



**Net Search Extender Administration and User's Guide**





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**Note**

Before using this information and the product it supports, read the general information under Appendix B, "Notices," on page 245.

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# Chapter 1. Net Search Extender overview and concepts

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## Net Search Extender key concepts

Net Search Extender offers users and application programmers a fast, versatile, and intelligent method of searching full-text documents stored in DB2, other databases, and file systems using SQL queries.

To fully understand the capabilities of Net Search Extender, it is necessary to understand key terms, which are found **bold** in this section, and the various options available. It is also necessary to have a basic understanding of DB2<sup>®</sup> database concepts and terms.

Basically, Net Search Extender searches **text documents** that are held in the column of a database table.

The text documents must be uniquely identifiable. Net Search Extender uses the **primary key** of the table for this purpose.

The documents can be stored in various formats. The formats include either unstructured plain text, structured text such as HTML or XML, or proprietary document formats such as PDF or Microsoft<sup>®</sup> Office document formats. For the latter, additional filtering software that might have to be licensed separately is required.

Rather than sequentially searching through the text documents at query time that would take a considerable amount of time, Net Search Extender creates a **text index** in order to make documents searchable efficiently.

A text index consists of significant **terms** that are extracted from the text documents.

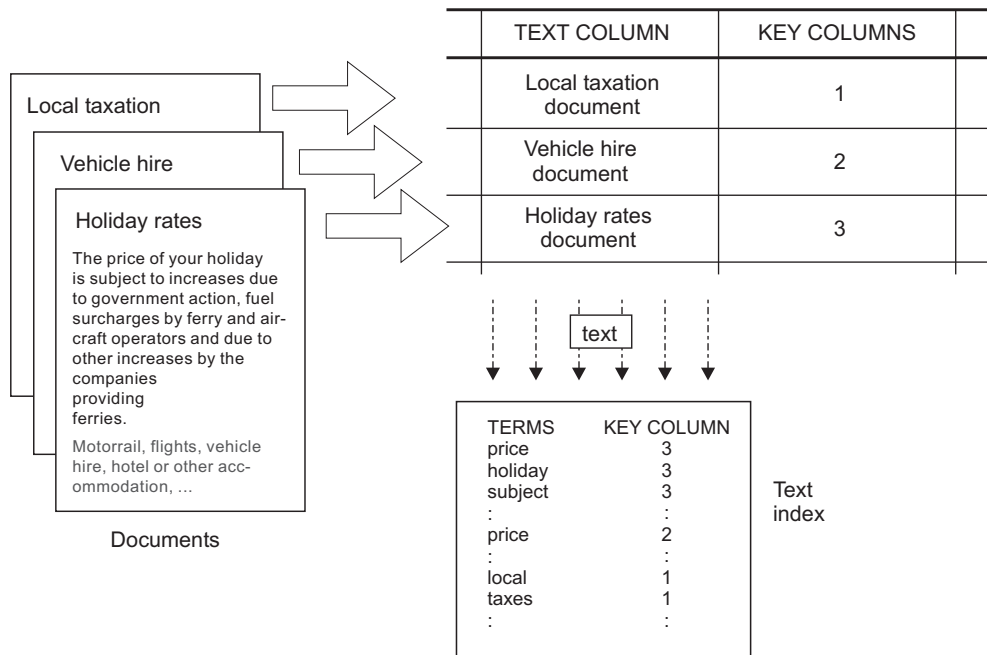


Figure 1. Creating a text index

**Text index creation** is the process of defining and declaring the properties of the index, such as the location of the index. After creation, the text index does not as yet contain any data. **Index update** is the process of adding data about terms and documents to the text index. The first index update adds information about all text documents from the text column to the index. The first update is known as the **initial update**.

By using a text index for searching, there are synchronization issues between the table and the text index that must be taken into account, as any follow-up changes to the table, such as additions, deletions, and updates to the text documents must be reflected in the text index.

Synchronization in Net Search Extender is based on **triggers** that automatically store information about new, changed, and deleted documents in a **log table**. There is one log table for each text index. Applying the change information in the log table to the corresponding text index is called **incremental update**.

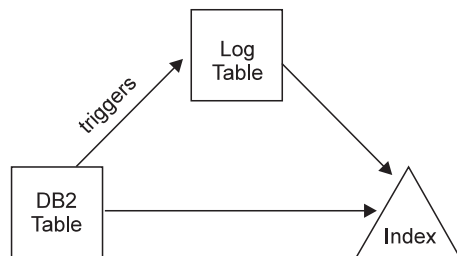


Figure 2. Incremental update process

You can update the text index by using a **manual** or **automatic** option. The automatic option uses an update schedule with specified days and times.

Note that **neither** of these options synchronizes the text index within the scope of a transaction that updates, deletes, and inserts text documents. Net Search Extender's asynchronous text indexing improves performance and concurrency. The update is applied within a separate transaction to a copy of a very small part of the index. The index is only locked for read access during a very short period of time when the copy is put in place of the original. This is invisible to search operations, see "Net Search Extender instance services" on page 25 for information.

A text index has certain properties, such as index file location and automatic update properties. If necessary, you can change some of the properties. This is known as **altering** the index. Altering the index does not modify any index data.

One such property is whether the ORDER BY phrase should presort the text index on the table columns. In such a case, the initial update will index the text document in the order specified, and return the search results in this order.

For example, you might specify presorted book abstracts according to the book price. When looking for the least expensive books about relational database systems, you can restrict your text search to return only the first couple of books as these will be the cheapest. However, without presorted indexes, you would have to search for all books and join these with the cheapest books, which would be a more costly operation.

Net Search Extender allows several presorted indexes per text column. For example, one index for presorting books according to the date of publication and, a second presorting books according to the price.

Usually the first update after creating a text index is an initial update, and the following updates are incremental. However, when working with presorted indexes you want to keep the order in case of updates. This is addressed by the **Recreate Index on Update** option, which totally rebuilds the index each time an update is performed.

After the text index is updated, you can search using one of the following options:

- An SQL scalar search function
- A stored procedure search
- An SQL table-valued function

As the search options have different operating characteristics, they are explained in the following sections.

## SQL scalar search function overview

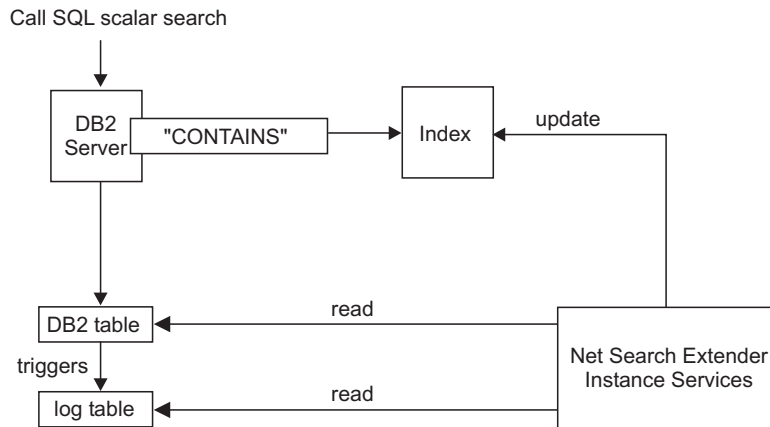


Figure 3. Using an SQL scalar search function for searching

Net Search Extender offers three scalar text search functions (CONTAINS, NUMBEROFMATCHES, and SCORE) that are seamlessly integrated within SQL. You can use the search functions in the same places that you would use standard SQL expressions within SQL queries. Typical queries are:

```
SELECT * FROM books WHERE CONTAINS (abstract, 'relational databases') = 1
AND PRICE <10
```

```
SELECT ISBN, SCORE (abstract, 'relational databases') as SCORE
from BOOKS
where NUMBEROFMATCHES (abstract, 'relational databases')
>5 AND PRICE <10
order by SCORE
```

The SQL scalar functions in the example return an indicator to how well the text documents matched a given text search condition. Then the SELECT phase of the SQL query determines the information returned to the end user.

Use the SQL scalar search functions as the default search method. These search functions should be suitable for a majority of situations, especially when the text search expression is combined with other conditions.

Note that the DB2 Optimizer is aware of how many text documents can be expected to match a CONTAINS predicate and how costly different access plan alternatives will be. The optimizer will choose the cheapest access plan.

## Stored procedure search overview

Usually, presenting search results to the end user involves a call to the search function itself that is followed by a join operation against the user table and possibly a sorting of the result data. This can be a costly operation. However, there are situations in which an application can avoid costly disk operations by performing the join operations on presorted data that is stored in memory. These situations include:

- The subset of data to present to the user is small
- The subset of data is known in advance
- The intended sort order is fixed and known in advance
- A ranked subset of the search results is sufficient

During text index creation, you must specify which columns out of the table or view are to be returned to the end user. The data is stored in a **cache** in main

memory. This enables the stored procedure search to return search results extremely quickly. The cache needs to be **activated** before it can be used and there is a corresponding **deactivate** command.

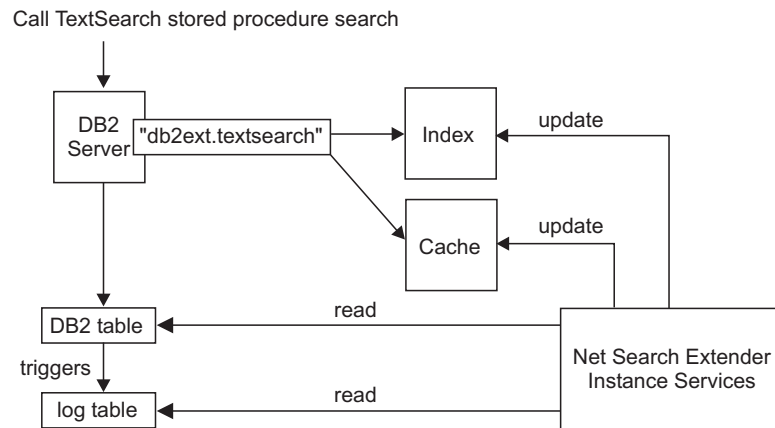


Figure 4. Using a stored procedure search

The ACTIVATE command loads data into either a temporary cache (which is created from scratch on activation), or a persistent cache, which is maintained on disk.

