTR_DATE_SEP	A 32–bit integer value that can be: • SQL_SEP_SLASH – A slash (/) is used as the date separator. This is the default. • SQL_SEP_DASH – A dash (-) is used as the date separator. • SQL_SEP_PERIOD – A period (.) is used as the date separator. • SQL_SEP_COMMA – A comma (,) is used as the date separator. • SQL_SEP_BLANK – A blank is used as the date separator. • SQL_SEP_JOB – The job default is used.
SQL_ATTR_DECIMAL_SEP	A 32–bit integer value that can be: • SQL_SEP_PERIOD – A period (.) is used as the decimal separator. This is the default. • SQL_SEP_COMMA – A comma (,) is used as the date separator. • SQL_SEP_JOB – The job default is used.
SQL_ATTR_DEFAULT_LIB	A character value that indicates the default library that will be used for resolving unqualified file references. This is not valid if the environment is using system naming mode.
SQL_ATTR_ENVHNDL_COUNTER	A 32-bit integer value that can be either: • SQL_FALSE – DB2 CLI does not count the number of times the environment handle was allocated. Therefore, the first call to free the environment frees handle and all associated resources. • SQL_TRUE – DB2 CLI keeps a counter of the number of times the environment handle was allocated. Each time the environment handle is freed, the counter is decremented. Only when the counter reaches zero will the DB2 CLI actually free the handle and all associated resources. This allows nested calls to programs using the CLI that allocate and free the CLI environment handle.
SQL_ATTR_ESCAPE_CHAR	A character value that indicates the escape character to be used when specifying a search pattern in either SQLColumns( ) or SQLTables( ).
SQL_ATTR_FOR_FETCH_ONLY	A 32-bit integer value that can be either: • SQL_TRUE – Cursors are read-only and cannot be used for positioned updates or deletes. This is the default. • SQL_FALSE – Cursors can be used for positioned updates and deletes. The attribute SQL_ATTR_FOR_FETCH_ONLY can also be set for individual statements using SQLSetStmtAttr().
SQL_ATTR_JOB_SORT_SEQUENCE	A 32-bit integer value that can be either: • SQL_TRUE – DB2 UDB CLI uses the sort sequence that has been set for the job. • SQL_FALSE – DB2 UDB CLI uses the default sort sequence, which is *HEX.

Table 159. Environment Attributes (continued)

Attribute	**Contents**
SQL_ATTR_OUTPUT_NTS	A 32-bit integer value that can be either: • SQL_TRUE – DB2 UDB CLI uses null termination to indicate the length of output character strings. • SQL_FALSE – DB2 UDB CLI does not use null termination The CLI functions affected by this attribute are all functions called for the environment (and for any connections allocated under the Environment) that have character string parameters.
SQL_ATTR_SERVER_MODE	A 32-bit integer value that can be either: • SQL_FALSE – DB2 CLI processes the SQL statements of all connections within the same job. All changes compose a single transaction. This is the default mode of processing. • SQL_TRUE – DB2 CLI processes the SQL statements of each connection in a separate job. This allows multiple connections to the same data source, possibly with different user IDs for each connection. It also separates the changes made under each connection handle into its own transaction. This allows each connection handle to be committed or rolled back, without impacting pending changes made under other connection handles. See Appendix D, “Running DB2 UDB CLI in Server Mode” on page 275 for more information.
SQL_ATTR_SYS_NAMING	A 32–bit integer value that can be either: • SQL_TRUE – DB2 UDB CLI uses the iSeries system naming mode. Files are qualified using the slash (/) delimiter. Unqualified files are resolved using the library list for the job. • SQL_FALSE – DB2 UDB CLI uses the default naming mode, which is SQL naming. Files are qualified using the period (.) delimiter. Unqualified files are resolved using either the default library, or the current user ID.
SQL_ATTR_TIME_FMT	A 32–bit integer value that can be: • SQL_FMT_ISO – The International Organization for Standardization (ISO) time format hh.mm.ss is used. This is the default. • SQL_FMT_USA – The United States time format hh:mmxx is used, where xx is AM or PM. • SQL_FMT_EUR – The European time format hh.mm.ss is used. • SQL_FMT_JIS – The Japanese Industrial Standard time format hh:mm:ss is used. • SQL_FMT_HMS – The hh:mm:ss format is used.

Table 159. Environment Attributes (continued)

Attribute	**Contents**
SQL_ATTR_TIME_SEP	A 32–bit integer value that can be: • SQL_SEP_COLON – A colon (:) is used as the time separator. This is the default. • SQL_SEP_PERIOD – A period (.) is used as the time separator. • SQL_SEP_COMMA – A comma (,) is used as the time separator. • SQL_SEP_BLANK – A blank is used as the time separator. • SQL_SEP_JOB – The job default is used.
SQL_ATTR_UTF8	A 32–bit integer value that can be either: • SQL_FALSE – Character data is treated as being in the default job CCSID. This is the default. • SQL_TRUE – Character data is treated as being in the UTF–8 CCSID (1208).

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 160. SQLSetEnvAttr SQLSTATEs

SQLSTATE	**Description**	**Explanation**
HY009	Invalid parameter value	The specified *Attribute* is not supported by DB2 UDB CLI. Given specified *Attribute*value, the value specified for the argument *Value* is not supported. The argument *pValue* was a null pointer.
HY010	Function sequence error	Connection handles are already allocated.

SQLSetParam - Set Parameter

Purpose

SQLSetParam() associates (binds) an application variable to a parameter marker in an SQL statement. When the statement is executed, the contents of the bound variables are sent to the database server. This function is also used to specify any required data conversion.

Syntax

```
SQLRETURN SQLSetParam (SQLHSTMT       hstmt,
                       SQLSMALLINT    ipar,
                       SQLSMALLINT    fCType,
                       SQLSMALLINT    fSqlType,
                       SQLINTEGER     cbParamDef,
                       SQLSMALLINT    ibScale,
                       SQLPOINTER     rgbValue,
                       SQLINTEGER     *pcbValue);
```

Note: Refer to “SQLBindParam - Binds A Buffer To A Parameter Marker” on page 43 for a description of this function. The functions are identical and supported for compatibility reasons.

SQLSetStmtAttr - Set a Statement Attribute

Purpose

SQLSetStmtAttr() sets an attribute of a specific statement handle. To set an option for all statement handles associated with a connection handle, the application can call SQLSetConnectOption() (refer also to "SQLSetConnectOption - Set Connection Option" on page 213 for additional details).

Syntax

```
SQLRETURN SQLSetStmtAttr  (SQLHSTMT       hstmt,
                           SQLINTEGER     fAttr,
                           SQLPOINTER     vParam,
                           SQLINTEGER     sLen);
```

Function Arguments

Table 161. SQLSetStmtAttr Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle
SQLINTEGER	*fAttr*	Input	Attribute to set. Refer to Table 162 for the list of settable statement attributes.
SQLPOINTER	*vParam*	Input	Value associated with *fAttr*. *vParam* can be a 32-bit integer value or a character string.
SQLINTEGER	*sLen*	Input	Length of data if data is a character string; otherwise, unused.

Usage

Statement options for an *hstmt* remain in effect until they are changed by another call to SQLSetStmtAttr() or the *hstmt* is dropped by calling SQLFreeStmt() with the SQL_DROP option. Calling SQLFreeStmt() with the SQL_CLOSE, SQL_UNBIND, or SQL_RESET_PARAMS options does not reset the statement options.

The format of information set through *vParam* depends on the specified *fOption*. The format of each is noted in Table 162.

Table 162. Statement Attributes

fAttr	Contents
SQL_ATTR_APP_PARAM_DESC	*VParam* must be a descriptor handle. The specified descriptor serves as the application parameter descriptor for later calls to SQLExecute() and SQLExecDirect() on the statement handle.
SQL_ATTR_APP_ROW_DESC	*VParam* must be a descriptor handle. The specified descriptor serves as the application row descriptor for later calls to SQLFetch() on the statement handle.
SQL_ATTR_CURSOR_HOLD	A 32-bit integer value that specifies if cursors opened for this statement handle should be held. • SQL_FALSE – An open cursor for this statement handle will be closed on a commit or rollback operation. This is the default. • SQL_TRUE – An open cursor for this statement handle will not be closed on a commit or rollback operation.

Table 162. Statement Attributes (continued)

fAttr	**Contents**
SQL_ATTR_CURSOR_SCROLLABLE	A 32-bit integer value that specifies if cursors opened for this statement handle should be scrollable. • SQL_FALSE – Cursors are not scrollable, and `SQLFetchScroll()` cannot be used against them. This is the default. • SQL_TRUE – Cursors are scrollable. `SQLFetchScroll()` can be used to retrieve data from these cursors.
SQL_ATTR_CURSOR_TYPE	A 32-bit integer value that specifies the behavior of cursors opened for this statement handle. • SQL_CURSOR_FORWARD_ONLY – Cursors are not scrollable, and `SQLFetchScroll()` cannot be used against them. This is the default. • SQL_DYNAMIC – Cursors are scrollable. `SQLFetchScroll()` can be used to retrieve data from these cursors.
SQL_ATTR_EXTENDED_COL_INFO	A 32-bit integer value that specifies if cursors opened for this statement handle should provide extended column information. • SQL_FALSE – This statement handle cannot be used on the `SQLColAttributes()` function to retrieve extended column information. This is the default. Setting this attribute at the statement level overrides the connection level setting of the attribute. • SQL_TRUE – This statement handle can be used on `SQLColAttributes()` to retrieve extended column information, such as Base Table, Base Schema, Base Column, and Label.
SQL_ATTR_FOR_FETCH_ONLY	A 32-bit integer value that specifies if cursors opened for this statement handle should be read-only. • SQL_TRUE – Cursors are read-only and cannot be used for positioned updates or deletes. This is the default unless SQL_ATTR_FOR_FETCH_ONLY environment has been set to SQL_FALSE. • SQL_FALSE – Cursors can be used for positioned updates and deletes.
SQL_ATTR_FULL_OPEN	A 32-bit integer value that specifies if cursors opened for this statement handle should be full opens. • SQL_FALSE – Opening a cursor for this statement handle may use a cached cursor for performance reasons. This is the default. • SQL_TRUE – Opening a cursor for this statement handle will always force a full open of a new cursor.
SQL_ATTR_ROWSET_SIZE	A 32–bit integer value that specifies the number of rows in the rowset. This is the number of rows returned by each call to `SQLExtendedFetch()`. The default value is 1.

Return Codes

- SQL_SUCCESS
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 163. SQLStmtAttr SQLSTATEs

SQLSTATE	Description	Explanation
40003 *	Statement completion unknown	The communication link between the CLI and the data source failed before the function completed processing.
HY000	General error	An error occurred for which there was no specific SQLSTATE and for which no implementation defined SQLSTATE was defined. The error message returned by SQLError in the argument *szErrorMsg* describes the error and its cause.
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	Given the specified *fAttr* value, an invalid value was specified for the argument vParam. An invalid *fAttr* value was specified. The argument *vParam* was a null pointer.
HY010	Function sequence error	The function was called out of sequence.
HYC00	Driver not capable	The driver or the data sources does not support the specified option.

SQLSetStmtOption - Set Statement Option

Purpose

SQLSetStmtOption() sets an attribute of a specific statement handle. To set an option for all statement handles associated with a connection handle, the application can call SQLSetConnectOption() (refer also to "SQLSetConnectOption - Set Connection Option" on page 213 for additional details).

Syntax

```
SQLRETURN SQLSetStmtOption  (SQLHSTMT       hstmt,
                             SQLSMALLINT    fOption,
                             SQLPOINTER     vParam);
```

Function Arguments

Table 164. SQLSetStmtOption Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle
SQLSMALLINT	*fOption*	Input	Option to set. Refer to Table 162 on page 226 for the list of settable statement options.
SQLPOINTER	*vParam*	Input	Value associated with *fOption*. *vParam* can be a pointer to a 32-bit integer value or a character string.

Usage

SQLSetStmtOption() provides the same function as SQLSetStmtAttr(), both functions are supported for compatibility reasons.

Statement options for an *hstmt* remain in effect until they are changed by another call to SQLSetStmtOption() or the *hstmt* is dropped by calling SQLFreeStmt() with the SQL_DROP option. Calling SQLFreeStmt() with the SQL_CLOSE, SQL_UNBIND, or SQL_RESET_PARAMS options does not reset statement options.

The format of information set through *vParam* depends on the specified *fOption*. The format of each is noted in Table 162 on page 226.

Refer to Table 162 on page 226 for the proper statement options.

Return Codes

- SQL_SUCCESS
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 165. SQLStmtOption SQLSTATEs

SQLSTATE	Description	Explanation
40003 *	Statement completion unknown	The communication link between the CLI and the data source failed before the function completed processing.

Table 165. SQLStmtOption SQLSTATEs (continued)

SQLSTATE	Description	Explanation
HY000	General error	An error occurred for which there was no specific SQLSTATE and for which no implementation defined SQLSTATE was defined. The error message returned by SQLError in the argument *szErrorMsg* describes the error and its cause.
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument value	Given the specified *fOption* value, an invalid value was specified for the argument vParam. An invalid *fOption* value was specified. The argument *szSchemaName* or *szTableName* was a null pointer.
HY010	Function sequence error	The function was called out of sequence.
HYC00	Driver not capable	The driver or the data sources does not support the specified option.

SQLSpecialColumns - Get Special (Row Identifier) Columns

Purpose

SQLSpecialColumns() returns unique row identifier information (primary key or unique index) for a table. For example, unique index or primary key information. The information is returned in an SQL result set, which can be retrieved using the same functions that are used to fetch a result set generated by a SELECT-statement.

Syntax

```
SQLRETURN SQLSpecialColumns  (SQLHSTMT       hstmt,
                              SQLSMALLINT    fColType,
                              SQLCHAR        *szCatalogName,
                              SQLSMALLINT    cbCatalogName,
                              SQLCHAR        *szSchemaName,
                              SQLSMALLINT    cbSchemaName,
                              SQLCHAR        *szTableName,
                              SQLSMALLINT    cbTableName,
                              SQLSMALLINT    fScope,
                              SQLSMALLINT    fNullable);
```

Function Arguments

Table 166. SQLSpecialColumns Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle
SQLSMALLINT	*fColType*	Input	Reserved for future use to support additional types of special columns. This data type is currently ignored.
SQLCHAR *	*szCatalogName*	Input	Catalog qualifier of a three-part table name. This must be a null pointer or a zero length string.
SQLSMALLINT	*cbCatalogName*	Input	Length of *szCatalogName*. This must be a set to 0.
SQLCHAR *	*szSchemaName*	Input	Schema qualifier of the specified table.
SQLSMALLINT	*cbSchemaName*	Input	Length of *szSchemaName*.
SQLCHAR *	*szTableName*	Input	Table name
SQLSMALLINT	*cbTableName*	Input	Length of *cbTableName*.

Table 166. SQLSpecialColumns Arguments (continued)

Data Type	Argument	Use	Description
SQLSMALLINT	*fScope*	Input	Minimum required duration for which the unique row identifier is valid. *fScope* must be one of the following: • SQL_SCOPE_CURROW - The row identifier is guaranteed to be valid only while positioned on that row. A later reselect using the same row identifier values may not return a row if the row was updated or deleted by another transaction. • SQL_SCOPE_TRANSACTION - The row identifier is guaranteed to be valid for the duration of the current transaction. • SQL_SCOPE_SESSION - The row identifier is guaranteed to be valid for the duration of the connection. The duration over which a row identifier value is guaranteed to be valid depends on the current transaction isolation level. For information and scenarios involving isolation levels, refer to the IBM DB2 SQL Reference.
SQLSMALLINT	*fNullable*	Input	Determines whether to return special columns that can have a NULL value. Must be one of the following: • SQL_NO_NULLS The row identifier column set returned cannot have any NULL values. • SQL_NULLABLE The row identifier column set returned may include columns where NULL values are permitted.

Usage

If multiple ways exist to uniquely identify any row in a table (for example, if there are multiple unique indexes on the specified table), then DB2 UDB CLI returns the *best* set of row identifier columns based on its internal criterion.

If there is no column set that allows any row in the table to be uniquely identified, an empty result set is returned.

The unique row identifier information is returned in the form of a result set where each column of the row identifier is represented by one row in the result set. The result set returned by `SQLSpecialColumns()` has the following columns in the following order:

Table 167. Columns Returned By SQLSpecialColumns

Column Name	Data Type	Description
SCOPE	SMALLINT not NULL	Actual scope of the rowid. Contains one of the following values: • SQL_SCOPE_CURROW • SQL_SCOPE_TRANSACTION • SQL_SCOPE_SESSION Refer to *fScope* in Table 166 on page 231 for a description of each value.
COLUMN_NAME	VARCHAR(128) not NULL	Name of the row identifier column.
DATA_TYPE	SMALLINT not NULL	SQL data type of the column.
TYPE_NAME	VARCHAR(128) not NULL	DBMS character string represented of the name associated with DATA_TYPE column value.
LENGTH_PRECISION	INTEGER	The precision of the column. NULL is returned for data types where precision is not applicable.
BUFFER_LENGTH	INTEGER	The length, in bytes, of the data returned in the default C type. For CHAR data types, this is the same as the value in the LENGTH_PRECISION column.
SCALE	SMALLINT	The scale of the column. NULL is returned for data types where scale is not applicable.
PSEUDO_COLUMN	SMALLINT	Indicates whether or not the column is a pseudo-column; DB2 UDB CLI only returns: • SQL_PC_NOT_PSEUDO

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 168. SQLSpecialColumns SQLSTATEs

SQLSTATE	Description	Explanation
24000	Invalid cursor state	Cursor related information was requested, but no cursor was open.
40003 *	Statement completion unknown	The communication link between the CLI and the data source failed before the function completed processing.
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument length	The value of one of the length arguments was less than 0, but not equal to SQL_NTS.

Table 168. SQLSpecialColumns SQLSTATEs (continued)

SQLSTATE	Description	Explanation
HYC00	Driver not capable	The data source does not support the *catalog* portion (first part) of a three-part table name.

SQLStatistics - Get Index and Statistics Information For A Base Table

Purpose

SQLStatistics() retrieves index information for a given table. It also returns the cardinality and the number of pages associated with the table and the indexes on the table. The information is returned in a result set, which can be retrieved using the same functions that are used to fetch a result set generated by a SELECT-statement.

Syntax

```
SQLRETURN SQLStatistics  (SQLHSTMT       hstmt,
                          SQLCHAR        *szCatalogName,
                          SQLSMALLINT    cbCatalogName,
                          SQLCHAR        *szSchemaName,
                          SQLSMALLINT    cbSchemaName,
                          SQLCHAR        *szTableName,
                          SQLSMALLINT    cbTableName,
                          SQLSMALLINT    fUnique,
                          SQLSMALLINT    fAccuracy);
```

Function Arguments

Table 169. SQLStatistics Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle
SQLCHAR *	*szCatalogName*	Input	Catalog qualifier of a three-part table name. This must be a null pointer or a zero length string.
SQLSMALLINT	*cbCatalogName*	Input	Length of *cbCatalogName*. This must be set to 0.
SQLCHAR *	*szSchemaName*	Input	Schema qualifier of the specified table.
SQLSMALLINT	*cbSchemaName*	Input	Length of *szSchemaName*.
SQLCHAR *	*szTableName*	Input	Table name
SQLSMALLINT	*cbTableName*	Input	Length of *cbTableName*.
SQLSMALLINT	*fUnique*	Input	Type of index information to return: • SQL_INDEX_UNIQUE Only unique indexes are returned. • SQL_INDEX_ALL All indexes are returned.
SQLSMALLINT	*fAccuracy*	Input	Not currently used, must be set to 0.

Usage

SQLStatistics() returns the following types of information:

- Statistics information for the table (if available):
  - When the TYPE column in the following table is set to SQL_TABLE_STAT, the number of rows in the table and the number of pages used to store the table.
  - When the TYPE column indicates an index, the number of unique values in the index, and the number of pages used to store the indexes.

SQLStatistics

– Information about each index, where each index column is represented by one row of the result set. The result set columns are given in the following table in the order shown; the rows in the result set are ordered by NON_UNIQUE, TYPE, INDEX_QUALIFIER, INDEX_QUALIFIER, INDEX_NAME and ORDINAL_POSITION.

Table 170. Columns Returned By SQLStatistics

Column Name	Data Type	Description
TABLE_CAT	VARCHAR(128)	The name of the catalog containing TABLE_SCHEM. This is set to NULL.
TABLE_SCHEM	VARCHAR(128)	The name of the schema containing TABLE_NAME.
TABLE_NAME	VARCHAR(128) not NULL	Name of the the table.
NON_UNIQUE	SMALLINT	Indicates whether the index prohibits duplicate values: • TRUE if the index allows duplicate values. • FALSE if the index values must be unique. • NULL is returned if the TYPE column indicates that this row is SQL_TABLE_STAT (statistics information on the table itself).
INDEX_QUALIFIER	VARCHAR(128)	The identifier used to qualify the index name. This is NULL if the TYPE column indicates SQL_TABLE_STAT.
INDEX_NAME	VARCHAR(128)	The name of the index. If the TYPE column has the value SQL_TABLE_STAT, this column has the value NULL.
TYPE	SMALLINT not NULL	Indicates the type of information contained in this row of the result set: • SQL_TABLE_STAT Indicates this row contains statistics information on the table itself. • SQL_INDEX_CLUSTERED Indicates this row contains information on an index, and the index type is a clustered index. • SQL_INDEX_HASHED Indicates this row contains information on an index, and the index type is a hashed index. • SQL_INDEX_OTHER Indicates this row contains information on an index, and the index type is other than clustered or hashed. **Note:** Currently, SQL_INDEX_OTHER is the only possible type.
ORDINAL_POSITION	SMALLINT	Ordinal position of the column within the index whose name is given in the INDEX_NAME column. A NULL value is returned for this column if the TYPE column has the value of SQL_TABLE_STAT.
COLUMN_NAME	VARCHAR(128)	Name of the column in the index.
COLLATION	CHAR(1)	Sort sequence for the column; ″**A**″ for ascending, ″**D**″ for descending. NULL value is returned if the value in the TYPE column is SQL_TABLE_STAT.
CARDINALITY	INTEGER	• If the TYPE column contains the value SQL_TABLE_STAT, this column contains the number of rows in the table. • If the TYPE column value is not SQL_TABLE_STAT, this column contains the number of unique values in the index. • A NULL value is returned if information is not available from the DBMS.

Table 170. Columns Returned By SQLStatistics (continued)

Column Name	Data Type	Description
PAGES	INTEGER	• If the TYPE column contains the value SQL_TABLE_STAT, this column contains the number of pages used to store the table. • If the TYPE column value is not SQL_TABLE_STAT, this column contains the number of pages used to store the indexes. • A NULL value is returned if information is not available from the DBMS.

For the row in the result set that contains table statistics (TYPE is set to SQL_TABLE_STAT), the columns values of NON_UNIQUE, INDEX_QUALIFIER, INDEX_NAME, ORDINAL_POSITION, COLUMN_NAME, and COLLATION are set to NULL. If the CARDINALITY or PAGES information cannot be determined, then NULL is returned for those columns.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 171. SQLStatistics SQLSTATEs

SQLSTATE	Description	Explanation
24000	Invalid cursor state	Cursor related information was requested, but no cursor was open.
40003 *	Statement completion unknown	The communication link between the CLI and the data source failed before the function completed processing.
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument or buffer length	The value of one of the name length arguments was less than 0, but not equal to SQL_NTS.
HYC00	Driver not capable	The catalog part (the first part) of a three-part table name is not supported by the data source.

SQLTablePrivileges – Get privileges associated with a table

Purpose

SQLTablePrivileges() returns a list of tables and associated privileges for each table. The information is returned in an SQL result set, which can be retrieved using the same functions that are used to process a result set generated by a query.

Syntax

```
SQLRETURN SQLTablePrivileges  (SQLHSTMT         StatementHandle,
                               SQLCHAR          *CatalogName,
                               SQLSMALLINT      NameLength1,
                               SQLCHAR          *SchemaName,
                               SQLSMALLINT      NameLength2,
                               SQLCHAR          *TableName,
                               SQLSMALLINT      NameLength3);
```

Function Arguments

Table 172. SQLTablePrivileges Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*StatementHandle*	Input	Statement handle.
SQLCHAR *	*szTableQualifier*	Input	Catalog qualifier of a 3 part table name. This must be a null pointer or a zero length string.
SQLSMALLINT	*cbTableQualifier*	Input	Length of *CatalogName.* This must be set to 0.
SQLCHAR *	*SchemaName*	Input	Buffer that may contain a *pattern-value* to qualify the result set by schema name.
SQLSMALLINT	*NameLength2*	Input	Length of *SchemaName.*
SQLCHAR *	*TableName*	Input	Buffer that may contain a *pattern-value* to qualify the result set by table name.
SQLSMALLINT	*NameLength3*	Input	Length of *TableName.*

Usage

The results are returned as a standard result set containing the columns listed in the following table. The result set is ordered by TABLE_CAT, TABLE_SCHEM, TABLE_NAME, and PRIVILEGE. If multiple privileges are associated with any given table, each privilege is returned as a separate row.

The granularity of each privilege reported here may or may not apply at the column level; for example, for some data sources, if a table can be updated, every column in that table can also be updated. For other data sources, the application must call SQLColumnPrivileges() to discover if the individual columns have the same table privileges.

Since calls to SQLColumnPrivileges() in many cases map to a complex and thus expensive query against the system catalog, they should be used sparingly, and the results saved rather than repeating calls.

The VARCHAR columns of the catalog functions result set have been declared with a maximum length attribute of 128 to be consistent with SQL92 limits. Since DB2 names are less than 128, the application can choose to always set aside 128 characters (plus the null-terminator) for the output buffer, or alternatively, call SQLGetInfo() with the SQL_MAX_CATALOG_NAME_LEN, SQL_MAX_OWNER_SCHEMA_LEN, SQL_MAX_TABLE_NAME_LEN, and SQL_MAX_COLUMN_NAME_LEN to determine respectively the actual lengths of the TABLE_CAT, TABLE_SCHEM, TABLE_NAME, and COLUMN_NAME columns supported by the connected DBMS.

Although new columns may be added and the names of the existing columns changed in future releases, the position of the current columns will not change.

Table 173. Columns Returned By SQLTablePrivileges

Column Name	Data Type	Description
TABLE_CAT	VARCHAR(128)	This is always null.
TABLE_SCHEM	VARCHAR(128)	The name of the schema containing TABLE_NAME.
TABLE_NAME	VARCHAR(128) not NULL	The name of the table.
GRANTOR	VARCHAR(128)	Authorization ID of the user who granted the privilege.
GRANTEE	VARCHAR(128)	Authorization ID of the user to whom the privilege is granted.
PRIVILEGE	VARCHAR(128)	The table privilege. This may be one of the following strings: • ALTER • CONTROL • INDEX • DELETE • INSERT • REFERENCES • SELECT • UPDATE
IS_GRANTABLE	VARCHAR(3)	Indicates whether the grantee is permitted to grant the privilege to other users. This can be ″YES″, ″NO″ or ″NULL″.

Note: The column names used by DB2 CLI follow the X/Open CLI CAE specification style. The column types, contents and order are identical to those defined for the `SQLProcedures()` result set in ODBC.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_STILL_EXECUTING
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 174. SQLTablePrivileges SQLSTATEs

SQLSTATE	Description	Explanation
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid string or buffer length	The value of one of the name length arguments was less than 0, but not equal SQL_NTS.
HY010	Function sequence error	Cursor open for statement handle. No connection for this statement handle.

Restrictions

None.

Example

```
/* From the CLI sample TBINFO.C */
/* ... */

    /* call SQLTablePrivileges */
    printf("\n    Call SQLTablePrivileges for:\n");
    printf("        tbSchemaPattern = %s\n", tbSchemaPattern);
    printf("        tbNamePattern = %s\n", tbNamePattern);
    sqlrc = SQLTablePrivileges( hstmt, NULL, 0,
                                tbSchemaPattern, SQL_NTS,
                                tbNamePattern, SQL_NTS);
    STMT_HANDLE_CHECK( hstmt, sqlrc);
```

References

SQLTables - Get Table Information

Purpose

SQLTables() returns a list of table names and associated information stored in the system catalogs of the connected data source. The list of table names is returned as a result set, which can be retrieved using the same functions that are used to retrieve a result set generated by a SELECT-statement.