The decision to use the stored procedure for search requires careful memory calculations, such as how much memory is required and how much free memory should be left for index updates. For defaults, see “Stored procedure search memory requirements” on page 19.

The stored procedure can work on text indexes that are created on views. However, as triggers can not be created on views, any changes are not automatically recognized. You must add the changed information to the log table manually, or work with the RECREATE option.

The main use of the stored procedure search is in high performance and high scalability applications that are interested in text-search-only queries, that is, in queries that do not need to join text search results with the results of other complex SQL conditions.

The main functional differences to the SQL scalar search functions are:

- The stored procedure search can not be used in arbitrary SQL queries, but is a query against a predefined cache table.
- The stored procedure search can exploit indexes on views.
- The stored procedure search can exploit multiple presorted text indexes on a column.

## SQL table-valued function overview

The SQL table-valued function is a compromise between the SQL scalar search functions and the stored procedure search. With the SQL table-valued function you can also use a `db2ext.highlight` function to get information about why a document qualified as a search result.

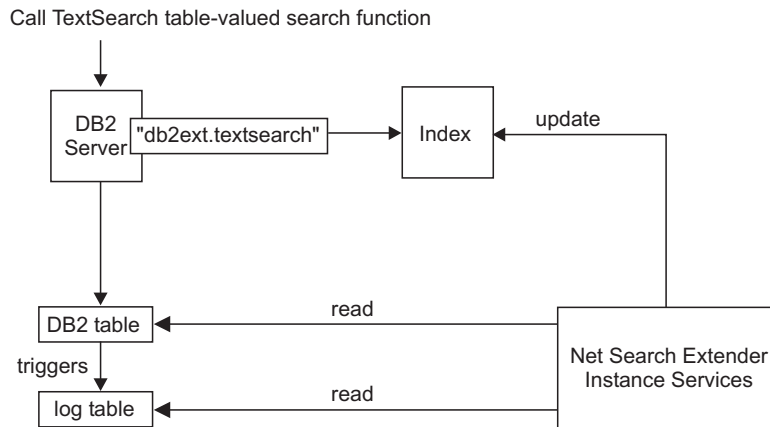


Figure 5. Using an SQL table-valued function for searching

The main functional differences to the stored procedure search are:

- No cache is necessary (and no cache is exploited).
- The table-valued function can be used in arbitrary SQL statements.
- Large amounts of memory are not required to pre-store cache table content.

The main functional difference to the SQL scalar search functions is:

- The SQL table-valued function can exploit indexes on views.

Use the SQL table-valued function in those cases where you would normally use an SQL scalar function, but you want to exploit text indexes on views.

## Additional concepts

### Column transformation function

You can use your own function to convert an unsupported format or data type into a supported format or data type. By specifying a User Defined Function (UDF), you can get the original text document as input. The output from the UDF should be a supported format, that can be processed during indexing.

You can also use this feature for indexing documents that are stored on external data stores that are not directly supported. In this case, the DB2 column contains document references and the function returns the document contents that have the relevant document reference.

### Instance services

Net Search Extender Instance Services take care of index-specific locking services and text index update services (both automatic and manual).

### Externally stored data

In a majority of cases, the data on which you create a text index is stored within native DB2 table columns, such as in CLOBs or VARCHARs.

However, text documents that are stored externally, such as in other databases, are also supported. For documents that are stored on other databases, use DB2 nickname tables to create a text index.

You can also use the column transformation function for data that are stored in unsupported external data stores.

## Administration tables and views

There are several tables and views available in Net Search Extender. They provide information on the text indexes and their properties.

## Partitioned database support

The search functions of Net Search Extender use partitioned database support in the following ways:

- The SQL scalar function exploits indexes that are created on a partitioned table.
- The stored procedure search and the SQL table-valued function exploit only tables on one node in a partitioned environment.
- Partitioned database support is only available on AIX®.

To enable partitioned database support, consider the following:

- Ensure that the DB2 setup is complete as described in the DB2 documentation. The NFS mount must be configured with root access and setuid.
- The RESULT LIMIT is evaluated on every node during search. This means that if you specify a RESULT LIMIT of 3 and use 4 nodes, you might get up to 12 results.
- If a problem occurs during db2text start, no detailed message is returned stating which of the available nodes is affected. If you issue db2text start a second time, the system tries to start the service on each of the nodes. The db2text start command is successful if the following message is displayed: CTE0185 The update and locking services are already active.

## Indexes on nicknames in a federated database

You can also create a text index on nicknames in a federated database that points to tables in a remote database. In this case, the role of the log table (for incremental index updates) differs from its role for an index on a regular table. Unlike regular tables, DB2 triggers can not be created on nicknames, so that change information about documents can not be inserted into a log table using triggers. Therefore, there are two different ways for incremental updates to create an index on a nickname:

- The log table is created locally in the federated database and the application is responsible that the log table contains correct change information on the nickname. For DB2 views, this is similar to the incremental index update. This option is the default option.
- DB2 Replication has been set up so that changes to the table referenced by the nickname are captured in a so-called "Change Data Table" (CD-table) for DB2 remote databases, or a "Consistent Change Data Table" (CCD-table) for non-DB2 relational databases. DB2 Net Search Extender can then use the CD or CCD table instead of creating a log table for an index on a nickname. In this case, you must specify the capture table characteristics in the DB2TEXT CREATE INDEX command.

## Native XML support

By fully supporting the SQL XML data type, all Net Search Extender search functions can be used on XML documents that are stored natively in the database.

The structural text search on XML documents by sections (see "Search parameters" on page 150 for more information on searching in **sections**) can be extended by powerful XQuery processing of the search results. Net Search Extender text search functionality can be leveraged within DB2's XQuery language support to provide optimal processing of XML documents.

By using full text search within the `db2-fn:sqlquery()` XQuery input function, it is possible to search in XML documents, and process the resulting XML documents using XQuery:

```
FOR $dept in db2-fn:sqlquery('select Department from MyTable
    where contains(Department,'sections(/dept/employee/resume) "DB2 XML" ''
    = 1')/dept
RETURN $dept/employee/name
```

In the example, column “Department” is of data type “XML”. See Chapter 8, “Working with structured documents,” on page 89 for more information.

A sample is available that shows you how you can query XML data. Refer to `<sqllib>/samples/extenders/db2ext`. Call `xmlsample <database>` to populate the database, and create and update the indexes. After you have connected to the database, you can perform searches on the data by issuing `db2 -tvf xmlsearch`.

---

## Key features of DB2 Net Search Extender

Net Search Extender Version 9.5 has the following key features:

- Indexing
  - Fast indexing of very large data volumes
  - Dynamic updating of indexes
  - Optional: Storing table columns in main memory at indexing time to avoid expensive physical read operations at search time
  - A choice of the command line or the DB2 Control Center interface for index maintenance
  - Support for structured text formats, for example HTML and XML
  - Support of third-party filtering software “Outside In”
  - Nickname table support
  - Support of presorted text indexes
  - Partitioned database support (AIX only)
  - Native XML support
- Search
  - Boolean operations
  - Proximity search for words in the same sentence or paragraph
  - “Fuzzy” searches for words having a similar spelling as the search term
  - Wildcard searches, using front, middle, and end masking, for whole words and single characters
  - Free-text searches. For documents containing specific text, the search argument is expressed in natural language
  - A highlight function to show why a particular document qualified as a search result
  - Thesaurus support
  - Restrict searching to sections within documents
  - Numeric attribute support
  - High-speed searching through a large number of text documents with many concurrent users
  - Integration into XQuery processing using the `db2-fn:sqlquery()` function.
- Search results
  - You can specify how the search results are sorted at indexing time



- You can specify search result subsets when searching large data volumes and expecting large result lists
- You can set a limit on search terms with a high hit count
- Built-in SQL functionality combined with the DB2 Optimizer automatically selects the best plan according to the expected search results

---

## Introducing the db2text commands

Here is an example of a Net Search Extender command:

```
db2text ENABLE DATABASE FOR TEXT
```

For every create and index maintenance command, you can specify the database, user, and password.

```
db2text ... connect TO <database> USER <userID> USING <password>
```

**Note:** if you leave out the connect options in the db2text command, the environment variable DB2DBDFT specifies the database.

To display a list of commands, enter the following command:

```
db2text ?
```

To display the syntax of an individual command, enter the following command:

```
db2text ? command
```

For example, to display the syntax of the CREATE INDEX command, use the following command:

```
db2text ? CREATE INDEX
```

db2text returns 0 if the command has been processed successfully, and 1 if the command has not been processed. Note that if there are document errors but the index still updates, the db2text command returns 0 with a warning message. Information about document errors can be found in the event table of the index.

Depending on your operating system and your active command shell, the system interprets special characters such as ?, (, ), \*, !, and ". Therefore, if the command contains these characters, use quotation marks or an escape character.

Here is an example of a UNIX® command that uses special characters:

```
db2 "SELECT * FROM sample WHERE CONTAINS (DESCRIPTION, '\"enable\"') = 1"
```



---

## Chapter 2. Installation

---

### Installing Net Search Extender in the DB2 client/server environment

Net Search Extender search functionality is integrated into SQL and executed on the server. Therefore, you do not need to install Net Search Extender on the client to issue text search queries.

Net Search Extender supports administration calls to the server from the client side. Either install Net Search Extender on the client sides and the server sides, or alternatively, use the DB2 Control Center to administrate Net Search Extender from the client side.