Syntax

```
SQLRETURN SQLTables  (SQLHSTMT       hstmt,
                      SQLCHAR        *szCatalogName,
                      SQLSMALLINT    cbCatalogName,
                      SQLCHAR        *szSchemaName,
                      SQLSMALLINT    cbSchemaName,
                      SQLCHAR        *szTableName,
                      SQLSMALLINT    cbTableName,
                      SQLCHAR        *szTableType,
                      SQLSMALLINT    cbTableType);
```

Function Arguments

Table 175. SQLTables Arguments

Data Type	Argument	Use	Description
SQLHSTMT	*hstmt*	Input	Statement handle
SQLCHAR *	*szCatalogName*	Input	Buffer that may contain a *pattern-value* to qualify the result set. *Catalog* is the first part of a three-part table name. This must be a NULL pointer or a zero length string.
SQLSMALLINT	*cbCatalogName*	Input	Length of *szCatalogName*. This must be set to 0.
SQLCHAR *	*szSchemaName*	Input	Buffer that may contain a *pattern-value* to qualify the result set by schema name.
SQLSMALLINT	*cbSchemaName*	Input	Length of *szSchemaName*.
SQLCHAR *	*szTableName*	Input	Buffer that may contain a *pattern-value* to qualify the result set by table name.
SQLSMALLINT	*cbTableName*	Input	Length of *szTableName*.
SQLCHAR *	*szTableType*	Input	Buffer that may contain a *value list* to qualify the result set by table type. The value list is a list of values separated by commas for the types of interest. Valid table type identifiers may include: ALL, BASE TABLE, TABLE, VIEW, SYSTEM TABLE. If *szTableType* argument is a NULL pointer or a zero length string, then this is equivalent to specifying all of the possibilities for the table type identifier. If SYSTEM TABLE is specified, then both system tables and system views (if there are any) are returned. The table types can be specified with or without quotes.

Table 175. SQLTables Arguments (continued)

Data Type	Argument	Use	Description
SQLSMALLINT	*cbTableType*	Input	Size of *szTableType*

Note that the *szCatalogName, szSchemaName*, and *szTableName* arguments accept search patterns.

An escape character can be specified in conjunction with a wildcard character to allow that actual character to be used in the search pattern. The escape character is specified on the SQL_ATTR_ESCAPE_CHAR environment attribute.

Usage

Table information is returned in a result set where each table is represented by one row of the result set.

The result set returned by `SQLTables()` contains the columns listed in the following table in the order given.

Table 176. Columns Returned By SQLTables

Column Name	Data Type	Description
TABLE_CAT	VARCHAR(128)	The current server.
TABLE_SCHEM	VARCHAR(128)	The name of the schema containing TABLE_NAME.
TABLE_NAME	VARCHAR(128)	The name of the table, or view, or alias, or synonym.
TABLE_TYPE	VARCHAR(128)	Identifies the type given by the name in the TABLE_NAME column. It can have the string values 'TABLE', 'VIEW', 'BASE TABLE', or 'SYSTEM TABLE'.
REMARKS	VARCHAR(254)	Contains the descriptive information about the table.

Return Codes

- SQL_SUCCESS
- SQL_SUCCESS_WITH_INFO
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 177. SQLTables SQLSTATEs

SQLSTATE	Description	Explanation
24000	Invalid cursor state	Cursor related information was requested, but no cursor was open.
40003 *	Statement completion unknown	The communication link between the CLI and the data source failed before the function completed processing.
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY009	Invalid argument or buffer length	The value of one of the name length arguments was less than 0, but not equal to SQL_NTS.
HYC00	Driver not capable	The catalog part (the first part) of a three-part table name is not supported by the data source.

SQLTransact - Transaction Management

Purpose

SQLTransact() commits or rolls back the current transaction in the connection.

All changes to the database performed on the connection since connect time or the previous call to SQLTransact() (whichever is the most recent) are committed or rolled back.

If a transaction is active on a connection, the application must call SQLTransact() before it can disconnect from the database.

Syntax

```
SQLRETURN SQLTransact (SQLHENV        henv,
                       SQLHDBC        hdbc,
                       SQLSMALLINT    fType);
```

Function Arguments

Table 178. SQLTransact Arguments

Data Type	Argument	Use	Description
SQLHENV	*henv*	Input	Environment handle. If *hdbc* is a valid connection handle, *henv* is ignored.
SQLHDBC	*hdbc*	Input	Database connection handle. If *hdbc* is set to SQL_NULL_HDBC, then *henv* must contain the environment handle that the connection is associated with.
SQLSMALLINT	*fType*	Input	The desired action for the transaction. The value for this argument must be one of: • SQL_COMMIT • SQL_ROLLBACK • SQL_COMMIT_HOLD • SQL_ROLLBACK_HOLD

Usage

Completing a transaction with SQL_COMMIT or SQL_ROLLBACK has the following effects:

- Statement handles are still valid after a call to SQLTransact().
- Cursor names, bound parameters, and column bindings survive transactions.
- Open cursors are closed, and any result sets that are pending retrieval are discarded.

Completing the transaction with SQL_COMMIT_HOLD or SQL_ROLLBACK_HOLD will still commit or roll back the database changes, but will not cause cursors to be closed.

If no transaction is currently active on the connection, calling SQLTransact() has no effect on the database server and returns SQL_SUCCESS.

SQLTransact() may fail while executing the COMMIT or ROLLBACK due to a loss of connection. In this case the application may be unable to determine whether the COMMIT or ROLLBACK has been processed, and a database administrator's help may be required. Refer to the DBMS product information for more information on transaction logs and other transaction management tasks.

Return Codes

- SQL_SUCCESS
- SQL_ERROR
- SQL_INVALID_HANDLE

Diagnostics

Table 179. SQLTransact SQLSTATEs

SQLSTATE	Description	Explanation
08003	Connection not open	The *hdbc* was not in a connected state.
08007	Connection failure during transaction.	The connection associated with the *hdbc* failed during the execution of the function during the execution of the function and it cannot be determined whether the requested COMMIT or ROLLBACK occurred before the failure.
58004	System error	Unrecoverable system error
HY001	Memory allocation failure	The driver is unable to allocate memory required to support execution or completion of the function.
HY012	Invalid transaction operation state.	The value specified for the argument *fType* was neither SQL_COMMIT not SQL_ROLLBACK.
HY013 *	Memory management problem	The driver was unable to access memory required to support execution or completion of the function.

Example

Refer to “Example” on page 102

Appendix A. DB2 UDB CLI General Diagnostic Information

This appendix section contains tables of information referred to by various sections in the book.

DB2 UDB CLI function return codes

Return Code	Value	Description
SQL_SUCCESS	0	The function completed successfully, no additional SQLSTATE information is available.
SQL_SUCCESS_WITH_INFO	1	The function completed successfully, with a warning or other information. Call `SQLError()` to receive the SQLSTATE and other error information.
SQL_NO_DATA_FOUND	100	The function returned successfully, but no relevant information was found.
SQL_ERROR	-1	The function failed. Call `SQLError()` to receive the SQLSTATE and any other error information.
SQL_INVALID_HANDLE	-2	The function failed due to an invalid handle (environment, connection or statement handle) passed as an input argument.

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Appendix B. DB2 UDB CLI Include files

The only include file used in DB2 UDB CLI is `sqlcli.h`.

```
/*** START HEADER FILE SPECIFICATIONS ******************************/
/*                                                                  */
/* Header File Name: SQLCLI                                         */
/*                                                                  */
/* Descriptive Name: Structured Query Language (SQL) Call Level     */
/*                   Interface.                                     */
/*                                                                  */
/* 5716-SS1  (C) Copyright IBM Corp. 1995,1995                      */
/* All rights reserved.                                             */
/* US Government Users Restricted Rights -                          */
/* Use, duplication or disclosure restricted                        */
/* by GSA ADP Schedule Contract with IBM Corp.                      */
/*                                                                  */
/* Licensed Materials-Property of IBM                               */
/*                                                                  */
/*                                                                  */
/* Description: The SQL Call Level Interface provides access to     */
/*              most SQL functions, without the need for a          */
/*              precompiler.                                        */
/*                                                                  */
/* Header Files Included: SQLCLI                                    */
/*                                                                  */
/* Function Prototype List:  SQLAllocConnect                        */
/*                           SQLAllocEnv                            */
/*                           SQLAllocHandle                         */
/*                           SQLAllocStmt                           */
/*                           SQLBindCol                             */
/*                           SQLBindFileToCol                       */
/*                           SQLBindFileToParam                     */
/*                           SQLBindParam                           */
/*                           SQLBindParameter                       */
/*                           SQLCancel                              */
/*                           SQLCloseCursor                         */
/*                           SQLColAttributes                       */
/*                           SQLColumns                             */
/*                           SQLConnect                             */
/*                           SQLCopyDesc                            */
/*                           SQLDataSources                         */
/*                           SQLDescribeCol                         */
/*                           SQLDescribeParam                       */
/*                           SQLDisconnect                          */
/*                           SQLDriverConnect                       */
/*                           SQLEndTran                             */
/*                           SQLError                               */
/*                           SQLExecDirect                          */
/*                           SQLExecute                             */
/*                           SQLExtendedFetch                       */
/*                           SQLFetch                               */
/*                           SQLFetchScroll                         */
/*                           SQLForeignKeys                         */
/*                           SQLFreeConnect                         */
/*                           SQLFreeEnv                             */
/*                           SQLFreeHandle                          */
/*                           SQLFreeStmt                            */
/*                           SQLGetCol                              */
/*                           SQLGetConnectOption                    */
/*                           SQLGetCursorName                       */
/*                           SQLGetConnectAttr                      */
/*                           SQLGetData                             */
/*                           SQLGetDescField                        */
/*                           SQLGetDescRec                          */
/*                           SQLGetDiagField                        */
```

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```
 /*                          SQLGetDiagRec                         */
 /*                          SQLGetEnvAttr                         */
 /*                          SQLGetFunctions                       */
 /*                          SQLGetInfo                            */
 /*                          SQLGetLength                          */
 /*                          SQLGetPosition                        */
 /*                          SQLGetStmtAttr                        */
 /*                          SQLGetStmtOption                      */
 /*                          SQLGetSubString                       */
 /*                          SQLGetTypeInfo                        */
 /*                          SQLLanguages                          */
 /*                          SQLMoreResults                        */
 /*                          SQLNativeSql                          */
 /*                          SQLNumParams                          */
 /*                          SQLNumResultCols                      */
 /*                          SQLParamData                          */
 /*                          SQLParamOptions                       */
 /*                          SQLPrepare                            */
 /*                          SQLPrimaryKeys                        */
 /*                          SQLProcedureColumns                   */
 /*                          SQLProcedures                         */
 /*                          SQLPutData                            */
 /*                          SQLReleaseEnv                         */
 /*                          SQLRowCount                           */
 /*                          SQLSetConnectAttr                     */
 /*                          SQLSetConnectOption                   */
 /*                          SQLSetCursorName                      */
 /*                          SQLSetDescField                       */
 /*                          SQLSetDescRec                         */
 /*                          SQLSetEnvAttr                         */
 /*                          SQLSetParam                           */
 /*                          SQLSetStmtAttr                        */
 /*                          SQLSetStmtOption                      */
 /*                          SQLSpecialColumns                     */
 /*                          SQLStatistics                         */
 /*                          SQLTables                             */
 /*                          SQLTransact                           */
 /*                                                                */
 /* Change Activity:                                               */
 /*                                                                */
 /* CFD List:                                                      */
 /*                                                                */
 /* FLAG REASON       LEVEL DATE   PGMR      CHANGE DESCRIPTION    */
 /* ---- ------------ ----- ------ --------- ----------------------*/
 /* $A0= D91823       3D60  941206 MEGERIAN  New Include           */
 /* $A1= D94881       4D20  960816 MEGERIAN  V4R2M0 enhancements   */
 /* $A2= D95600       4D30  970910 MEGERIAN  V4R3M0 enhancements   */
 /* $A3= P3682850     4D40  981030 MEGERIAN  V4R4M0 enhancements   */
 /* $A4= D97596       4D50  990326 LJAMESON  V4R5M0 enhancements   */
 /*                                                                */
 /* End CFD List.                                                  */
 /*                                                                */
 /*  Additional notes about the Change Activity                    */
 /* End Change Activity.                                           */
 /*** END HEADER FILE SPECIFICATIONS ******************************/

#ifndef SQL_H_SQLCLI
   #define SQL_H_SQLCLI            /* Permit duplicate Includes */

#ifndef __SQL_EXTERN
    #ifdef __ILEC400__
        #define SQL_EXTERN extern
    #else
        #ifdef __cplusplus
            #define SQL_EXTERN extern "C nowiden"
        #else
            #define SQL_EXTERN extern "C"
```

```
        #endif
    #endif
    #define __SQL_EXTERN
#endif

/* generally useful constants */
#define  SQL_FALSE                 0
#define  SQL_TRUE                  1
#define  SQL_NTS                  -3  /* NTS = Null Terminated String    */
#define  SQL_SQLSTATE_SIZE         5  /* size of SQLSTATE, not including
                                         null terminating byte           */
#define  SQL_MAX_MESSAGE_LENGTH    512

/* RETCODE values             */
#define  SQL_SUCCESS               0
#define  SQL_SUCCESS_WITH_INFO     1
#define  SQL_NO_DATA_FOUND         100
#define  SQL_NEED_DATA             99
#define  SQL_NO_DATA               SQL_NO_DATA_FOUND
#define  SQL_ERROR                -1
#define  SQL_INVALID_HANDLE       -2

/* SQLFreeStmt option values  */
#define  SQL_CLOSE                 0
#define  SQL_DROP                  1
#define  SQL_UNBIND                2
#define  SQL_RESET_PARAMS          3

/* SQLSetParam defines        */
#define  SQL_C_DEFAULT            99

/* SQLTransact option values  */
#define  SQL_COMMIT                0
#define  SQL_ROLLBACK              1
#define  SQL_COMMIT_HOLD           2
#define  SQL_ROLLBACK_HOLD         3

/* SQLDriverConnect option values  */
#define  SQL_DRIVER_COMPLETE          1
#define  SQL_DRIVER_COMPLETE_REQUIRED 1
#define  SQL_DRIVER_NOPROMPT          1

/*  Valid option codes for GetInfo procedure               */
#define  SQL_ACTIVE_CONNECTIONS    0
#define  SQL_ACTIVE_STATEMENTS     1
#define  SQL_PROCEDURES            2
#define  SQL_DBMS_NAME             17
#define  SQL_DBMS_VER              18
#define  SQL_MAX_COLUMN_NAME_LEN   30
#define  SQL_MAX_CURSOR_NAME_LEN   31
#define  SQL_MAX_OWNER_NAME_LEN    32
#define  SQL_MAX_SCHEMA_NAME_LEN   33
#define  SQL_MAX_TABLE_NAME_LEN    35

/* Standard SQL data types */
#define  SQL_CHAR                  1
#define  SQL_NUMERIC               2
#define  SQL_DECIMAL               3
#define  SQL_INTEGER               4
#define  SQL_SMALLINT              5
#define  SQL_FLOAT                 6
#define  SQL_REAL                  7
#define  SQL_DOUBLE                8
#define  SQL_DATETIME              9
#define  SQL_VARCHAR              12
#define  SQL_BLOB                 13
#define  SQL_CLOB                 14
```

```
#define  SQL_DBCLOB             15
#define  SQL_DATALINK           16
#define  SQL_WCHAR              17
#define  SQL_WVARCHAR           18
#define  SQL_BIGINT             19
#define  SQL_BLOB_LOCATOR       20
#define  SQL_CLOB_LOCATOR       21
#define  SQL_DBCLOB_LOCATOR     22
#define  SQL_WLONGVARCHAR       SQL_WVARCHAR
#define  SQL_LONGVARCHAR        SQL_VARCHAR
#define  SQL_GRAPHIC            95
#define  SQL_VARGRAPHIC         96
#define  SQL_LONGVARGRAPHIC     SQL_VARGRAPHIC
#define  SQL_BINARY             97
#define  SQL_VARBINARY          98
#define  SQL_LONGVARBINARY      SQL_VARBINARY
#define  SQL_DATE               91
#define  SQL_TYPE_DATE          91
#define  SQL_TIME               92
#define  SQL_TYPE_TIME          92
#define  SQL_TIMESTAMP          93
#define  SQL_TYPE_TIMESTAMP     93
#define  SQL_CODE_DATE           1
#define  SQL_CODE_TIME           2
#define  SQL_CODE_TIMESTAMP      3
#define  SQL_ALL_TYPES           0

/*
 * NULL status defines; these are used in SQLColAttributes, SQLDescribeCol,
 * to describe the nullability of a column in a table.
 */
#define  SQL_UNUSED                          0
#define  SQL_HANDLE_ENV                      1
#define  SQL_HANDLE_DBC                      2
#define  SQL_HANDLE_STMT                     3
#define  SQL_HANDLE_DESC                     4
#define  SQL_NULL_HANDLE                     0

#define  SQL_NO_NULLS         0
#define  SQL_NULLABLE         1
#define  SQL_NULLABLE_UNKNOWN 2

/* Special length values  */
#define  SQL_NULL_DATA       -1
#define  SQL_DATA_AT_EXEC    -2
#define  SQL_BIGINT_PREC     19
#define  SQL_INTEGER_PREC    10
#define  SQL_SMALLINT_PREC    5


/* SQLColAttributes defines */
#define  SQL_ATTR_READONLY            0
#define  SQL_ATTR_WRITE               1
#define  SQL_ATTR_READWRITE_UNKNOWN   2

/* Valid concurrency values */
#define  SQL_CONCUR_LOCK              0
#define  SQL_CONCUR_READ_ONLY         1

/*  Valid environment attributes                    */
#define SQL_ATTR_OUTPUT_NTS          10001
#define SQL_ATTR_SYS_NAMING          10002
#define SQL_ATTR_DEFAULT_LIB         10003
#define SQL_ATTR_SERVER_MODE         10004
#define SQL_ATTR_JOB_SORT_SEQUENCE   10005
#define SQL_ATTR_ENVHNDL_COUNTER     10009
#define SQL_ATTR_ESCAPE_CHAR         10010
```

```
/*  Valid environment/connection attributes           */
#define SQL_ATTR_DATE_FMT            10020
#define SQL_ATTR_DATE_SEP            10021
#define SQL_ATTR_TIME_FMT            10022
#define SQL_ATTR_TIME_SEP            10023
#define SQL_ATTR_DECIMAL_SEP         10024

/*  Valid environment/connection values               */
#define SQL_FMT_ISO                  1
#define SQL_FMT_USA                  2
#define SQL_FMT_EUR                  3
#define SQL_FMT_JIS                  4
#define SQL_FMT_MDY                  5
#define SQL_FMT_DMY                  6
#define SQL_FMT_YMD                  7
#define SQL_FMT_JUL                  8
#define SQL_FMT_HMS                  9
#define SQL_FMT_JOB                  10
#define SQL_SEP_SLASH                1
#define SQL_SEP_DASH                 2
#define SQL_SEP_PERIOD               3
#define SQL_SEP_COMMA                4
#define SQL_SEP_BLANK                5
#define SQL_SEP_COLON                6
#define SQL_SEP_JOB                  7

/*  Valid values for type in GetCol                                 */
#define SQL_DEFAULT               99
#define SQL_ARD_TYPE             -99

/*  Valid values for UPDATE_RULE and DELETE_RULE in SQLForeignKeys  */
#define SQL_CASCADE              1
#define SQL_RESTRICT             2
#define SQL_NO_ACTION            3
#define SQL_SET_NULL             4
#define SQL_SET_DEFAULT          5

/*  Valid values for COLUMN_TYPE in SQLProcedureColumns  */
#define SQL_PARAM_INPUT             1
#define SQL_PARAM_OUTPUT            2
#define SQL_PARAM_INPUT_OUTPUT      3

/* statement attributes */
#define SQL_ATTR_APP_ROW_DESC      10010
#define SQL_ATTR_APP_PARAM_DESC    10011
#define SQL_ATTR_IMP_ROW_DESC      10012
#define SQL_ATTR_IMP_PARAM_DESC    10013
#define SQL_ATTR_FOR_FETCH_ONLY    10014
#define SQL_ATTR_CONCURRENCY       10014
#define SQL_CONCURRENCY            10014
#define SQL_ATTR_CURSOR_SCROLLABLE 10015
#define SQL_ATTR_ROWSET_SIZE       10016
#define SQL_ROWSET_SIZE            10016

 /*  Codes used in FetchScroll                                       */
#define SQL_FETCH_NEXT                   1
#define SQL_FETCH_FIRST                  2
#define SQL_FETCH_LAST                   3
#define SQL_FETCH_PRIOR                  4
#define SQL_FETCH_ABSOLUTE               5
#define SQL_FETCH_RELATIVE               6

/* SQLColAttributes defines */
#define SQL_DESC_COUNT                   1
#define SQL_DESC_TYPE                    2
#define SQL_DESC_LENGTH                  3
```

```
#define SQL_DESC_LENGTH_PTR              4
#define SQL_DESC_PRECISION               5
#define SQL_DESC_SCALE                   6
#define SQL_DESC_DATETIME_INTERVAL_CODE  7
#define SQL_DESC_NULLABLE                8
#define SQL_DESC_INDICATOR_PTR           9
#define SQL_DESC_DATA_PTR                10
#define SQL_DESC_NAME                    11
#define SQL_DESC_UNNAMED                 12
#define SQL_DESC_DISPLAY_SIZE            13
#define SQL_DESC_ALLOC_TYPE              99
#define SQL_DESC_ALLOC_AUTO              1
#define SQL_DESC_ALLOC_USER              2

#define SQL_COLUMN_COUNT                   1
#define SQL_COLUMN_TYPE                    2
#define SQL_COLUMN_LENGTH                  3
#define SQL_COLUMN_LENGTH_PTR              4
#define SQL_COLUMN_PRECISION               5
#define SQL_COLUMN_SCALE                   6
#define SQL_COLUMN_DATETIME_INTERVAL_CODE  7
#define SQL_COLUMN_NULLABLE                8
#define SQL_COLUMN_INDICATOR_PTR           9
#define SQL_COLUMN_DATA_PTR                10
#define SQL_COLUMN_NAME                    11
#define SQL_COLUMN_UNNAMED                 12
#define SQL_COLUMN_DISPLAY_SIZE            13
#define SQL_COLUMN_ALLOC_TYPE              99
#define SQL_COLUMN_ALLOC_AUTO              1
#define SQL_COLUMN_ALLOC_USER              2

/*  Valid codes for SpecialColumns procedure              */
#define SQL_SCOPE_CURROW         0
#define SQL_SCOPE_TRANSACTION    1
#define SQL_SCOPE_SESSION        2
#define SQL_PC_UNKNOWN           0
#define SQL_PC_NOT_PSEUDO        1
#define SQL_PC_PSEUDO            2

/*  Valid values for connect attribute                     */
#define SQL_ATTR_AUTO_IPD       10001
#define SQL_ATTR_ACCESS_MODE    10002
#define SQL_ACCESS_MODE         10002
#define SQL_ATTR_AUTOCOMMIT     10003
#define SQL_AUTOCOMMIT          10003
#define SQL_ATTR_DBC_SYS_NAMING 10004
#define SQL_ATTR_DBC_DEFAULT_LIB 10005
#define SQL_ATTR_COMMIT             0
#define SQL_MODE_READ_ONLY          0
#define SQL_MODE_READ_WRITE         1
#define SQL_MODE_DEFAULT            1
#define SQL_AUTOCOMMIT_OFF          0
#define SQL_AUTOCOMMIT_ON           1
#define SQL_TXN_ISOLATION           0
#define SQL_COMMIT_NONE             1
#define SQL_TXN_NO_COMMIT           1
#define SQL_TXN_NOCOMMIT            1
#define SQL_COMMIT_CHG              2
#define SQL_COMMIT_UR               2
#define SQL_TXN_READ_UNCOMMITTED    2
#define SQL_COMMIT_CS               3
#define SQL_TXN_READ_COMMITTED      3
#define SQL_COMMIT_ALL              4
#define SQL_COMMIT_RS               4
#define SQL_TXN_REPEATABLE_READ     4
#define SQL_COMMIT_RR               5
#define SQL_TXN_SERIALIZABLE        5
```

```
/*  Valid index flags                       */
#define SQL_INDEX_UNIQUE            0
#define SQL_INDEX_ALL               1
#define SQL_INDEX_OTHER             3

/*  Valid File Options                      */
#define SQL_FILE_READ               2
#define SQL_FILE_CREATE             8
#define SQL_FILE_OVERWRITE         16
#define SQL_FILE_APPEND            32

/* Valid types for GetDiagField                          */
#define SQL_DIAG_RETURNCODE         1
#define SQL_DIAG_NUMBER             2
#define SQL_DIAG_ROW_COUNT          3
#define SQL_DIAG_SQLSTATE           4
#define SQL_DIAG_NATIVE             5
#define SQL_DIAG_MESSAGE_TEXT       6
#define SQL_DIAG_DYNAMIC_FUNCTION   7
#define SQL_DIAG_CLASS_ORIGIN       8
#define SQL_DIAG_SUBCLASS_ORIGIN    9
#define SQL_DIAG_CONNECTION_NAME    10
#define SQL_DIAG_SERVER_NAME        11

/*
 * SQLColAttributes defines
 * These are also used by SQLGetInfo
 */
#define  SQL_UNSEARCHABLE             0
#define  SQL_LIKE_ONLY                1
#define  SQL_ALL_EXCEPT_LIKE          2
#define  SQL_SEARCHABLE               3

/* GetFunctions() values to identify CLI functions   */
#define  SQL_API_SQLALLOCCONNECT        1
#define  SQL_API_SQLALLOCENV            2
#define  SQL_API_SQLALLOCHANDLE      1001
#define  SQL_API_SQLALLOCSTMT           3
#define  SQL_API_SQLBINDCOL             4
#define  SQL_API_SQLBINDFILETOCOL    2002
#define  SQL_API_SQLBINDFILETOPARAM  2003
#define  SQL_API_SQLBINDPARAM        1002
#define  SQL_API_SQLBINDPARAMETER    1023
#define  SQL_API_SQLCANCEL              5
#define  SQL_API_SQLCLOSECURSOR      1003
#define  SQL_API_SQLCOLATTRIBUTES       6
#define  SQL_API_SQLCOLUMNS            40
#define  SQL_API_SQLCONNECT             7
#define  SQL_API_SQLCOPYDESC         1004
#define  SQL_API_SQLDATASOURCES        57
#define  SQL_API_SQLDESCRIBECOL         8
#define  SQL_API_SQLDESCRIBEPARAM      58
#define  SQL_API_SQLDISCONNECT          9
#define  SQL_API_SQLDRIVERCONNECT      68
#define  SQL_API_SQLENDTRAN          1005
#define  SQL_API_SQLERROR              10
#define  SQL_API_SQLEXECDIRECT         11
#define  SQL_API_SQLEXECUTE            12
#define  SQL_API_SQLEXTENDEDFETCH    1022
#define  SQL_API_SQLFETCH              13
#define  SQL_API_SQLFETCHSCROLL      1021
#define  SQL_API_SQLFOREIGNKEYS        60
#define  SQL_API_SQLFREECONNECT        14
#define  SQL_API_SQLFREEENV            15
#define  SQL_API_SQLFREEHANDLE       1006
#define  SQL_API_SQLFREESTMT           16
```