The Net Search Extender documentation includes the following categories of installation topics:

- System requirements
- Installation on UNIX
- Installation on Windows
- Directory names and file names
- Installing the Outside In libraries
- Installation verification
- Uninstalling Net Search Extender

After installation, run the Net Search Extender installation verification script.

---

### Installation system requirements

The following versions of software are required to run Net Search Extender:

- DB2 Version 9.5
- Java™ Runtime Environment (JRE). The JRE version depends on the DB2 version.

Net Search Extender is available on the following operating systems:

Solaris SPARC (64-bit):

- Solaris 9
- Solaris 10

AIX (64-bit):

- AIX Version 5.2.0/5.3.0. The following file sets are required for 64-bit code support:
  - 64-bit AIX kernel is required
  - TL5 SP3
  - Minimum C++ runtime level is x1C.rte 8.0.0.0 and x1C.aix50.rte 8.0.0.8The recommended maintenance level for AIX 5.3 is ML03. APAR IY68989 must be applied.

Note that you can download the AIX file sets from <http://techsupport.services.ibm.com/server/fixes>

Windows® x86 (Intel® Pentium®, Intel Xeon™, and AMD Athlon):

- Windows 2000, 2003
- Windows XP
- Windows server 2000, 2003

Windows x86-64 (Intel EM64T and AMD64):

- Windows XP
- Windows server 2003

Linux®:

- Linux x86 (Intel Pentium, Intel Xeon, and AMD Athlon)
- Linux x86-64 (Intel EM64T and AMD64)
- Linux on zSeries® (64-bit)

If you move from a 32-bit application to a 64-bit application, you must rebuild all Net Search Extender indexes.

The minimum disk space for a typical Net Search Extender installation is 50 MB.

Net Search Extender has the same minimum software and hardware requirements as DB2 Version 9.5. For these requirements, as well as specific operating system patches, refer to the corresponding DB2 documentation.

Any additional hardware requirements depend on the size and type of text index selected.

---

## Installation overview for a partitioned DB2 server (AIX only)

Ensure the correct installation and configuration of DB2 on every node. After installing DB2, you need to install Net Search Extender on each node.

**Note:** A fenced user ID that is different from the instance owner ID does not work with partitioned databases.

---

## Installation on UNIX

To install on UNIX, follow these steps:

1. Install the product.
2. Update the DB2 instance.

### Step 1 for UNIX: Install the product components

To install on UNIX, follow these steps:

1. Log on at the target machine as the root user.
2. Change to the correct directory for your platform:
  - `cd /<cdrom>` where <cdrom> is your CD-ROM driver path.
  - `cd <platform>`
3. Call `./nsetup.sh` and follow the instructions displayed on the screen.

After you accept the license agreement, you are presented with a list of possible installation paths. The installation paths that are eligible for you to use depend on the Net Search Extender version you want to install and the installed copies

of DB2. After you select a path for the installation, the product is installed at this path. An installation log file is written to the /tmp directory and prefixed db2nsei.

### Step 2 for UNIX: Update the DB2 instance

To update the DB2 instance, follow these steps:

1. Ensure that you are active as the root user.
2. Use the following command to change your working directory to the path where you installed Net Search Extender:  

```
cd <path>/instance
```

<path> is the path of the DB2 copy where you installed Net Search Extender.
3. Run db2iupdt using ./db2iupdt <db2instance>, where <db2instance> is the name of an existing DB2 instance user ID that you would like to use with Net Search Extender.

---

## Installation on Windows

To install on Windows you must log on with a user ID that has administrative rights, and then follow these steps:

1. Use the <cdrom>:\windows\install\setup.exe to transfer the files from the package to the target machine.

Note that for every DB2 service, you must enter a user ID and password to create the correct Net Search Extender service.

After you accept the license agreement, you are presented with a list of possible DB2 copy names. The DB2 copy names that are eligible for you to use depend on the Net Search Extender version you want to install. After you select a DB2 copy name, the product is installed at the path where this DB2 copy has been already installed.

For silent install, you can call setup.exe in two different modes:

### RECORDMODE

Creates a silent install response file.

A predefined response file called setup.iss is located in the installation source directory. If you want to create a new response file, run setup.exe -r. The new setup.iss is created in your Windows directory. Copy this setup.iss into your installation source directory. Make sure that you have made a backup of your old response file.

### SILENTMODE

Silent installation.

Make sure that the file setup.iss is located in your installation source directory. Run setup.exe -s. The installation is successful if ResponseResult is set to 0 in the setup.log file located in your installation source directory.

2. Reboot the system after data transfer.
3. Call db2text start to start the DB2 Net Search Extender Instance Services.

Every DB2 instance creates a Windows service. Make sure that the DB2 instance services run under a user account and not under the systems account.

Net Search Extender does not support Microsoft Cluster Server.

---

## Directory names and file names

You must specify the directory names and file names in SBCS characters for all Net Search Extender commands. The maximum length of the path names (including the file name) is 256 bytes.

---

## Installing the Outside In libraries

The Outside In software from Stellent™ is available on following DB2 platforms:

- Linux Intel (32-bit)
- Windows Intel (32-bit)
- Windows AMD64

To use Net Search Extender with the Outside In software from Stellent™, you must set up the libraries for each platform:

- On Windows, ensure that the directory where the libraries are located is added to the path environment variable.
- On Linux Intel (32-bit), add the Outside In libraries into the DB2 lib install directory.

---

## Installation verification

### Installation verification on UNIX

Complete the following steps to verify that Net Search Extender is correctly installed.

- Follow these steps to call the administration script `nseample` to set up the text indexes:
  1. Change to `<instance_owner_home>/sql1lib/samples/extenders/db2ext`
  2. Call `./nseample <yourdb>`. Note that this command creates the database if it does not already exist.
  3. Check the generated output file `nseample.log` in your home directory.
- Then call some sample queries to execute in the same DB2 command window:
  1. Connect to your database using `db2 connect to <yourdb>`
  2. Execute the sample queries using `db2 -tvf search`
  3. Check the results of the queries contained in the script. Note that every query should return one or more hits.

If there are no errors in the `nseample.log` file and all the queries are working, Net Search Extender is successfully installed.

**Note:** For distributed databases on AIX, use the following verification sample:

```
nseample_partitioned database_name [node_number][table_space_filename]
```

### Installation verification on Windows

Complete the following steps to verify that Net Search Extender is correctly installed.

- Follow these steps to call the administration script `nseample.bat` to set up the text indexes:

1. Call `db2cmd` to open a DB2 command window.
  2. Change to `<sqllib>\samples\extenders\db2ext`
  3. From the DB2 command window, call `nseample.bat <yourdb>` where `<yourdb>` is the name of a database. Note that this command creates the database if it does not already exist.
  4. Check the generated output file `nseample.log` in the current directory.
- Then call the following sample queries to execute in the DB2 command window:
    1. Connect to your database using `db2 connect to <yourdb>`
    2. Execute the sample queries using `db2 -tvf search`
    3. Check the results of the queries contained in the script. Note that every query should return one or more hits.

If there are no errors in the `nseample.log` file and all the queries are working, Net Search Extender is successfully installed.

---

## Uninstalling Net Search Extender

To permanently remove Net Search Extender from your system and remove all Net Search Extender indexes, you must first disable each database that contains Net Search Extender indexes and then only remove Net Search Extender.

### Uninstalling Net Search Extender on UNIX

Complete the following steps to uninstall Net Search Extender correctly on UNIX.

- For each DB2 instance from which you want to uninstall Net Search Extender:
  1. Switch to the user ID of the DB2 instance
  2. For each database, run:
 

```
db2text disable database for text connect to <databasename>
```
  3. Stop the DB2 Net Search Extender instance
  4. Stop the DB2 instance
- Ensure that you are active as the root user.
- Change your working directory to the DB2 path where you want to remove Net Search Extender. For example, `cd /opt/IBM/db2/V9.5/install`.
- Issue the command `./db2nse_deinstall`. For details on the command syntax, see “`db2nse_deinstall` command” on page 146.

### Uninstalling Net Search Extender on Windows

Complete the following steps to uninstall Net Search Extender correctly on Windows.

1. For each database run `db2text disable database for text connect to <databasename>`.
2. Stop the DB2 instance.
3. Select **Settings->Control Panel ->Add or Remove Programs**. From the list, select the Net Search Extender<COPYNAME> entry that correlates with the DB2<COPYNAME> that Net Search Extender was assigned during installation. Click **Remove**.





---

## Chapter 3. Migration to DB2 Net Search Extender Version 9.5

Migrating to DB2 Net Search Extender Version 9.5 requires that you migrate your DB2 server to Version 9.5 first and then migrate the databases that you enabled for Net Search Extender in Net Search Extender Version 8 or Version 9.1 using the db2extmdb migration script.

### Prerequisites

- Back up all text index directories index subdirectories before migrating.

### Procedure

To migrate to DB2 Net Search Extender Version 9.5:

1. Execute the following calls before you migrate to Version 9.5 because the Data Links Manager is no longer supported in DB2 Version 9.1 or Version 9.5:
  - \$db2 DROP SPECIFIC FUNCTION DB2EXT.DATALINKCONTENT1;
  - \$db2 DROP SPECIFIC FUNCTION DB2EXT.DATALINKCONTENT2;
  - \$db2 DROP SPECIFIC FUNCTION DB2EXT.DATALINKCONTENT3;
  - \$db2 DROP SPECIFIC FUNCTION DB2EXT.DATALINKCONTENT4;

**Note:** If you have text indexes that you created using an earlier version of Net Search Extender that includes the Datalinks feature, you are still able to search these indexes but you cannot update these indexes. If you still need to create an index on text stored outside the database, you must write a UDF that you can plug into Net Search Extender as a transformation function.