```
#define  SQL_API_SQLGETCOL             43
#define  SQL_API_SQLGETCONNECTATTR   1007
#define  SQL_API_SQLGETCONNECTOPTION   42
#define  SQL_API_SQLGETCURSORNAME      17
#define  SQL_API_SQLGETDATA            43
#define  SQL_API_SQLGETDESCFIELD     1008
#define  SQL_API_SQLGETDESCREC       1009
#define  SQL_API_SQLGETDIAGFIELD     1010
#define  SQL_API_SQLGETDIAGREC       1011
#define  SQL_API_SQLGETENVATTR       1012
#define  SQL_API_SQLGETFUNCTIONS       44
#define  SQL_API_SQLGETINFO            45
#define  SQL_API_SQLGETLENGTH        2004
#define  SQL_API_SQLGETPOSITION      2005
#define  SQL_API_SQLGETSTMTATTR      1014
#define  SQL_API_SQLGETSTMTOPTION      46
#define  SQL_API_SQLGETSUBSTRING     2006
#define  SQL_API_SQLGETTYPEINFO        47
#define  SQL_API_SQLLANGUAGES        2001
#define  SQL_API_SQLMORERESULTS        61
#define  SQL_API_SQLNATIVESQL          62
#define  SQL_API_SQLNUMPARAMS          63
#define  SQL_API_SQLNUMRESULTCOLS      18
#define  SQL_API_SQLPARAMDATA          48
#define  SQL_API_SQLPARAMOPTIONS     2007
#define  SQL_API_SQLPREPARE            19
#define  SQL_API_SQLPRIMARYKEYS        65
#define  SQL_API_SQLPROCEDURECOLUMNS   66
#define  SQL_API_SQLPROCEDURES         67
#define  SQL_API_SQLPUTDATA            49
#define  SQL_API_SQLRELEASEENV       1015
#define  SQL_API_SQLROWCOUNT           20
#define  SQL_API_SQLSETCONNECTATTR   1016
#define  SQL_API_SQLSETCONNECTOPTION   50
#define  SQL_API_SQLSETCURSORNAME      21
#define  SQL_API_SQLSETDESCFIELD     1017
#define  SQL_API_SQLSETDESCREC       1018
#define  SQL_API_SQLSETENVATTR       1019
#define  SQL_API_SQLSETPARAM           22
#define  SQL_API_SQLSETSTMTATTR      1020
#define  SQL_API_SQLSETSTMTOPTION      51
#define  SQL_API_SQLSPECIALCOLUMNS     52
#define  SQL_API_SQLSTATISTICS         53
#define  SQL_API_SQLTABLES             54
#define  SQL_API_SQLTRANSACT           23

/* NULL handle defines    */
#define  SQL_NULL_HENV                0L
#define  SQL_NULL_HDBC                0L
#define  SQL_NULL_HSTMT               0L

#if !defined(SDWORD)
typedef long int            SDWORD;
#endif
#if !defined(UDWORD)
typedef unsigned long int   UDWORD;
#endif
#if !defined(UWORD)
typedef unsigned short int  UWORD;
#endif
#if !defined(SWORD)
typedef signed short int    SWORD;
#endif

typedef  char              SQLCHAR;
typedef  long     int      SQLINTEGER;
typedef  short    int      SQLSMALLINT;
```

```
typedef  UWORD             SQLUSMALLINT;
typedef  UDWORD            SQLUINTEGER;
typedef  double            SQLDOUBLE;
typedef  float             SQLREAL;

typedef  void *            PTR;
typedef  PTR               SQLPOINTER;
typedef  long              HENV;
typedef  long              HDBC;
typedef  long              HSTMT;
typedef  long              HDESC;
typedef  HENV              SQLHENV;
typedef  HDBC              SQLHDBC;
typedef  HSTMT             SQLHSTMT;
typedef  HDESC             SQLHDESC;

typedef  SQLINTEGER        RETCODE;
typedef  RETCODE           SQLRETURN;

typedef  float             SFLOAT;



/*
 * DATE, TIME, and TIMESTAMP structures.  These are for compatibility
 * purposes only.  When actually specifying or retrieving DATE, TIME,
 * and TIMESTAMP values, character strings must be used.
 */


typedef  struct DATE_STRUCT
  {
    SQLSMALLINT   year;
    SQLSMALLINT   month;
    SQLSMALLINT   day;
  } DATE_STRUCT;

typedef  struct TIME_STRUCT
  {
    SQLSMALLINT   hour;
    SQLSMALLINT   minute;
    SQLSMALLINT   second;
  } TIME_STRUCT;

typedef  struct TIMESTAMP_STRUCT
  {
    SQLSMALLINT   year;
    SQLSMALLINT   month;
    SQLSMALLINT   day;
    SQLSMALLINT   hour;
    SQLSMALLINT   minute;
    SQLSMALLINT   second;
    SQLINTEGER    fraction;     /* fraction of a second */
  } TIMESTAMP_STRUCT;




SQL_EXTERN SQLRETURN  SQLAllocConnect (SQLHENV             henv,
                                       SQLHDBC            *phdbc);


SQL_EXTERN SQLRETURN  SQLAllocEnv     (SQLHENV            *phenv);

SQL_EXTERN SQLRETURN  SQLAllocHandle  (SQLSMALLINT          htype,
```

```
                                SQLINTEGER           ihnd,
                                SQLINTEGER          *ohnd);

SQL_EXTERN SQLRETURN  SQLAllocStmt    (SQLHDBC          hdbc,
                                SQLHSTMT         *phstmt);

SQL_EXTERN SQLRETURN  SQLBindCol      (SQLHSTMT         hstmt,
                                SQLSMALLINT       icol,
                                SQLSMALLINT       iType,
                                SQLPOINTER        rgbValue,
                                SQLINTEGER        cbValueMax,
                                SQLINTEGER       *pcbValue);

SQL_EXTERN SQLRETURN  SQLBindFileToCol (SQLHSTMT         hstmt,
                                SQLSMALLINT       icol,
                                SQLCHAR          *fName,
                                SQLSMALLINT      *fNameLen,
                                SQLINTEGER       *fOptions,
                                SQLSMALLINT       fValueMax,
                                SQLINTEGER       *sLen,
                                SQLINTEGER       *pcbValue);

SQL_EXTERN SQLRETURN  SQLBindFileToParam (SQLHSTMT         hstmt,
                                SQLSMALLINT       ipar,
                                SQLSMALLINT       iType,
                                SQLCHAR          *fName,
                                SQLSMALLINT      *fNameLen,
                                SQLINTEGER       *fOptions,
                                SQLSMALLINT       fValueMax,
                                SQLINTEGER       *pcbValue);

SQL_EXTERN SQLRETURN  SQLBindParam    (SQLHSTMT         hstmt,
                                SQLSMALLINT       iparm,
                                SQLSMALLINT       iType,
                                SQLSMALLINT       pType,
                                SQLINTEGER        pLen,
                                SQLSMALLINT       pScale,
                                SQLPOINTER        pData,
                                SQLINTEGER       *pcbValue);

SQL_EXTERN SQLRETURN  SQLBindParameter (SQLHSTMT         hstmt,
                                SQLSMALLINT       ipar,
                                SQLSMALLINT       fParamType,
                                SQLSMALLINT       fCType,
                                SQLSMALLINT       fSQLType,
                                SQLINTEGER        pLen,
                                SQLSMALLINT       pScale,
                                SQLPOINTER        pData,
                                SQLINTEGER        cbValueMax,
                                SQLINTEGER       *pcbValue);

SQL_EXTERN SQLRETURN  SQLCancel       (SQLHSTMT         hstmt);

SQL_EXTERN SQLRETURN  SQLCloseCursor  (SQLHSTMT         hstmt);

SQL_EXTERN SQLRETURN  SQLColAttributes (SQLHSTMT         hstmt,
                                SQLSMALLINT       icol,
                                SQLSMALLINT       fDescType,
                                SQLCHAR          *rgbDesc,
                                SQLINTEGER        cbDescMax,
                                SQLINTEGER       *pcbDesc,
                                SQLINTEGER       *pfDesc);

SQL_EXTERN SQLRETURN   SQLColumns    (SQLHSTMT       hstmt,
                               SQLCHAR        *szTableQualifier,
                               SQLSMALLINT    cbTableQualifier,
                               SQLCHAR        *szTableOwner,
```

```
                                SQLSMALLINT    cbTableOwner,
                                SQLCHAR        *szTableName,
                                SQLSMALLINT    cbTableName,
                                SQLCHAR        *szColumnName,
                                SQLSMALLINT    cbColumnName);

SQL_EXTERN SQLRETURN  SQLConnect    (SQLHDBC           hdbc,
                                SQLCHAR          *szDSN,
                                SQLSMALLINT       cbDSN,
                                SQLCHAR          *szUID,
                                SQLSMALLINT       cbUID,
                                SQLCHAR          *szAuthStr,
                                SQLSMALLINT       cbAuthStr);

SQL_EXTERN SQLRETURN  SQLCopyDesc   (SQLHDESC   sDesc,
                                SQLHDESC   tDesc);

SQL_EXTERN SQLRETURN  SQLDataSources (SQLHENV       henv,
                                    SQLSMALLINT   fDirection,
                                    SQLCHAR      *szDSN,
                                    SQLSMALLINT   cbDSNMax,
                                    SQLSMALLINT  *pcbDSN,
                                    SQLCHAR      *szDescription,
                                    SQLSMALLINT   cbDescriptionMax,
                                    SQLSMALLINT  *pcbDescription);

SQL_EXTERN SQLRETURN  SQLDescribeCol (SQLHSTMT         hstmt,
                                SQLSMALLINT       icol,
                                SQLCHAR          *szColName,
                                SQLSMALLINT       cbColNameMax,
                                SQLSMALLINT      *pcbColName,
                                SQLSMALLINT      *pfSqlType,
                                SQLINTEGER       *pcbColDef,
                                SQLSMALLINT      *pibScale,
                                SQLSMALLINT      *pfNullable);

SQL_EXTERN SQLRETURN  SQLDescribeParam (SQLHSTMT         hstmt,
                                SQLSMALLINT       ipar,
                                SQLSMALLINT      *pfSqlType,
                                SQLINTEGER       *pcbColDef,
                                SQLSMALLINT      *pibScale,
                                SQLSMALLINT      *pfNullable);

SQL_EXTERN SQLRETURN  SQLDisconnect  (SQLHDBC             hdbc);

SQL_EXTERN SQLRETURN  SQLDriverConnect (SQLHDBC             hdbc,
                                    SQLPOINTER          hwnd,
                                    SQLCHAR      *szConnStrIn,
                                    SQLSMALLINT   cbConnStrin,
                                    SQLCHAR      *szConnStrOut,
                                    SQLSMALLINT  cbConnStrOutMax,
                                    SQLSMALLINT  *pcbConnStrOut,
                                    SQLSMALLINT fDriverCompletion);

SQL_EXTERN SQLRETURN  SQLEndTran     (SQLSMALLINT         htype,
                                SQLHENV             henv,
                                SQLSMALLINT         ctype);

SQL_EXTERN SQLRETURN  SQLError       (SQLHENV             henv,
                                SQLHDBC             hdbc,
                                SQLHSTMT            hstmt,
                                SQLCHAR         *szSqlState,
                                SQLINTEGER      *pfNativeError,
                                SQLCHAR         *szErrorMsg,
                                SQLSMALLINT      cbErrorMsgMax,
                                SQLSMALLINT     *pcbErrorMsg);
```

```
SQL_EXTERN SQLRETURN  SQLExecDirect  (SQLHSTMT           hstmt,
                                  SQLCHAR          *szSqlStr,
                                  SQLINTEGER        cbSqlStr);

SQL_EXTERN SQLRETURN  SQLExecute     (SQLHSTMT           hstmt);

SQL_EXTERN SQLRETURN  SQLExtendedFetch (SQLHSTMT           hstmt,
                                  SQLSMALLINT         fOrient,
                                  SQLINTEGER          fOffset,
                                  SQLINTEGER         *pcrow,
                                  SQLSMALLINT        *rgfRowStatus);

SQL_EXTERN SQLRETURN  SQLFetch       (SQLHSTMT           hstmt);

SQL_EXTERN SQLRETURN  SQLFetchScroll (SQLHSTMT           hstmt,
                                   SQLSMALLINT         fOrient,
                                   SQLINTEGER          fOffset);

SQL_EXTERN SQLRETURN  SQLForeignKeys (SQLHSTMT         hstmt,
                                  SQLCHAR          *szPkTableQualifier,
                                  SQLSMALLINT       cbPkTableQualifier,
                                  SQLCHAR          *szPkTableOwner,
                                  SQLSMALLINT       cbPkTableOwner,
                                  SQLCHAR          *szPkTableName,
                                  SQLSMALLINT       cbPkTableName,
                                  SQLCHAR          *szFkTableQualifier,
                                  SQLSMALLINT       cbFkTableQualifier,
                                  SQLCHAR          *szFkTableOwner,
                                  SQLSMALLINT       cbFkTableOwner,
                                  SQLCHAR          *szFkTableName,
                                  SQLSMALLINT       cbFkTableName);

SQL_EXTERN SQLRETURN  SQLFreeConnect (SQLHDBC            hdbc);

SQL_EXTERN SQLRETURN  SQLFreeEnv     (SQLHENV            henv);

SQL_EXTERN SQLRETURN  SQLFreeStmt    (SQLHSTMT           hstmt,
                                  SQLSMALLINT         fOption);

SQL_EXTERN SQLRETURN  SQLFreeHandle  (SQLSMALLINT         htype,
                                  SQLINTEGER          hndl);

SQL_EXTERN SQLRETURN  SQLGetCol      (SQLHSTMT           hstmt,
                                  SQLSMALLINT         icol,
                                  SQLSMALLINT         itype,
                                  SQLPOINTER          tval,
                                  SQLINTEGER          blen,
                                  SQLINTEGER         *olen);

SQL_EXTERN SQLRETURN  SQLGetConnectAttr (SQLHDBC             hdbc,
                                   SQLINTEGER          attr,
                                   SQLPOINTER          oval,
                                   SQLINTEGER          ilen,
                                   SQLINTEGER         *olen);

SQL_EXTERN SQLRETURN  SQLGetConnectOption (SQLHDBC             hdbc,
                                    SQLSMALLINT         iopt,
                                    SQLPOINTER          oval);

SQL_EXTERN SQLRETURN  SQLGetCursorName (SQLHSTMT           hstmt,
                                  SQLCHAR          *szCursor,
                                  SQLSMALLINT       cbCursorMax,
                                  SQLSMALLINT      *pcbCursor);

SQL_EXTERN SQLRETURN  SQLGetData     (SQLHSTMT         hstmt,
                                  SQLSMALLINT       icol,
                                  SQLSMALLINT       fCType,
```

```
                                SQLPOINTER        rgbValue,
                                SQLINTEGER        cbValueMax,
                                SQLINTEGER       *pcbValue);

SQL_EXTERN SQLRETURN SQLGetDescField (SQLHDESC            hdesc,
                                SQLSMALLINT          recNum,
                                SQLSMALLINT          fieldID,
                                SQLPOINTER           fValue,
                                SQLINTEGER           fLength,
                                SQLINTEGER          *stLength);

SQL_EXTERN SQLRETURN SQLGetDescRec   (SQLHDESC            hdesc,
                                SQLSMALLINT          recNum,
                                SQLCHAR             *fname,
                                SQLSMALLINT          bufLen,
                                SQLSMALLINT         *sLength,
                                SQLSMALLINT         *sType,
                                SQLSMALLINT         *sbType,
                                SQLINTEGER          *fLength,
                                SQLSMALLINT         *fprec,
                                SQLSMALLINT         *fscale,
                                SQLSMALLINT         *fnull);

SQL_EXTERN SQLRETURN SQLGetDiagField (SQLSMALLINT        hType,
                                SQLINTEGER          hndl,
                                SQLSMALLINT         recNum,
                                SQLSMALLINT         diagID,
                                SQLPOINTER          dValue,
                                SQLSMALLINT         bLength,
                                SQLSMALLINT        *sLength);

SQL_EXTERN SQLRETURN SQLGetDiagRec   (SQLSMALLINT        hType,
                                SQLINTEGER          hndl,
                                SQLSMALLINT         recNum,
                                SQLCHAR            *SQLstate,
                                SQLINTEGER         *SQLcode,
                                SQLCHAR            *msgText,
                                SQLSMALLINT         bLength,
                                SQLSMALLINT        *SLength);

SQL_EXTERN SQLRETURN SQLGetEnvAttr  (SQLHENV    hEnv,
                               SQLINTEGER fAttribute,
                               SQLPOINTER pParam,
                               SQLINTEGER cbParamMax,
                               SQLINTEGER * pcbParam);

SQL_EXTERN SQLRETURN  SQLGetFunctions  (SQLHDBC        hdbc,
                                   SQLSMALLINT    fFunction,
                                   SQLSMALLINT    *pfExists);

SQL_EXTERN SQLRETURN  SQLGetInfo       (SQLHDBC        hdbc,
                                   SQLSMALLINT    fInfoType,
                                   SQLPOINTER     rgbInfoValue,
                                   SQLSMALLINT    cbInfoValueMax,
                                   SQLSMALLINT    *pcbInfoValue);

SQL_EXTERN SQLRETURN  SQLGetLength (SQLHSTMT       hstmt,
                                   SQLSMALLINT    locType,
                                   SQLINTEGER     locator,
                                   SQLINTEGER    *sLength,
                                   SQLINTEGER    *ind);

SQL_EXTERN SQLRETURN  SQLGetPosition (SQLHSTMT       hstmt,
                                   SQLSMALLINT    locType,
                                   SQLINTEGER     srceLocator,
                                   SQLINTEGER     srchLocator,
                                   SQLCHAR       *srchLiteral,
```

```
                                    SQLINTEGER     srchLiteralLen,
                                    SQLINTEGER     fPosition,
                                    SQLINTEGER    *located,
                                    SQLINTEGER    *ind);

SQL_EXTERN SQLRETURN  SQLGetStmtAttr   (SQLHSTMT       hstmt,
                                    SQLINTEGER     fAttr,
                                    SQLPOINTER     pvParam,
                                    SQLINTEGER     bLength,
                                    SQLINTEGER    *SLength);

SQL_EXTERN SQLRETURN  SQLGetStmtOption (SQLHSTMT       hstmt,
                                    SQLSMALLINT    fOption,
                                    SQLPOINTER     pvParam);

SQL_EXTERN SQLRETURN  SQLGetSubString (SQLHSTMT       hstmt,
                                    SQLSMALLINT    locType,
                                    SQLINTEGER     srceLocator,
                                    SQLINTEGER     fPosition,
                                    SQLINTEGER     length,
                                    SQLSMALLINT    tType,
                                    SQLPOINTER     rgbValue,
                                    SQLINTEGER     cbValueMax,
                                    SQLINTEGER    *StringLength,
                                    SQLINTEGER    *ind);

SQL_EXTERN SQLRETURN  SQLGetTypeInfo   (SQLHSTMT       hstmt,
                                    SQLSMALLINT    fSqlType);

SQL_EXTERN SQLRETURN  SQLLanguages   (SQLHSTMT          hstmt);

SQL_EXTERN SQLRETURN  SQLMoreResults (SQLHSTMT          hstmt);

SQL_EXTERN SQLRETURN  SQLNativeSql   (SQLHDBC           hdbc,
                                     SQLCHAR          *szSqlStrIn,
                                     SQLINTEGER        cbSqlStrIn,
                                     SQLCHAR          *szSqlStr,
                                     SQLINTEGER        cbSqlStrMax,
                                     SQLINTEGER       *pcbSqlStr);

SQL_EXTERN SQLRETURN  SQLNumParams (SQLHSTMT            hstmt,
                                    SQLSMALLINT      *pcpar);

SQL_EXTERN SQLRETURN  SQLNumResultCols (SQLHSTMT        hstmt,
                                    SQLSMALLINT      *pccol);

SQL_EXTERN SQLRETURN  SQLParamData   (SQLHSTMT          hstmt,
                                  SQLPOINTER         *Value);

SQL_EXTERN SQLRETURN  SQLParamOptions (SQLHSTMT         hstmt,
                                  SQLINTEGER          crow,
                                  SQLINTEGER          *pirow);

SQL_EXTERN SQLRETURN  SQLPrepare     (SQLHSTMT          hstmt,
                                  SQLCHAR          *szSqlStr,
                                  SQLSMALLINT       cbSqlStr);

SQL_EXTERN SQLRETURN  SQLPrimaryKeys (SQLHSTMT          hstmt,
                                  SQLCHAR          *szTableQualifier,
                                  SQLSMALLINT       cbTableQualifier,
                                  SQLCHAR          *szTableOwner,
                                  SQLSMALLINT       cbTableOwner,
                                  SQLCHAR          *szTableName,
                                  SQLSMALLINT       cbTableName);

SQL_EXTERN SQLRETURN  SQLProcedureColumns (SQLHSTMT          hstmt,
                                  SQLCHAR          *szProcQualifier,
```

```
                                SQLSMALLINT       cbProcQualifier,
                                SQLCHAR          *szProcOwner,
                                SQLSMALLINT       cbProcOwner,
                                SQLCHAR          *szProcName,
                                SQLSMALLINT       cbProcName,
                                SQLCHAR          *szColumnName,
                                SQLSMALLINT       cbColumnName);

SQL_EXTERN SQLRETURN  SQLProcedures (SQLHSTMT          hstmt,
                                SQLCHAR          *szProcQualifier,
                                SQLSMALLINT       cbProcQualifier,
                                SQLCHAR          *szProcOwner,
                                SQLSMALLINT       cbProcOwner,
                                SQLCHAR          *szProcName,
                                SQLSMALLINT       cbProcName);

SQL_EXTERN SQLRETURN  SQLPutData     (SQLHSTMT            hstmt,
                                SQLPOINTER           Data,
                                SQLINTEGER           SLen);

SQL_EXTERN SQLRETURN  SQLReleaseEnv     (SQLHENV           henv);

SQL_EXTERN SQLRETURN  SQLRowCount    (SQLHSTMT           hstmt,
                                SQLINTEGER        *pcrow);

SQL_EXTERN SQLRETURN  SQLSetConnectAttr   (SQLHDBC        hdbc,
                                   SQLINTEGER     attrib,
                                   SQLPOINTER     vParam,
                                   SQLINTEGER     inlen);

SQL_EXTERN SQLRETURN  SQLSetConnectOption (SQLHDBC        hdbc,
                                   SQLSMALLINT    fOption,
                                   SQLPOINTER     vParam);

SQL_EXTERN SQLRETURN  SQLSetCursorName (SQLHSTMT            hstmt,
                                SQLCHAR          *szCursor,
                                SQLSMALLINT       cbCursor);

SQL_EXTERN SQLRETURN  SQLSetDescField  (SQLHDESC          hdesc,
                                SQLSMALLINT       recNum,
                                SQLSMALLINT       fID,
                                SQLPOINTER        Value,
                                SQLINTEGER        buffLen);

SQL_EXTERN SQLRETURN  SQLSetDescRec    (SQLHDESC          hdesc,
                                SQLSMALLINT       recNum,
                                SQLSMALLINT       Type,
                                SQLSMALLINT       subType,
                                SQLINTEGER        fLength,
                                SQLSMALLINT       fPrec,
                                SQLSMALLINT       fScale,
                                SQLPOINTER        Value,
                                SQLINTEGER       *sLength,
                                SQLSMALLINT      *indic);

SQL_EXTERN SQLRETURN  SQLSetEnvAttr( SQLHENV hEnv,
                             SQLINTEGER fAttribute,
                             SQLPOINTER pParam,
                             SQLINTEGER cbParam);

SQL_EXTERN SQLRETURN  SQLSetParam      (SQLHSTMT            hstmt,
                                SQLSMALLINT       ipar,
                                SQLSMALLINT       fCType,
                                SQLSMALLINT       fSqlType,
                                SQLINTEGER        cbColDef,
                                SQLSMALLINT       ibScale,
                                SQLPOINTER        rgbValue,
```

```
                                    SQLINTEGER       *pcbValue);

SQL_EXTERN SQLRETURN  SQLSetStmtAttr (SQLHSTMT       hstmt,
                                    SQLINTEGER     fAttr,
                                    SQLPOINTER     pParam,
                                    SQLINTEGER     vParam);

SQL_EXTERN SQLRETURN  SQLSetStmtOption (SQLHSTMT          hstmt,
                                    SQLSMALLINT    fOption,
                                    SQLPOINTER     vParam);

SQL_EXTERN SQLRETURN SQLSpecialColumns (SQLHSTMT       hstmt,
                                    SQLSMALLINT    fColType,
                                    SQLCHAR        *szTableQual,
                                    SQLSMALLINT    cbTableQual,
                                    SQLCHAR        *szTableOwner,
                                    SQLSMALLINT    cbTableOwner,
                                    SQLCHAR        *szTableName,
                                    SQLSMALLINT    cbTableName,
                                    SQLSMALLINT    fScope,
                                    SQLSMALLINT    fNullable);

SQL_EXTERN SQLRETURN  SQLStatistics    (SQLHSTMT       hstmt,
                                    SQLCHAR        *szTableQualifier,
                                    SQLSMALLINT    cbTableQualifier,
                                    SQLCHAR        *szTableOwner,
                                    SQLSMALLINT    cbTableOwner,
                                    SQLCHAR        *szTableName,
                                    SQLSMALLINT    cbTableName,
                                    SQLSMALLINT    fUnique,
                                    SQLSMALLINT    fres);

SQL_EXTERN SQLRETURN SQLTables        (SQLHSTMT       hstmt,
                                   SQLCHAR        *szTableQualifier,
                                   SQLSMALLINT    cbTableQualifier,
                                   SQLCHAR        *szTableOwner,
                                   SQLSMALLINT    cbTableOwner,
                                   SQLCHAR        *szTableName,
                                   SQLSMALLINT    cbTableName,
                                   SQLCHAR        *szTableType,
                                   SQLSMALLINT    cbTableType);

SQL_EXTERN SQLRETURN  SQLTransact      (SQLHENV             henv,
                                    SQLHDBC             hdbc,
                                    SQLSMALLINT       fType);


#define FAR
#define  SQL_SQLSTATE_SIZE         5   /* size of SQLSTATE, not including
                                          null terminating byte              */
#define  SQL_MAX_DSN_LENGTH       18   /* maximum data source name size      */
#define  SQL_MAX_ID_LENGTH        18   /* maximum identifier name size,
                                          e.g. cursor names                  */

#define SQL_MAX_STMT_SIZ       32767   /* Maximum statement size             */

#define SQL_MAXRECL            32766   /* Maximum record length              */

#define SQL_SMALL_LENGTH       2       /* Size of a SMALLINT                 */
#define SQL_MAXSMALLVAL        32767   /* Maximum value of a SMALLINT        */
#define SQL_MINSMALLVAL (-(SQL_MAXSMALLVAL)-1) /* Minimum value of a SMALLINT */
#define SQL_INT_LENGTH         4       /* Size of an INTEGER                 */
#define SQL_MAXINTVAL          2147483647 /* Maximum value of an INTEGER     */
#define SQL_MININTVAL (-(SQL_MAXINTVAL)-1)/* Minimum value of an INTEGER     */
#define SQL_FLOAT_LENGTH       8       /* Size of a FLOAT                    */
#define SQL_DEFDEC_PRECISION   5       /* Default precision for DECIMAL      */
#define SQL_DEFDEC_SCALE       0       /* Default scale for DECIMAL          */
```

```
#define SQL_MAXDECIMAL         31      /* Maximum scale/prec. for DECIMAL     */
#define SQL_DEFCHAR            1       /* Default length for a CHAR           */
#define SQL_DEFWCHAR           1       /* Default length for a wchar_t        */
#define SQL_MAXCHAR            32766   /* Maximum length of a CHAR            */
#define SQL_MAXLSTR            255     /* Maximum length of an LSTRING        */
#define SQL_MAXVCHAR           32740   /* Maximum length of a         */
                                       /* VARCHAR                             */
#define SQL_MAXVGRAPH          16370   /* Maximum length of a VARGRAPHIC      */
#define SQL_MAXBLOB            15728640 /* Max. length of a BLOB host var   */
#define SQL_MAXCLOB            15728640 /* Max. length of a CLOB host var   */
#define SQL_MAXDBCLOB          7864320 /* Max. length of an DBCLOB host    */
                                       /* var                                 */
#define SQL_LONGMAX            32740   /* Maximum length of a LONG VARCHAR    */
#define SQL_LONGGRMAX          16370   /* Max. length of a LONG VARGRAPHIC    */
#define SQL_LVCHAROH           26      /* Overhead for LONG VARCHAR in        */
                                       /* record                              */
#define SQL_LOBCHAROH          312     /* Overhead for LOB in record          */
#define SQL_BLOB_MAXLEN        15728640 /* BLOB maximum length, in bytes    */
#define SQL_CLOB_MAXLEN        15728640 /* CLOB maximum length, in chars    */
#define SQL_DBCLOB_MAXLEN      7864320 /* maxlen for dbcs lobs             */
#define SQL_TIME_LENGTH        3       /* Size of a TIME field                */
#define SQL_TIME_STRLEN        8       /* Size of a TIME field output         */
#define SQL_TIME_MINSTRLEN     5       /* Size of a non-USA TIME field        */
                                       /* output without seconds              */
#define SQL_DATE_LENGTH        4       /* Size of a DATE field                */
#define SQL_DATE_STRLEN        10      /* Size of a DATE field output         */
#define SQL_STAMP_LENGTH       10      /* Size of a TIMESTAMP field           */
#define SQL_STAMP_STRLEN       26      /* Size of a TIMESTAMP field output    */
#define SQL_STAMP_MINSTRLEN    19      /* Size of a TIMESTAMP field output    */
                                       /* without microseconds                */
#define SQL_BOOLEAN_LENGTH     1       /* Size of a BOOLEAN field             */
#define SQL_IND_LENGTH         2       /* Size of an indicator value          */