2. Migrate your DB2 server where Net Search Extender is installed from Version 8 or Version 9.1 to Version 9.5 .

Migrating your database is part of these tasks. If you have external unfenced routines on Linux or UNIX that have no dependency on the DB2 engine libraries, the MIGRATE DATABASE command redefines your external routines as FENCED and NOT THREADSAFE and returns the warning message SQL1349W. The Net Search Extender functions with schema name DB2EXT that were altered during the database migration are redefined as NOT FENCED and THREADSAFE by the db2extmdb migration script in step 4.

3. Install DB2 Net Search Extender Version 9.5.
4. Run the db2extmdb migration script to migrate the databases that you enabled for Net Search Extender using the following syntax:

```
db2extmdb <database-name>
```

While you are running this migration script, do not make any changes to user tables with text indexes.

All migration steps are logged in the file called db2extm<database-name>.log located in one of the following directories:

- INSTHOME/sqllib/db2ext/ on Linux and UNIX operating systems
- DB2PATH\db2ext\ on Windows operating systems

Where INSTHOME is the instance home directory and DB2PATH is the location where you installed your DB2 Version 9.5 copy.

5. If you are migrating from DB2 Version 8 or Version 9.1 32-bit server to a DB2 Version 9.5 64-bit server, you must drop your text indexes and recreate your

text indexes. In Net Search Extender, you cannot use in a 64-bit instance text indexes that you created in a 32-bit instance. The search engine returns error CTE0101 Reason code: "17".

6. If you migrated from DB2 Version 9.1 on Linux and UNIX operating systems, log on as root and run the db2extimigr script using the following syntax:  
DB2DIR/instance/db2extimigr [-h|-?] InstanceName

Where DB2DIR is the directory where you installed your DB2 Version 9.5 copy.

7. If you migrated on Windows operating systems and want to use text indexes that you created before migration, keep any text indexes directories under the installation directories of your DB2 Version 8 or Version 9.1 copies. If you want to uninstall these DB2 copies, restore the indexes that you backed up to the same location after uninstalling your DB2 copies.

---

## Chapter 4. Planning considerations

To use Net Search Extender in the most effective way, it is essential that some planning occurs prior to deployment. Planning might involve several user groups including those in database administration, interface and system designers, system architects, and developers.

The following topics provide a guide to the areas that you should consider:

- Directory locations and index storage
- Table, column, and index names
- Document formats and supported code pages
- Outside In filtering software
- User roles

For more information on developing Net Search Extender based applications, see the following related topics:

---

### Directory locations and index storage

The disk space you need for an index depends on the amount and type of data you want to index. As a guideline, for indexing single-byte documents you need to reserve disk space of about 0.7 times the size of the documents you want to index. For double-byte documents, reserve the same disk space as the total size of the documents you want to index. The total size might have to include data stored outside the active database that is retrieved through user-defined functions.

The amount of space needed for the temporary files in the work directory is 1.0 to 4.0 times the amount of space needed for the final index file in the index directory. Note that the default index directory is `./sqllib/db2ext/indexes` which is usually located in the `/home` partition of the system and might have size limitations. If you plan to create large indexes, make sure that you explicitly specify an index and a work directory at a location with sufficient disk space.

If you have several large indexes, you should store them on separate disk devices, especially if you have concurrent access to the indexes during index update or search.

For creating, updating, and deleting Net Search Extender indexes, you can either use the command line interface, or the DB2 Control Center.

---

### Stored procedure search memory requirements

Using the cache for a stored procedure search requires a large amount of memory and different memory requirements for the following platforms:

- AIX
- Windows
- Solaris
- Linux

## Memory requirements for AIX (64-bit)

Configuring the system limits:

- Check the system limits using the command `ulimit -a`
- If there are values other than "unlimited", use the following steps:
  - Log on as root.
  - Back up the file `/etc/security/limits` and then edit the file to raise the hard limits.
  - Set all values to the "unlimited" (value -1) for the DB2 instance owner used.

Configuring the shared memory limits:

- On AIX, there is no need to configure the shared memory limits.

Configuring the swap space:

- Obtain the system RAM size using the command `lsattr -E -l sys0`
- Obtain the size of the swap space using the `lspv -a` command.
- Set the swap space size to at least 1.5 - 2 times of either the RAM amount of your system, or use the `MAXIMUM CACHE SIZE` parameter you provide in the `CREATE INDEX` command. Use the SMIT utility to select the larger number.

## Memory requirements for Windows (32-bit and 64-bit)

Adjusting the size of the paging file:

- Set the Windows virtual-memory paging file size to at least 1.5 - 2 times of either the RAM amount of your system, or use the `MAXIMUM CACHE SIZE` parameter you provide in the `CREATE INDEX` command. Select the larger number. See the Windows documentation for information on changing the size of the paging file.

On Windows 32-bit, you are recommended to not exceed a maximum cache size of about 1000 MB (1 GB = 1073741824 bytes).

## Memory requirements for Solaris (64-bit)

Configuring the system limits:

- Check the system limits using the command: `ulimit -a`
- Then use the following steps:
  - Log on as root.
  - Back up the file `/etc/system` and then edit the file to raise the hard limits.
  - Add or check that the following lines are set to at least the minimum values shown:

```
rlim_fd_cur -> Default 64, recommended >= 1024
```

```
rlim_fd_cur_max -> Default 1024, recommended >= 4096
```

Configuring the shared memory limits:

- Check current settings using command `sysdef -i`
- Edit the file `/etc/system` to set the shared memory size limit using: `set shmsys:shminfo_shmmax=0xffffffff`

You may also have to increase the following parameter values:

```
set shmsys:shminfo_shmmni=512
```

```
set shmsys:shminfo_shmseg=128 and then reboot the system.
```

Configuring the swap space:

- Obtain the system RAM size using the command `/usr/sbin/prtconf`

- Obtain the size of the swap space using the `swap -l` command.
  - Set the swap space size to at least 1.5 - 2 times of either the RAM amount in your system, or use the `MAXIMUM CACHE SIZE` parameter you provide in the `CREATE INDEX` command. Select the larger number.
- Refer to the Solaris system documentation for information on how to add swap space.
- You are recommended not to exceed the maximum cache size of about 2000 MB (2 GB = 2147483647 bytes).

## Memory requirements for Linux (32-bit and 64-bit)

Check the DB2 documentation for information about recommended kernel parameters on Linux.

The validation status for new Linux kernels and distributions is frequently updated. To obtain the latest information for supported Linux software levels, refer to: <http://www.ibm.com/software/data/db2/linux/validate>

To see your current shared resource limits use `ipcs -l`. To check the system limits, use the `ulimit -a` command.

---

## Table, column and index name considerations

All table, column and index names are usually case-insensitive. Net Search Extender allows you to specify these names in mixed case too. On Windows, if you want to specify table, column and index names in mixed case, you must enter the name in a backslash (\) double quote (") character sequence. For example, `\DocTxt\`.

---

## Document formats and supported code pages

Net Search Extender needs to know the format (or type) of text documents that you intend to search. This information is necessary for indexing text documents.

Net Search Extender supports the following document formats:

**TEXT** Plain text (for example, flat ASCII), in general, text without any markup

**HTML** Hypertext Markup Language

**XML** Extended Markup Language

Document format XML is the default for column data type XML, and is the only supported document format for that data type.

**GPP** General Purpose Format (flat text with user-defined tags)

**Outside In (INSO)**

Use this format if you are using filtering software to extract textural content from PDFs and other common text formatting tools, for example, Microsoft Word.

For the document formats HTML, XML, GPP, and the Outside In filter formats, searching can be restricted to specific parts of a document.

Where Outside In filters can not be used because the format of your document is not supported, you can write a User Defined Function (UDF) that does its own

filtering. This UDF must be specified at index creation time and converts the data from the unsupported format to a supported format.

You can index documents if they are stored in one of the supported Coded Character Set Identifiers (CCSIDs). See the DB2 documentation for a list of these code pages.

To check the database code page, use the following DB2 command:

```
db2 GET DB CFG for <dbname>
```

and take the value written for Database code page.

For consistency, DB2 normally converts the code page of a document to the code page of the database. However, when you store data in a DB2 database in a column with a binary data type, such as BLOB or FOR BIT DATA, DB2 does not convert the data, and the documents retain their original CCSIDs.

Note that incompatible code pages might cause problems when creating a text index or searching.

---

## Outside In filtering software

Net Search Extender supports a third-party document filtering software. Known as Outside In Transformation Technology from Stellent™, you can use the software for extracting the textual contents from PDF files, or from documents written in the proprietary format of common text formatting tools without using native applications. Example formats include Microsoft Word and Lotus® Word Pro®.

Net Search Extender loads the Outside In libraries as plug-ins during UPDATE INDEX. The libraries are not part of Net Search Extender and need to be installed separately. You need to ensure that Net Search Extender can find the Outside In libraries.

The Outside In software generates not only textual content but also structural information, for example, fields. Net Search Extender can also customize which part of the Outside In generated document information is to be stored in the index. To do this, you need to apply a specific type of document model, the Outside In document model.

To view a list of filtering formats and supported platforms, visit the Stellent Web site at <http://www.stellent.com>.

---

## User roles

### DB2 instance owner

The DB2 instance owner user can start and stop the instance services for DB2 Net Search Extender and control the locking services. In addition, the DB2 instance user is granted DBADM authority for each enabled database. This enables a central point of control for all database changes driven by Net Search Extender.

### Required DB2 authorizations

DBADM is granted on ENABLE DATABASE.

**Required file system authorizations**

Read and write access for all text index directories and read access to model files.

**Commands for the instance owner**

DB2TEXT START, DB2TEXT STOP, and DB2TEXT CONTROL.

The commands are only allowed on the server. In a distributed DB2 environment, this can be any of the configured nodes. Each command checks if the user running the command is the DB2 instance owner. If you, as the instance owner, decide to use a fenced user ID to run the stored procedure and UDFs, the fenced user must have read access to all files in the index directory (read access to the entire directory path). Assign correct group membership and file permissions.