#define SQL_MAX_PNAME_LENGTH   254     /* Max size of Stored Proc Name        */
#define SQL_LG_IDENT           18      /* Maximum length of Long Identifer    */
#define SQL_SH_IDENT           8       /* Maximum length of Short Identifer   */
#define SQL_MN_IDENT           1       /* Minimum length of Identifiers       */
#define SQL_MAX_VAR_NAME       30      /* Max size of Host Variable Name      */
#define SQL_KILO_VALUE         1024    /* # of bytes in a kilobyte            */
#define SQL_MEGA_VALUE         1048576 /* # of bytes in a megabyte            */
#define SQL_GIGA_VALUE         1073741824 /* # of bytes in a gigabyte         */

/* SQL extended data types (negative means unsupported) */
#define  SQL_TINYINT            -6
#define  SQL_BIT                -7

/* C data type to SQL data type mapping */
#define  SQL_C_CHAR       SQL_CHAR      /* CHAR, VARCHAR, DECIMAL, NUMERIC */
#define  SQL_C_LONG       SQL_INTEGER   /* INTEGER                         */
#define  SQL_C_SHORT      SQL_SMALLINT  /* SMALLINT                        */
#define  SQL_C_FLOAT      SQL_REAL      /* REAL                            */
#define  SQL_C_DOUBLE     SQL_DOUBLE    /* FLOAT, DOUBLE                   */
#define  SQL_C_DATE       SQL_DATE      /* DATE                            */
#define  SQL_C_TIME       SQL_TIME      /* TIME                            */
#define  SQL_C_TIMESTAMP  SQL_TIMESTAMP /* TIMESTAMP                       */
#define  SQL_C_BINARY     SQL_BINARY    /* BINARY, VARBINARY               */
#define  SQL_C_BIT        SQL_BIT
#define  SQL_C_TINYINT    SQL_TINYINT
#define  SQL_C_BIGINT     SQL_BIGINT
#define  SQL_C_DBCHAR     SQL_DBCLOB
#define  SQL_C_WCHAR      SQL_WCHAR     /* UNICODE                         */
#define  SQL_C_DATETIME   SQL_DATETIME  /* DATETIME                        */
#define  SQL_C_BLOB           SQL_BLOB
#define  SQL_C_CLOB           SQL_CLOB
#define  SQL_C_DBCLOB         SQL_DBCLOB
#define  SQL_C_BLOB_LOCATOR   SQL_BLOB_LOCATOR
#define  SQL_C_CLOB_LOCATOR   SQL_CLOB_LOCATOR
```

```
#define  SQL_C_DBCLOB_LOCATOR SQL_DBCLOB_LOCATOR


#define SQL_WARN_VAL_TRUNC                  "01004"

#endif /* SQL_H_SQLCLI */
```

Appendix C. Example DB2 UDB CLI application code listing

This appendix section gives complete code listings for the examples used throughout the book.

Detailed error checking has not been implemented in the examples.

See:
- "Example: Embedded SQL and the equivalent DB2 UDB CLI function calls"
- "Example: Interactive SQL and the equivalent DB2 UDB CLI function calls" on page 268

Example: Embedded SQL and the equivalent DB2 UDB CLI function calls

This example shows embedded statements in comments, and the equivalent DB2 UDB CLI function calls.

See "Code disclaimer information" on page viii for information pertaining to code examples.

```
/************************************************************************
** file = embedded.c
**
** Example of executing an SQL statement using CLI.
** The equivalent embedded SQL statements are shown in comments.
**
** Functions used:
**
**        SQLAllocConnect      SQLFreeConnect
**        SQLAllocEnv          SQLFreeEnv
**        SQLAllocStmt         SQLFreeStmt
**        SQLConnect           SQLDisconnect
**
**        SQLBindCol           SQLFetch
**        SQLSetParam          SQLTransact
**        SQLError             SQLExecDirect
**
************************************************************************/
#include <stdio.h>
#include <string.h>
#include "sqlcli.h"

#ifndef NULL
#define NULL   0
#endif

int print_err (SQLHDBC    hdbc,
               SQLHSTMT   hstmt);

int main ()
{
    SQLHENV        henv;
    SQLHDBC        hdbc;
    SQLHSTMT       hstmt;

    SQLCHAR     server[] = "sample";
    SQLCHAR     uid[30];
    SQLCHAR     pwd[30];

    SQLINTEGER     id;
    SQLCHAR        name[51];
    SQLINTEGER     namelen, intlen;
    SQLSMALLINT    scale;

    scale = 0;
```

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```
/* EXEC SQL CONNECT TO :server USER :uid USING :authentication_string; */
SQLAllocEnv (&henv);                /* allocate an environment handle */

SQLAllocConnect (henv, &hdbc);      /* allocate a connection handle   */


/* Connect to database indicated by "server" variable with            */
/*    authorization-name given in "uid", authentication-string given  */
/*    in "pwd". Note server, uid, and pwd contain null-terminated     */
/*    strings, as indicated by the 3 input lengths set to SQL_NTS     */
if (SQLConnect (hdbc, server, SQL_NTS, NULL, SQL_NTS, NULL, SQL_NTS)
              != SQL_SUCCESS)
    return (print_err (hdbc, SQL_NULL_HSTMT));

SQLAllocStmt (hdbc, &hstmt);        /* allocate a statement handle    */


/* EXEC SQL CREATE TABLE NAMEID (ID integer, NAME varchar(50));       */
{
   SQLCHAR create[] = "CREATE TABLE NAMEID (ID integer, NAME varchar(50))";

/* execute the sql statement                                          */
   if (SQLExecDirect (hstmt, create, SQL_NTS) != SQL_SUCCESS)
       return (print_err (hdbc, hstmt));
}


/* EXEC SQL COMMIT WORK;                                              */
SQLTransact (henv, hdbc, SQL_COMMIT);          /* commit create table */


/* EXEC SQL INSERT INTO NAMEID VALUES ( :id, :name         */
{
   SQLCHAR insert[] = "INSERT INTO NAMEID VALUES (?, ?)";


/* show the use of SQLPrepare/SQLExecute method                       */
/* prepare the insert                                                 */

   if (SQLPrepare (hstmt, insert, SQL_NTS) != SQL_SUCCESS)
      return (print_err (hdbc, hstmt));

/* Set up the first input parameter "id"                              */
   intlen = sizeof (SQLINTEGER);
   SQLSetParam (hstmt, 1,
                SQL_C_LONG, SQL_INTEGER,
               (SQLINTEGER) sizeof (SQLINTEGER),
                scale, (SQLPOINTER) &id,
               (SQLINTEGER *) &intlen);

   namelen = SQL_NTS;
/* Set up the second input parameter "name"                           */
   SQLSetParam (hstmt, 2,
                SQL_C_CHAR, SQL_VARCHAR,
                50,
                scale, (SQLPOINTER) name,
                (SQLINTEGER *) &namelen);

/* now assign parameter values and execute the insert                */
   id=500;
   strcpy (name, "Babbage");

   if (SQLExecute (hstmt) != SQL_SUCCESS)
      return (print_err (hdbc, hstmt));
}
```

```
    /* EXEC SQL COMMIT WORK;                                              */
    SQLTransact (henv, hdbc, SQL_COMMIT);        /* commit inserts        */


    /* EXEC SQL DECLARE c1 CURSOR FOR SELECT ID, NAME FROM NAMEID;        */
    /* EXEC SQL OPEN c1;                                                  */
    /* The application doesn't specify "declare c1 cursor for"            */
    {
       SQLCHAR select[] = "select ID, NAME from NAMEID";
       if (SQLExecDirect (hstmt, select, SQL_NTS) != SQL_SUCCESS)
          return (print_err (hdbc, hstmt));
    }


    /* EXEC SQL FETCH c1 INTO :id, :name;                    */
    /* Binding first column to output variable "id"                       */
    SQLBindCol (hstmt, 1,
                SQL_C_LONG, (SQLPOINTER) &id,
               (SQLINTEGER) sizeof (SQLINTEGER),
               (SQLINTEGER *) &intlen);

    /* Binding second column to output variable "name"                    */
    SQLBindCol (hstmt, 2,
                SQL_C_CHAR, (SQLPOINTER) name,
               (SQLINTEGER) sizeof (name),
                &namelen);

    SQLFetch (hstmt);                     /* now execute the fetch        */
    printf("Result of Select: id = %ld name = %s\n", id, name);

    /* finally, we should commit, discard hstmt, disconnect               */
    /* EXEC SQL COMMIT WORK;                                              */
    SQLTransact (henv, hdbc, SQL_COMMIT);  /* commit the transaction      */

    /* EXEC SQL CLOSE c1;                                                 */
    SQLFreeStmt (hstmt, SQL_DROP);         /* free the statement handle   */

    /* EXEC SQL DISCONNECT;                                               */
    SQLDisconnect (hdbc);                  /* disconnect from the database */

    SQLFreeConnect (hdbc);                 /* free the connection handle  */
    SQLFreeEnv (henv);                     /* free the environment handle */

    return (0);
}

int print_err (SQLHDBC    hdbc,
               SQLHSTMT   hstmt)
{
SQLCHAR        buffer[SQL_MAX_MESSAGE_LENGTH + 1];
SQLCHAR        sqlstate[SQL_SQLSTATE_SIZE + 1];
SQLINTEGER     sqlcode;
SQLSMALLINT    length;


        while ( SQLError(SQL_NULL_HENV, hdbc, hstmt,
                  sqlstate,
                  &sqlcode,
                  buffer,
                  SQL_MAX_MESSAGE_LENGTH + 1,
                  &length) == SQL_SUCCESS )
        {
                 printf("SQLSTATE: %s Native Error Code: %ld\n",
                        sqlstate, sqlcode);
                 printf("%s \n", buffer);
```

```
                printf("---------------------------- \n");
         };

        return(SQL_ERROR);

}
```

Example: Interactive SQL and the equivalent DB2 UDB CLI function calls

This example shows the execution of interactive SQL statements, and follows the flow described in Chapter 2, "Writing a DB2 UDB CLI application" on page 7.

See "Code disclaimer information" on page viii for information pertaining to code examples.

```
/************************************************************************
** file = typical.c
**
** Example of executing interactive SQL statements, displaying result sets
** and simple transaction management.
**
** Functions used:
**
**        SQLAllocConnect      SQLFreeConnect
**        SQLAllocEnv          SQLFreeEnv
**        SQLAllocStmt         SQLFreeStmt
**        SQLConnect           SQLDisconnect
**
**        SQLBindCol           SQLFetch
**        SQLDescribeCol       SQLNumResultCols
**        SQLError             SQLRowCount
**        SQLExecDirect        SQLTransact
**
************************************************************************/

#include <stdlib.h>
#include <stdio.h>
#include <string.h>
#include "sqlcli.h"

#define  MAX_STMT_LEN 255
#define  MAXCOLS   100

#define  max(a,b) (a > b ? a : b)

int initialize(SQLHENV *henv,
               SQLHDBC *hdbc);

int process_stmt(SQLHENV    henv,
                 SQLHDBC        hdbc,
                 SQLCHAR        *sqlstr);

int terminate(SQLHENV henv,
              SQLHDBC hdbc);

int print_error(SQLHENV    henv,
                SQLHDBC    hdbc,
                SQLHSTMT   hstmt);

int check_error(SQLHENV    henv,
                SQLHDBC    hdbc,
                SQLHSTMT   hstmt,
                SQLRETURN  frc);

void display_results(SQLHSTMT hstmt,
                     SQLSMALLINT nresultcols);
```

```
/*****************************************************************
** main
** - initialize
** - start a transaction
**   - get statement
**   - another statement?
** - COMMIT or ROLLBACK
** - another transaction?
** - terminate
*****************************************************************/
int main()
{
    SQLHENV     henv;
    SQLHDBC     hdbc;
    SQLCHAR     sqlstmt[MAX_STMT_LEN + 1]="";
    SQLCHAR     sqltrans[sizeof("ROLLBACK")];
    SQLRETURN   rc;

    rc = initialize(&henv, &hdbc);
    if (rc == SQL_ERROR) return(terminate(henv, hdbc));

    printf("Enter an SQL statement to start a transaction(or 'q' to Quit):\n");
    gets(sqlstmt);

    while (sqlstmt[0] !='q')
    {
        while (sqlstmt[0] != 'q')
        {   rc = process_stmt(henv, hdbc, sqlstmt);
            if (rc == SQL_ERROR) return(SQL_ERROR);
            printf("Enter an SQL statement(or 'q' to Quit):\n");
            gets(sqlstmt);
        }

        printf("Enter 'c' to COMMIT or 'r' to ROLLBACK the transaction\n");
        fgets(sqltrans, sizeof("ROLLBACK"), stdin);

        if (sqltrans[0] == 'c')
        {
          rc = SQLTransact (henv, hdbc, SQL_COMMIT);
          if (rc == SQL_SUCCESS)
            printf ("Transaction commit was successful\n");
          else
            check_error (henv, hdbc, SQL_NULL_HSTMT, rc);
        }

        if (sqltrans[0] == 'r')
        {
          rc = SQLTransact (henv, hdbc, SQL_ROLLBACK);
          if (rc == SQL_SUCCESS)
            printf ("Transaction roll back was successful\n");
          else
            check_error (henv, hdbc, SQL_NULL_HSTMT, rc);
        }

        printf("Enter an SQL statement to start a transaction or 'q' to quit\n");
        gets(sqlstmt);
    }

    terminate(henv, hdbc);

    return (SQL_SUCCESS);
}/* end main */

/*****************************************************************
** process_stmt
** - allocates a statement handle
```

```
** - executes the statement
** - determines the type of statement
**   - if there are no result columns, therefore non-select statement
**      - if rowcount > 0, assume statement was UPDATE, INSERT, DELETE
**     else
**      - assume a DDL, or Grant/Revoke statement
**   else
**      - must be a select statement.
**      - display results
** - frees the statement handle
*****************************************************************/

int process_stmt (SQLHENV    henv,
                  SQLHDBC    hdbc,
                  SQLCHAR    *sqlstr)
{
SQLHSTMT        hstmt;
SQLSMALLINT     nresultcols;
SQLINTEGER      rowcount;
SQLRETURN       rc;


    SQLAllocStmt (hdbc, &hstmt);       /* allocate a statement handle */

    /* execute the SQL statement in "sqlstr"    */

    rc = SQLExecDirect (hstmt, sqlstr, SQL_NTS);
    if (rc != SQL_SUCCESS)
        if (rc == SQL_NO_DATA_FOUND) {
            printf("\nStatement executed without error, however,\n");
            printf("no data was found or modified\n");
            return (SQL_SUCCESS);
        }
        else
            check_error (henv, hdbc, hstmt, rc);

    SQLRowCount (hstmt, &rowcount);
    rc = SQLNumResultCols (hstmt, &nresultcols);
    if (rc != SQL_SUCCESS)
      check_error (henv, hdbc, hstmt, rc);

    /* determine statement type */
    if (nresultcols == 0) /* statement is not a select statement */
    {
        if (rowcount > 0 ) /* assume statement is UPDATE, INSERT, DELETE */
        {
            printf ("Statement executed, %ld rows affected\n", rowcount);
        }
      else  /* assume statement is GRANT, REVOKE or a DLL statement */
        {
              printf ("Statement completed successful\n");
        }
    }
    else /* display the result set */
    {
        display_results(hstmt, nresultcols);
    } /* end determine statement type */

    SQLFreeStmt (hstmt, SQL_DROP );       /* free statement handle */

    return (0);
}/* end process_stmt */

/*****************************************************************
** initialize
**  - allocate environment handle
**  - allocate connection handle
```

```
**  - prompt for server, user id, & password
**  - connect to server
*********************************************************************/

int initialize(SQLHENV *henv,
               SQLHDBC *hdbc)
{
SQLCHAR     server[18],
            uid[10],
            pwd[10];
SQLRETURN   rc;

    rc = SQLAllocEnv (henv);         /* allocate an environment handle   */
    if (rc != SQL_SUCCESS )
        check_error (*henv, *hdbc, SQL_NULL_HSTMT, rc);

    rc = SQLAllocConnect (*henv, hdbc);  /* allocate a connection handle     */
    if (rc != SQL_SUCCESS )
        check_error (*henv, *hdbc, SQL_NULL_HSTMT, rc);

    printf("Enter Server Name:\n");
    gets(server);
    printf("Enter User Name:\n");
    gets(uid);
    printf("Enter Password Name:\n");
    gets(pwd);

    if (uid[0] == '\0')
    {   rc = SQLConnect (*hdbc, server, SQL_NTS, NULL, SQL_NTS, NULL, SQL_NTS);
        if (rc != SQL_SUCCESS )
            check_error (*henv, *hdbc, SQL_NULL_HSTMT, rc);
    }
    else
    {   rc = SQLConnect (*hdbc, server, SQL_NTS, uid, SQL_NTS, pwd, SQL_NTS);
        if (rc != SQL_SUCCESS )
            check_error (*henv, *hdbc, SQL_NULL_HSTMT, rc);
    }
}/* end initialize */

/*********************************************************************
** terminate
**  - disconnect
**  - free connection handle
**  - free environment handle
*********************************************************************/
int terminate(SQLHENV henv,
              SQLHDBC hdbc)
{
SQLRETURN   rc;

    rc = SQLDisconnect (hdbc);          /* disconnect from database      */
    if (rc != SQL_SUCCESS )
        print_error (henv, hdbc, SQL_NULL_HSTMT);
    rc = SQLFreeConnect (hdbc);         /* free connection handle        */
    if (rc != SQL_SUCCESS )
        print_error (henv, hdbc, SQL_NULL_HSTMT);
    rc = SQLFreeEnv (henv);             /* free environment handle       */
    if (rc != SQL_SUCCESS )
        print_error (henv, SQL_NULL_HDBC, SQL_NULL_HSTMT);

}/* end terminate */

/*********************************************************************
** display_results - displays the selected character fields
**
**  - for each column
**      - get column name
```

```
**      - bind column
**  - display column headings
**  - fetch each row
**      - if value truncated, build error message
**      - if column null, set value to "NULL"
**      - display row
**      - print truncation message
**  - free local storage
**
*****************************************************************/
void display_results(SQLHSTMT hstmt,
                SQLSMALLINT nresultcols)
{
SQLCHAR         colname[32];
SQLSMALLINT     coltype[MAXCOLS];
SQLSMALLINT     colnamelen;
SQLSMALLINT     nullable;
SQLINTEGER      collen[MAXCOLS];
SQLSMALLINT     scale;
SQLINTEGER      outlen[MAXCOLS];
SQLCHAR *       data[MAXCOLS];
SQLCHAR         errmsg[256];
SQLRETURN       rc;
SQLINTEGER      i;
SQLINTEGER      displaysize;

    for (i = 0; i < nresultcols; i++)
    {
        SQLDescribeCol (hstmt, i+1, colname, sizeof (colname),
        &colnamelen, &coltype[i], &collen[i], &scale, &nullable);

        /* get display length for column */
        SQLColAttributes (hstmt, i+1, SQL_DESC_PRECISION, NULL, 0     ,
            NULL, &displaysize);

        /* set column length to max of display length, and column name
           length.  Plus one byte for null terminator       */
        collen[i] = max(displaysize, collen[i]);
        collen[i] = max(collen[i], strlen((char *) colname) ) + 1;

        printf ("%-*.*s", collen[i], collen[i], colname);

        /* allocate memory to bind column                           */
        data[i] = (SQLCHAR *) malloc (collen[i]);

        /* bind columns to program vars, converting all types to CHAR */
        SQLBindCol (hstmt, i+1, SQL_C_CHAR, data[i], collen[i], &outlen[i]);
    }
    printf("\n");

    /* display result rows                                          */
    while ((rc = SQLFetch (hstmt)) != SQL_NO_DATA_FOUND)
    {
        errmsg[0] = '\0';
        for (i = 0; i < nresultcols; i++)
        {
            /* Build a truncation message for any columns truncated */
            if (outlen[i] >= collen[i])
            {    sprintf ((char *) errmsg + strlen ((char *) errmsg),
                        "%d chars truncated, col %d\n",
                         outlen[i]-collen[i]+1, i+1);
            }
            if (outlen[i] == SQL_NULL_DATA)
                printf ("%-*.*s", collen[i], collen[i], "NULL");
            else
                printf ("%-*.*s", collen[i], collen[i], data[i]);
        } /* for all columns in this row  */
```

```
        printf ("\n%s", errmsg);  /* print any truncation messages    */
    } /* while rows to fetch */

    /* free data buffers                                              */
    for (i = 0; i < nresultcols; i++)
    {
        free (data[i]);
    }

}/* end display_results

/************************************************************************
** SUPPORT FUNCTIONS
**  - print_error     - call SQLError(), display SQLSTATE and message
**  - check_error     - call print_error
**                    - check severity of Return Code
**                    - rollback & exit if error, continue if warning
************************************************************************/

/************************************************************************/
int print_error (SQLHENV    henv,
                 SQLHDBC    hdbc,
                 SQLHSTMT   hstmt)
{
SQLCHAR     buffer[SQL_MAX_MESSAGE_LENGTH + 1];
SQLCHAR     sqlstate[SQL_SQLSTATE_SIZE + 1];
SQLINTEGER  sqlcode;
SQLSMALLINT length;

    while ( SQLError(henv, hdbc, hstmt, sqlstate, &sqlcode, buffer,
                     SQL_MAX_MESSAGE_LENGTH + 1, &length) == SQL_SUCCESS )
    {
        printf("\n **** ERROR *****\n");
        printf("         SQLSTATE: %s\n", sqlstate);
        printf("Native Error Code: %ld\n", sqlcode);
        printf("%s \n", buffer);
    };
    return;
}

/************************************************************************/
int check_error (SQLHENV    henv,
                 SQLHDBC    hdbc,
                 SQLHSTMT   hstmt,
                 SQLRETURN  frc)
{
SQLRETURN   rc;

    print_error(henv, hdbc, hstmt);

    switch (frc){
    case SQL_SUCCESS : break;
    case SQL_ERROR :
    case SQL_INVALID_HANDLE:
        printf("\n ** FATAL ERROR, Attempting to rollback transaction **\n");
        rc = SQLTransact(henv, hdbc, SQL_ROLLBACK);
        if (rc != SQL_SUCCESS)
            printf("Rollback Failed, Exiting application\n");
        else
            printf("Rollback Successful, Exiting application\n");
        terminate(henv, hdbc);
        exit(frc);
        break;
    case SQL_SUCCESS_WITH_INFO :
        printf("\n ** Warning Message, application continuing\n");
        break;
```

```
    case SQL_NO_DATA_FOUND :
        printf("\n ** No Data Found ** \n");
        break;
    default :
        printf("\n ** Invalid Return Code ** \n");
        printf(" ** Attempting to rollback transaction **\n");
        SQLTransact(henv, hdbc, SQL_ROLLBACK);
        terminate(henv, hdbc);
        exit(frc);
        break;
    }
    return(SQL_SUCCESS);

}
```

Appendix D. Running DB2 UDB CLI in Server Mode

See “Why you would run DB2 UDB CLI in SQL server mode”.

Why you would run DB2 UDB CLI in SQL server mode

The reason for running in SQL server mode is that many applications have the need to act as database servers. This means that a single job will perform SQL requests on behalf of multiple users. Without using SQL server mode, applications may encounter one or more of the following three limitations:

1. A single job can only have one commit transaction per activation group.
2. A single job can only connect to an RDB once.
3. All SQL statements run under the job’s user profile, regardless of the userid passed in on the connect.

SQL server mode circumvents these limitations by routing all SQL statements to separate jobs. Each connection runs in its own job. The system uses prestart jobs in the QSYSWRK subsystem to minimize the startup time for each connection. Since each call to SQLConnect can accept a different user profile, each job also has its own commit transaction. Once a SQLDisconnect has been performed, the job is reset, and put back in the pool of available jobs.

For more information on running DB2 UDB CLI in SQL server mode, see:

- “Starting DB2 UDB CLI in SQL Server Mode”
- “Restrictions for running DB2 UDB CLI in server mode”

Starting DB2 UDB CLI in SQL Server Mode

There are two ways to place a job into SQL server mode:

1. The most likely case is using the CLI function, SQLSetEnvAttr. The SQL server mode is best suited to CLI applications because they already use the concept of multiple connections handles. Set this mode immediately after allocating the CLI environment. Furthermore, the job must not have run any SQL, or started commitment control, prior to setting this mode. If either one of those cases is true, the mode does not become changed to server mode, and SQL will continue to run ″inline″.

   EXAMPLE.

   ```
   .
   SQLAllocEnv(&henv);
   long  attr;
   attr  =  SQL_TRUE
   SQLSetEnvAttr(henv,SQL_ATTR_SERVER_MODE,&attr,0);
   SQLAllocConnect(henv,&hdbc);
   .
   .
   ```

2. The second way to set server mode is using the Change Job (QWTCHGJB) API. Refer to the APIs topic in the iSeries Information Center for a complete description of the QWTCHGJB API.

Once SQL server mode has been set, all SQL connections and SQL statements will run in server mode. There is no switching back and forth. The job, once in server mode, cannot start commitment control, and cannot use Interactive SQL.

Restrictions for running DB2 UDB CLI in server mode

- A job must set server mode at the very beginning of processing, before doing anything else. For jobs that are strictly CLI users, they must use the SQLSetEnvAttr call to turn on server mode. Remember to do this right after SQLAllocEnv but prior to any other calls. Once server mode is on, it cannot be turned off.

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- All the SQL functions run in the prestart jobs and commitment control. DO NOT start commitment control in the originating job, either before or after entering server mode.
- Since the SQL is processed in the prestart job, there is no sensitivity to certain changes in the originating job. This includes changes to library list, job priority, message logging, and so forth. The prestart is sensitive to a change of the CCSID value in the originating job, since this can affect the way data is mapped back to the program of the user.
- When running server mode, the application MUST use SQL commits and rollbacks, either embedded or by the SQL CLI. They cannot use the CL commands, since there is no commitment control that is running in the originating job. The job MUST issue a COMMIT before disconnecting; otherwise an implicit ROLLBACK will occur.
- It is not possible to use interactive SQL from a job in server mode. Use of STRSQL when in server mode will result in an SQL6141 message.
- It is also not possible to perform SQL compiles while in server mode. Server mode can be used when running compiled SQL programs, but must not be on for the compiles. The compiles will fail, if the job is in server mode.
- SQLDataSources is unique in that it does not require a connection handle to run. When in server mode, the program must already have done a connect to the local database, before using SQLDataSources. Since DataSources is used to find the name of the RDB for connection, IBM supports passing a NULL pointer for the RDB name on SQLConnect. This obtains a local connection. This makes it possible to write a generic program, when there is no prior knowledge of the system names.
- When doing commits and rollbacks through the CLI, the calls to SQLEndTran and SQLTransact must include a connection handle. When not running in server mode, one can omit the connection handle to commit everything. However, this is not supported in server mode since each connection (or thread) has its own transaction scoping.
- It is not recommended to share connection handles across threads, when running in SQL server mode. This is because one thread could overwrite return data or error information that another thread has yet to process.

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