**Database administrators**

Database administrators can enable and disable databases for use with Net Search Extender.

**Required DB2 authorizations**

DBADM (SYSADM for ENABLE DATABASE).

**Commands for the database administrator**

DB2TEXT ENABLE DATABASE and DB2TEXT DISABLE DATABASE.

**Text table owners**

The text table owner can create, drop, and change indexes. Note that they must be able to control (by having read and write access) the location of indexes and updates to the full-text indexes.

**Required DB2 authorizations and privileges**

Owner of text table.

**Commands for the text table owner:**

DB2TEXT CREATE INDEX, DB2TEXT DROP INDEX, DB2TEXT ALTER INDEX, DB2TEXT ACTIVATE CACHE, DB2TEXT DEACTIVATE CACHE, DB2TEXT UPDATE INDEX, DB2TEXT CLEAR EVENTS, and DB2EXTTH.

Note that the command implementation partially runs under the user ID of the DB2 instance owner. Therefore, grant the instance owner the necessary file system access before creating or altering the text indexes.





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## Chapter 5. Administering Net Search Extender

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### Net Search Extender instance services

DB2 Net Search Extender Instance Services consist of the following services:

- Locking services
- Update services

The following topics explain how to start and stop the DB2 Net Search Extender Instance Services and further discusses Locking Services and Update Services in detail.

- Starting and stopping NSE instance services
- Locking services
- Update services
- NSE information catalogues

---

### Starting and stopping Net Search Extender instance services using the DB2 control center

Before you can maintain text indexes and search your documents, you have to start the Net Search Extender Instance Services.

To start the Instance Services, log on to the DB2 instance owner user ID (UNIX systems only) and enter the following command:

```
db2text start
```

To stop the Instance Services, enter the following command:

```
db2text stop
```

Note that there must be one Net Search Extender Instance Service per DB2 instance. The locking service maintains the locks for all enabled databases for that instance.

---

### NSE locking services

When you start Net Search Extender, the locking services automatically start. The locking services are needed to synchronize concurrent access to text indexes in Net Search Extender.

The locking services ensure that no two processes attempt to change a text index simultaneously, or that no process reads text index data while another process is making changes to the same text index data. Therefore, most processes request a lock on a text index before starting, and release it again when processing has completed.

Note that the locking services for Net Search Extender text indexes must not be confused with DB2 locks that control access to DB2 tables.

## Using the locking services

In Net Search Extender, there are different types of locks that control concurrent access to an index. The different locks depend on whether the text index is only being read, as in the case of a search request, or if changes to the text index need to be computed and subsequently written to files, as in the case of an index update.

During db2text start, the locking services automatically start. There are the following types of locks on a text index:

**S-lock** For shared read-only access. For example, search requests.

**U-lock**

For read and write access while computing changes to an index (update) with concurrent read access.

**X-lock** For exclusive read/write access for a short period during which changes are actually written to the index.

**IX-lock**

For intended exclusive read/write access preventing any new S-locks while the update process is waiting for an X-lock.

There is one Net Search Extender locking service per DB2 instance. The locking service maintains the locks for multiple databases.

The locking services configuration file is db2ext1m.cfg. It is stored on <instance\_owner\_home>/sql1lib/db2ext for UNIX systems and on <sql1lib>\<DB2INSTANCE>\db2ext for Windows.

Changes to the configuration file only take effect when Net Search Extender Instance Services are started during db2text start. The user can set the following values:

- The maximum number of databases
- The maximum number of indexes per database
- The maximum number of allowed locks (concurrent users) per index
- Waiting times and the number of attempts to obtain a lock

The default values of the configuration file are as follows:

```
<default
    maxDbs          = " 8"
    maxIdxPerDb     = " 50"
    maxLocksPerIdx = "100"

    sWait = " 50"
    uWait = " 500"
    xWait = " 500"

    sAttempt = "50"
    uAttempt = "10"
    xAttempt = "60"

    latchTimeout = "80"

/>
```

The syntax is <default attribute=value.../> and the attributes have the following meanings:

**maxDbs**

The number of databases the locking services can handle (integer >1).

**maxIdxPerDb**

The number of indexes per database that can be locked (integer >1). This value is the same for all databases.

**maxLocksPerIdx**

The number of locks that can simultaneously exist on an index (integer >1). This value is the same for all indexes.

If you increase the values for `maxDbs`, `maxIdxPerDb`, or `maxLocksPerIdx` beyond the default values in the configuration file mentioned above, ensure that you have sufficient memory.

**sWait/sAttempt**

When requesting an S-lock, `sAttempt` is the number of attempts that are made if the lock is not granted immediately. `sWait` is the waiting time between these attempts (integer >1). These parameters also apply to IX-locks.

**uWait/uAttempt**

When requesting a U-lock, `uAttempt` is the number of attempts that are made if the lock is not granted immediately. `uWait` is the waiting time between these attempts (integer >1).

**xWait/xAttempt**

When requesting an X-lock, `xAttempt` is the number of attempts that are made if the lock is not granted immediately. `xWait` is the waiting time between these attempts (integer >1).

**latchTimeout**

This is additional waiting time for interval locking services. To determine the total waiting time for a lock, use the following calculation:

$$\text{waiting time} = \# \text{ attempts} * (\# \text{ waits} + (2 * \# \text{ latchTimeout}))$$

The waiting time is calculated in milliseconds. Note that with each attempt, the `latchTimeout` value is doubled when added to the overall waiting time.

## Viewing a lock snapshot

You can view a lock snapshot by using one of the following commands:

- For a single text index:  
`db2text CONTROL LIST ALL LOCKS FOR DATABASE mydatabase INDEX myindex`
- For all the locked text indexes of a database:  
`db2text CONTROL LIST ALL LOCKS FOR DATABASE mydatabase`  
Note that only indexes that are actually locked are in the list.

The first time a text index is locked, memory is reserved for the database and the text index in the locking services. If further text indexes are locked, memory is also allocated for these indexes in the locking services. This memory is only freed again when the text index is dropped or the database disabled, or whenever the Net Search Extender services are restarted. This means that a text index or database consumes memory in the locking services, even if there are no locks currently set.

The command `"db2text CONTROL CLEAR ALL LOCKS"` forces the release of all the locks on a database or index. See "CONTROL command" on page 111 for details

on how to use this command. Note that this command does not free any memory allocated for the database or indexes. To free memory, you must either drop the index or disable the database, or restart the Net Search Extender services. Do not release locks during an active index update process.

---

## Update services

Table changes and index updates are not synchronous. The index update process can be started manually or can be scheduled to begin automatically at given intervals. The update services provide this functionality and are started during `db2text start`.

During index creation, you can specify how often the update services check if an update of the index is required by using the following command:

```
db2text create index DB2EXT.TITLE for text on DB2EXT.TEXTTAB (TITLE)
        UPDATE FREQUENCY D(1,3) H(0,12) M(0) update minimum 5
```

In this example, every Monday and Wednesday at 12 p.m. and 12 a.m. the Update Services wake up and check if there is some work to be completed on index `db2ext.title`. Note that in this example there need to be at least five changes to `DB2EXT.TITLE` before the automatic index update will start to synchronize the text index with the database.

In a partitioned database environment, the update services only start on one node.

### Note

Setting index update processes at very short intervals affects system performance negatively. You must consider the amount of changes that you expect to be processed during each update and the time that this will take, as well as the number of indexes that you want to process during automatic index update. Ensure that the intervals between each index update are large enough to allow for an update to finish before the next scheduled update begins, and that updates on several indexes are not scheduled to begin at the same time..

---

## Using the DB2 control center

Use the DB2 Control Center to manage Net Search Extender administration functions, DB2 instances, databases and database objects such as tables, views, and user groups.

You can invoke the commands on different DB2 Control Center objects, for example:

- Instance objects
- Database objects
- Index objects

The main elements of the DB2 Control Center are the menu bar, the tool bar, the object tree, and the content pane.

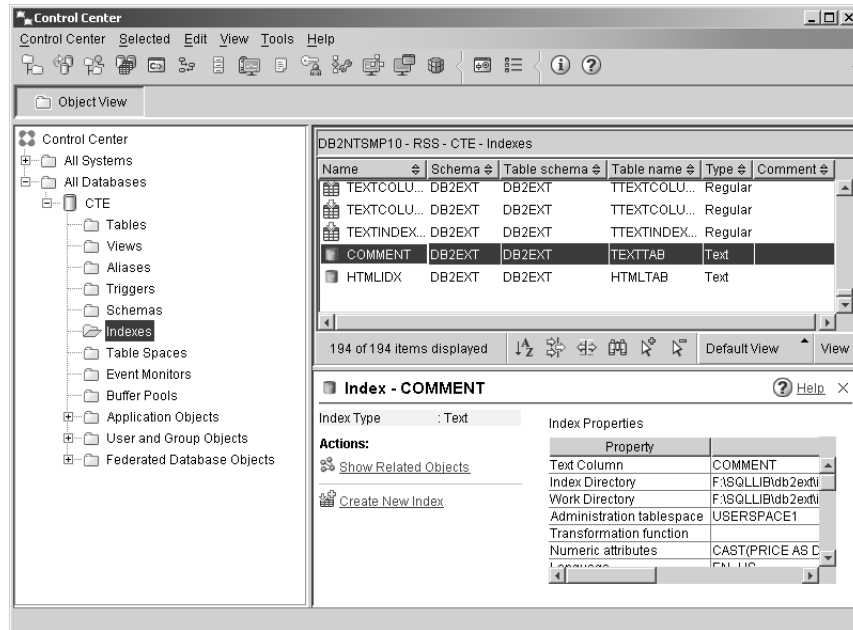


Figure 6. DB2 Control Center

Alternatively, you can use the command line. For more information, see the following sections:

- Chapter 6, “Developing: creating and maintaining a text index,” on page 49
- “Net Search Extender instance services” on page 25

**Note:** Only Net Search Extender indexing and administration functions are found in this chapter. For information on using the DB2 Control Center for other tasks, refer to the DB2 documentation.

## Starting and stopping Net Search Extender Instance Services using the DB2 Control Center

From the object tree, click on a system to display the available instances. Highlight the instance and right-click to display the instance object pop-up menu. Highlight **Net Search Extender** and select one of the following commands from the pop-up menu:

### Start Net Search Extender Instance Services

This starts the instance services if they are not already started.

### Stop Net Search Extender Instance Services

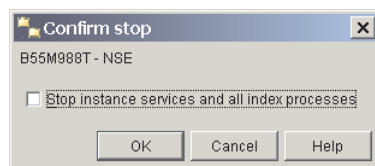


Figure 7. Stop Net Search Extender Services dialog

This displays a dialog. Use the check box to stop the instance services and index processes. In the command line syntax, this is known as the **FORCE** option. Click on the **OK** button.

### Instance status

This displays a dialog showing the status of the instance.

## Enabling and disabling a database using the DB2 control center

Database administration from DB2 Control Center

In the object tree, click on the instance object to display the available databases. Highlight the database and right-click to display the pop-up menu. Highlight **Net Search Extender** and select one of the following commands from the extended menu:

### Enable the database for text

This displays a dialog if the database is not enabled. Click on the **OK** button to enable the database. If the database is enabled, a message box displays.

### Disable the database for text

This displays a dialog if the database is not disabled. Click on the **OK** button to disable the database. If the database is already disabled, a message box displays.

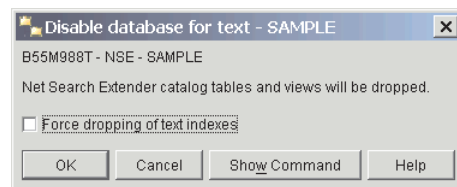


Figure 8. Disable database for text dialog

Click on the check box if you want to disable the database and drop all the text indexes.

Note that in all the dialogs, the **Show Command** button displays the command line version of the command.

## Text index administration using the DB2 control center

In the object tree, below the database object you can see the index object. Click on the index object to view the indexes in the content pane. You can identify the text index objects by the type 'text' in the Type column.

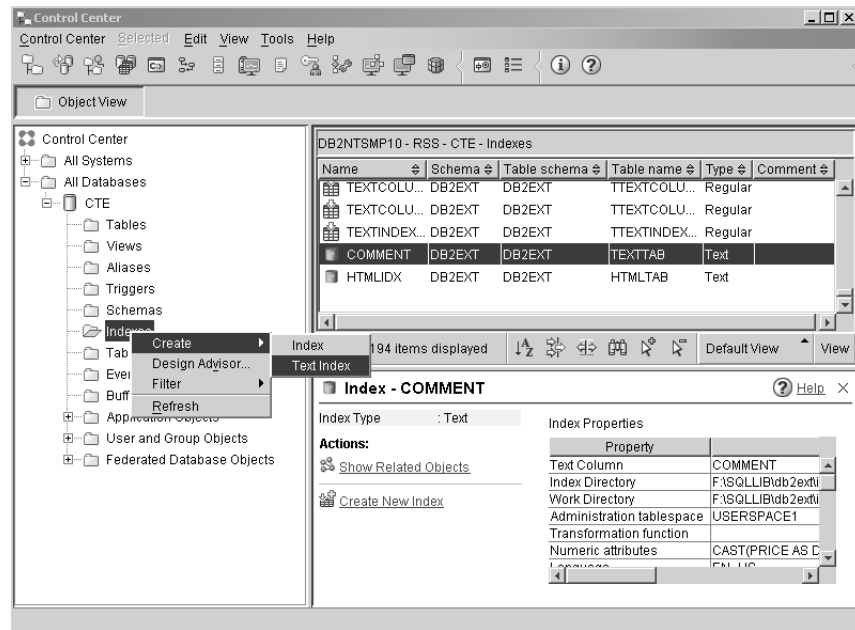


Figure 9. DB2 Control Center

Right-click on the index object and select one of the following commands from the pop-up menu:

**Create** This displays a dialog. By selecting **Text Index** in the dialog, you start a wizard for creating a text index.

**Filter** This displays a dialog where you can select which index objects display in the control pane view.

**Refresh**

This refreshes information in the object tree and control pane.

**Note:**

To access the instance, database and text index object commands without using the right-click option, click on the **Selected** menu command and highlight **Net Search Extender** to access the relevant commands.

Before creating a text index, ensure that you have considered the prerequisites found in Chapter 4, “Planning considerations,” on page 19.

Other indexing prerequisites include:

- Starting Net Search Extender Instance services
- Enabling the database

## Creating a text index using the DB2 control center

Select the **Create** command and from the extended menu highlight **Text Index**. A Create Text Index Wizard pops up. Use the wizard to specify the configuration options for the text index in a number of panels.

To move between the panels, enter all the mandatory information and click on the **Next** button until the **Finish** button is enabled. Click on the **Finish** button to create the text index.

## Name panel

### Purpose

This panel allows you to specify the schema and name for the text index. You can also specify a work and index directory for the text index files. Create the administrative tables for the index on the administration table space.

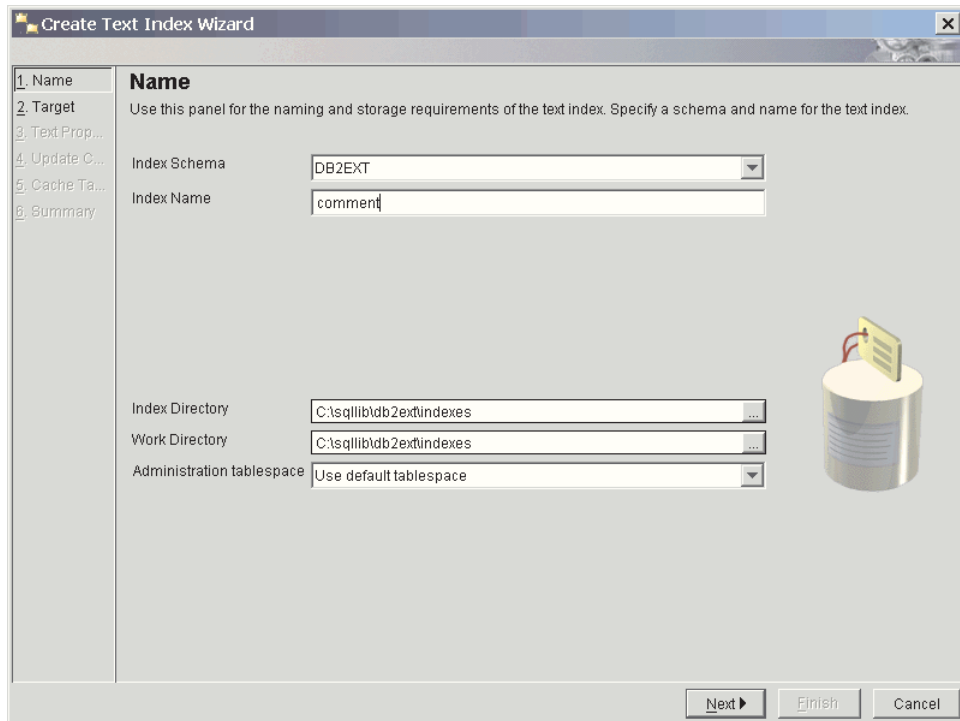


Figure 10. Create Text Index Wizard: Name panel

Here is a description of the fields in the panel:

Table 1. Name panel text fields

Field Name	Mandatory/ Optional	Default	Description
Index schema	Mandatory	user ID	Select a schema name of the text index. This is the DB2 schema name for the index-specific administration tables.
Index name	Mandatory	N/A	Enter a valid DB2 index name for the text index. With the index schema, this uniquely identifies a full-text index in the database.
Index directory	Optional	See the path name	Specify the directory path where you will store the text index. The directory must exist with read, write, and execute permissions for the DB2 instance owner user ID.
Work directory	Optional	See the path name	Specify the work directory where you will store temporary files during search and administration operations. The directory must exist with read, write, and execute permissions for the DB2 instance owner user ID.



Table 1. Name panel text fields (continued)

Field Name	Mandatory/Optional	Default	Description
Administration table space	Optional	Use the default table space	Select a table space name for the text index administration tables. You must define the table space on the same node group as the table space for the user table.

## Target panel Purpose

This panel allows you to specify the schema and name of the table or nickname table, and the name of the text column containing the data you want to index. You can use a transformation function to modify the content of the text column. In addition to the text column, you can also specify numeric attributes if you want to add the content of a table column expression to the text index.

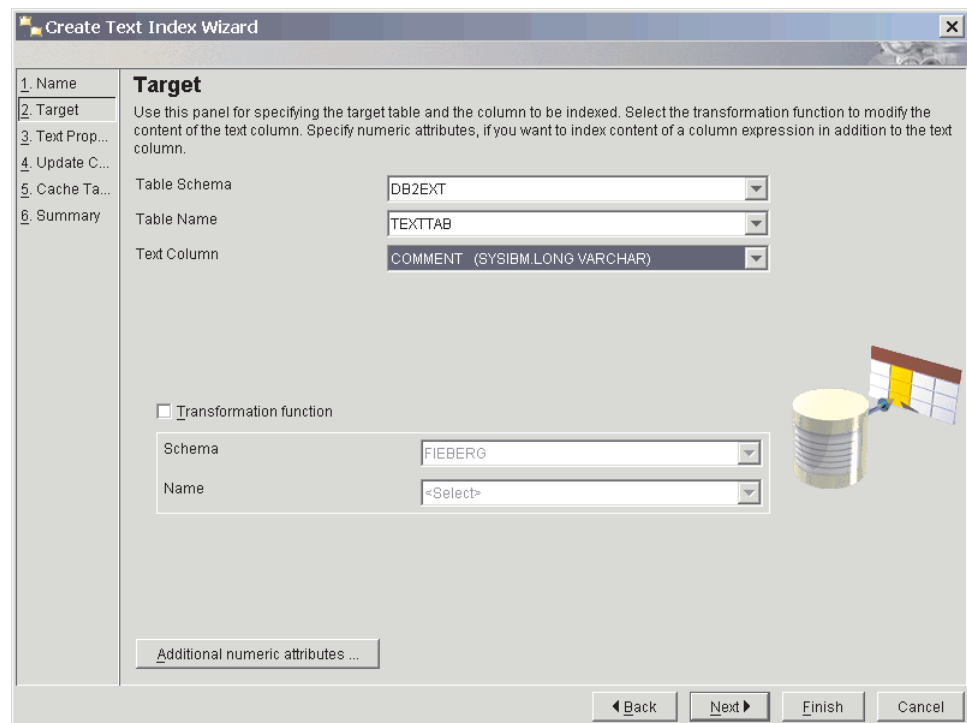


Figure 11. Create Text Index Wizard: Target panel

Here is a description of the fields in the panel:

Table 2. Target panel text fields

Field Name	Mandatory/Optional	Default	Description
Table schema (1)	Mandatory	user ID	Select the schema of the table or nickname table on which you are creating a text index.
Table name (2)	Mandatory	N/A	Select the name of the table or nickname table on which you are creating an index. The table must have a primary key.

Table 2. Target panel text fields (continued)

Field Name	Mandatory/Optional	Default	Description
Text column (3)	Mandatory	N/A	Select the name of the column used for creating the text index. The column must be one of the following types: CHAR (for bit data), VARCHAR (for bit data), LONG VARCHAR (for bit data), CLOB, DBCLOB, BLOB, GRAPHIC, VARGRAPHIC, LONG VARGRAPHIC, and XML. If this is not the case, the specified transformation function must ensure that it delivers one of the valid data types mentioned here.
Transformation function	Optional	Disabled	Select to use a transformation function.
Transformation function: Schema	Mandatory (if function selected)	user ID	Select the schema of the UDF used to access the text documents.
Transformation function: Name	As above	N/A	Select the name of a UDF used to access the text documents.

Note that you can only specify the table schema (1), table name (2) and text column (3) in this order.

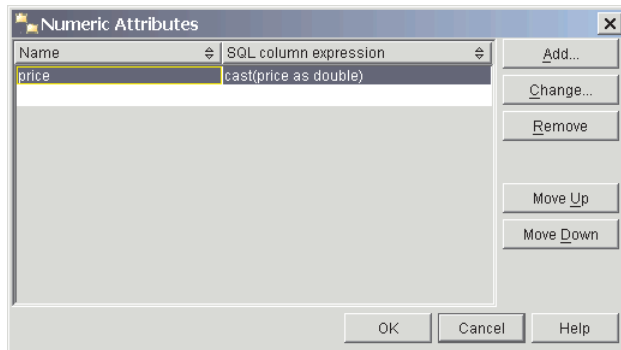


Figure 12. Numeric Attributes dialog

To view or add attributes, click on the **Numeric Attributes** button. A window displays. To add numeric attributes to the index, click on the **Add** button and a further window displays. Specify the SQL column expression and name for the attribute.

Alternatively, select an attribute and press the appropriate buttons to change, move, or remove an entry.

Use Numeric attributes to index numeric column expressions in addition to the text column. For example, if you want to index the column date of type `TIMESTAMP` in addition to the text column, specify a numeric attribute `"cast(julian_day(date) as double)"` and specify a name for the attribute. Numeric attributes must be of data type `DOUBLE`.

Specify a numeric attribute if you want to use a numeric expression inside a search query.

## Text properties panel

### Purpose

This panel allows you to specify the language and format of the text documents. If the documents are not stored in the same CCSID as the database, and the text column is of binary type, specify the CCSID.

Note that the database CCSID is initially selected. If your documents are of a GPP, HTML, Outside In, or XML structured format, you can specify a document model.

**Note:** In the format list box, the Outside In filtering format is known as INSO.

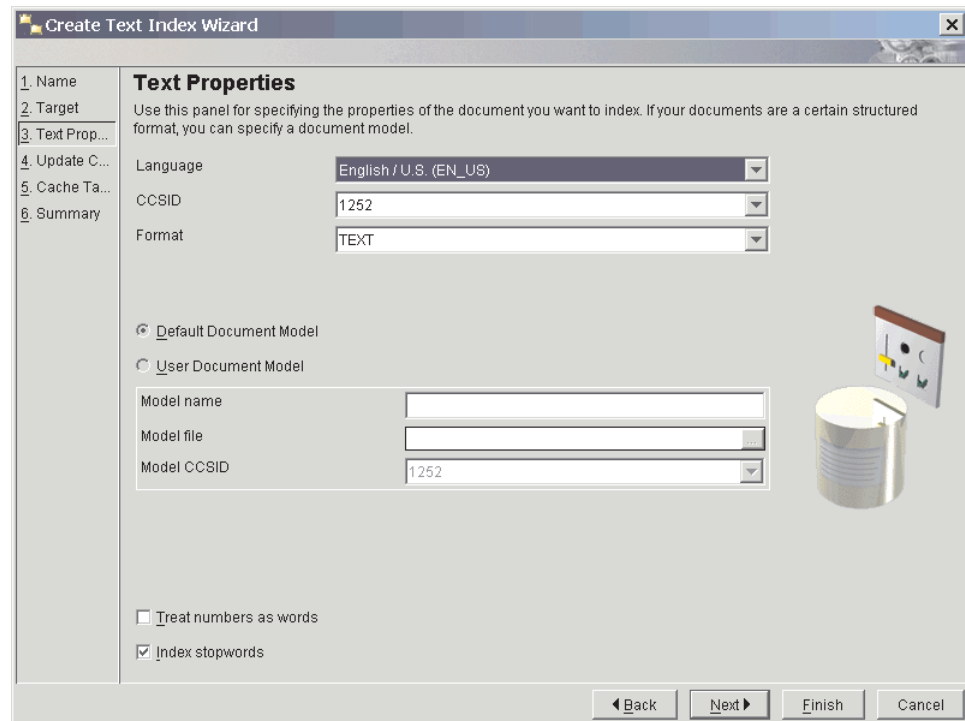


Figure 13. Create Text Index Wizard: Text Properties panel

Here is a description of the fields in the panel:

Table 3. Text Properties panel text fields

Field Name	Mandatory/Optional	Default	Description
Language	Optional	EN_US	Select a language to determine end-of-sentence and end-of-paragraph delimiters when indexing documents.
CCSID	Optional	CCSID of database	Select the CCSID for indexing text documents.
Format	Optional	TEXT or XML if the column type is XML	Select the text document format: HTML, XML, TEXT, INSO or GPP.

Table 3. Text Properties panel text fields (continued)

Field Name	Mandatory/ Optional	Default	Description
Default Document Model	Optional	Enabled	Use the default document model.
User Document Model	Optional	Disabled	Use your document model.
Model name	Mandatory (if User Document Model selected)	N/A	Enter the name of the document model. For HTML, XML, Outside In, and GPP formats, you can specify a document model. Note that the name is only found in the model file.
Model file	As above	N/A	Specify the document model file. The file must be readable by the DB2 instance owner.
Model CCSID	As above	Database CCSID	Select the CCSID to interpret the contents of the document model file.
Treat numbers as words	Optional	Disabled	Select to interpret sequences of digits as separate words, even if they are adjacent to characters.
Index stop words	Optional	Enabled	Select to enable language-specific stop word processing. The <language>.tsw file in the directory sql1lib/db2ext/resources contains the stopword list.

## Update characteristics panel

### Purpose

This panel allows you to specify whether the index updates incrementally or is recreated from scratch. You can specify update settings so that the index automatically updates at the specified time.

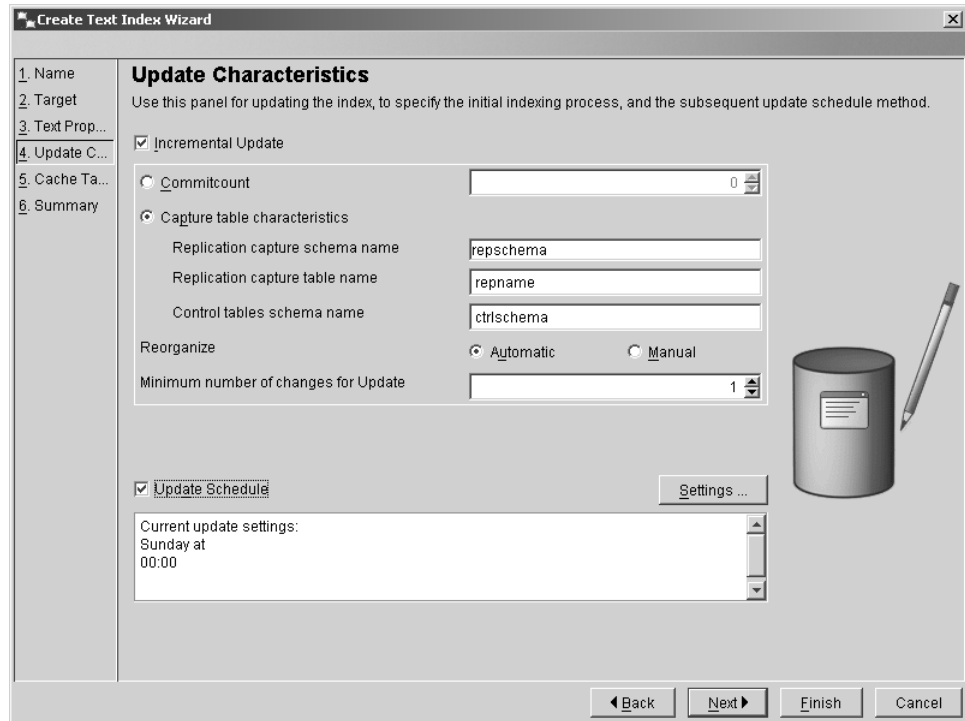


Figure 14. Create Text Index Wizard: Update Characteristics panel

Here is a description of the fields in the panel:

Table 4. Update Characteristics panel text fields

Field Name	Mandatory/ Optional	Default	Description
Incremental update	Optional	Enabled	Select for incremental index updates. If you do not enable the check box, you recreate the index when an update operation is performed.
Commitcount	Optional	0	Number of changes processed during an update in one transaction. You are recommended not to change this default.  Using a non-zero Commitcount has implications on performance.
Capture table characteristics	Optional	N/A	Select to use a replication capture table for capturing changes on the source table. The replication capture table must either be a Capture Data (CD) table , or a Capture Change Data (CCD) table and replaces the DB2 Net Search Extender generated log table.
Replication capture schema name	Optional	User ID	The schema name of the replication capture table. Note that the table must have been previously created using DB2 Replication.
Replication capture table name	Mandatory, if Capture table characteristics enabled	N/A	The table name of the replication capture table. Note that the table must have been previously created using DB2 Replication.

Table 4. Update Characteristics panel text fields (continued)

Field Name	Mandatory/ Optional	Default	Description
Control table schema name	Mandatory, if Capture table characteristics enabled	N/A	The control table schema name. Note that the tables must have been previously created using DB2 Replication.
Reorg automatic or manual radio button	Optional or Mandatory	Enabled/ disabled	Completes index reorganization automatically or manually.
Minimum number of changes for Update	Optional	1	Specify the minimum number of changes to the text documents before the index incrementally updates at the specified time.
Update schedule	Optional	Disabled	Select to add automatic update settings.

To add index update settings, click on the **Settings** button. Note that this button is only enabled if you select **Update Schedule**. In the dialog, select the days, hours, and minutes for the update time. Note that if you select multiple days, the update occurs at the same time on all the selected days.

### Cache table panel Purpose

This panel allows you to specify a cached table in addition to the index. You can specify the result columns to be cached and you can search the cache using a stored procedure. You can also specify other cache parameters, such as type, maximum size, and the order in which you retrieve the contents of the user table during initial indexing.

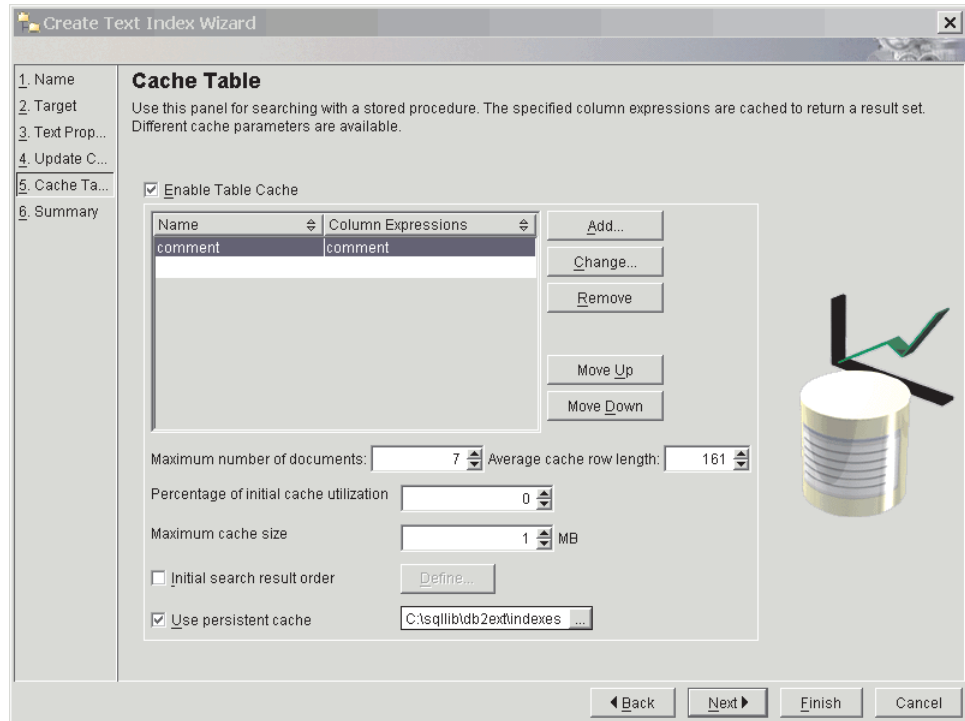


Figure 15. Create Text Index Wizard: Cache Table panel

Here is a description of the fields in the panel:

Table 5. Result Cache panel text fields

Field Name	Mandatory/ Optional	Default	Description
Enable table cache	Optional	Disabled	Select to enable the building of a cached table.
Result column table	Mandatory (if Enable table cache selected)	N/A	Displays a list of SQL column expressions specifying the search result columns.
Maximum number of documents	Mandatory	Row count of table	See the following section: Determining cache utilization and cache size.
Average cache row length	Mandatory	N/A	See the following section: Determining cache utilization and cache size.
Percentage of initial cache utilization	Optional	50%	Select the percentage of the cache held free for additional documents.
Maximum cache size	Optional	N/A	Specify a maximum size for the cached table built during index activate. If the number is too small, the activation will fail.
Initial search result order	Optional	Disabled	Select to define the search result order. Documents are returned in the same indexing order as in the cached table. This order can not be ensured after incremental update.

Table 5. Result Cache panel text fields (continued)

Field Name	Mandatory/ Optional	Default	Description
Use persistent cache	Optional	Enabled	This option enables a fast activate execution after a deactivation or system reboot. Note that you must specify a directory path for the persistent cache. Leave disabled if the cache should be temporary.

: Determining cache utilization and cache size

The Percentage of initial cache utilization specifies the percentage of the cache to be held free for additional documents. The Maximum cache size specifies the maximum size of the cached table to be built during activate cache. These options depend on the following factors:

- The actual number of documents in the table.
- The expected number of updates.
- The average size of the SQL expressions you want to cache.

You can enter the recommended values for the Percentage of initial cache utilization and Maximum cache size. Alternatively, you can let them be calculated each time you enter values in the Maximum number of documents or Average cache row length fields.

The Maximum number of documents value is initially set to the row count of the table. Modify this according to the number of documents and expected number of changes. Include all document updates, additions, and deletions.

When you add an SQL expression to the cache table list, the Average cache row length is calculated according to the length of the result. As this is based on the current number of rows in your table, the calculation can take a considerable amount of time. If you know that on average this value is smaller, modify the value.

For example, if your table has 10 entries and the sum of your column expressions is 100, then these values are initially set. If you expect that the maximum number of documents (including deleted ones) is 10 000, enter this figure. If you know that column expressions on average are smaller than the calculated value, such as a VARCHAR(100) and a filled-in text size of 10, use this figure for the average row size.

To define the initial search result order, click on the **Define** button. Note that this button is only enabled if you select the Initial Search Result Order check box. A dialog displays all the specified SQL column expressions. To add a result order, click on the **Add** button and, in the dialog, specify the SQL result order.

To change, move, or remove an entry, select the expression and click on the appropriate buttons.



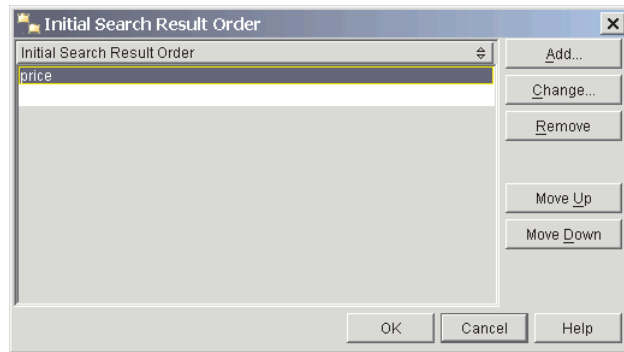


Figure 16. Initial Search Result Order dialog

To add SQL column expressions, click on the **Add** button, next to the Result Column table. In the dialog, specify the result column expression and name.

To change or remove an entry, click on the column expression which enables the appropriate buttons.

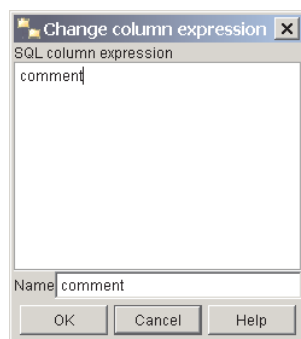


Figure 17. Change column expression dialog

### Determining cache utilization and cache size:

The Percentage of initial cache utilization specifies the percentage of the cache to be held free for additional documents. The Maximum cache size specifies the maximum size of the cached table to be built during activate cache. These options depend on the following factors:

- The actual number of documents in the table.
- The expected number of updates.
- The average size of the SQL expressions you want to cache.

You can enter the recommended values for the Percentage of initial cache utilization and Maximum cache size. Alternatively, you can let them be calculated each time you enter values in the Maximum number of documents or Average cache row length fields.

The Maximum number of documents value is initially set to the row count of the table. Modify this according to the number of documents and expected number of changes. Include all document updates, additions, and deletions.

When you add an SQL expression to the cache table list, the Average cache row length is calculated according to the length of the result. As this is based on the

current number of rows in your table, the calculation can take a considerable amount of time. If you know that on average this value is smaller, modify the value.

For example, if your table has 10 entries and the sum of your column expressions is 100, then these values are initially set. If you expect that the maximum number of documents (including deleted ones) is 10 000, enter this figure. If you know that column expressions on average are smaller than the calculated value, such as a VARCHAR(100) and a filled-in text size of 10, use this figure for the average row size.

## Summary panel

### Purpose

This panel provides an overview of the previously selected parameters.

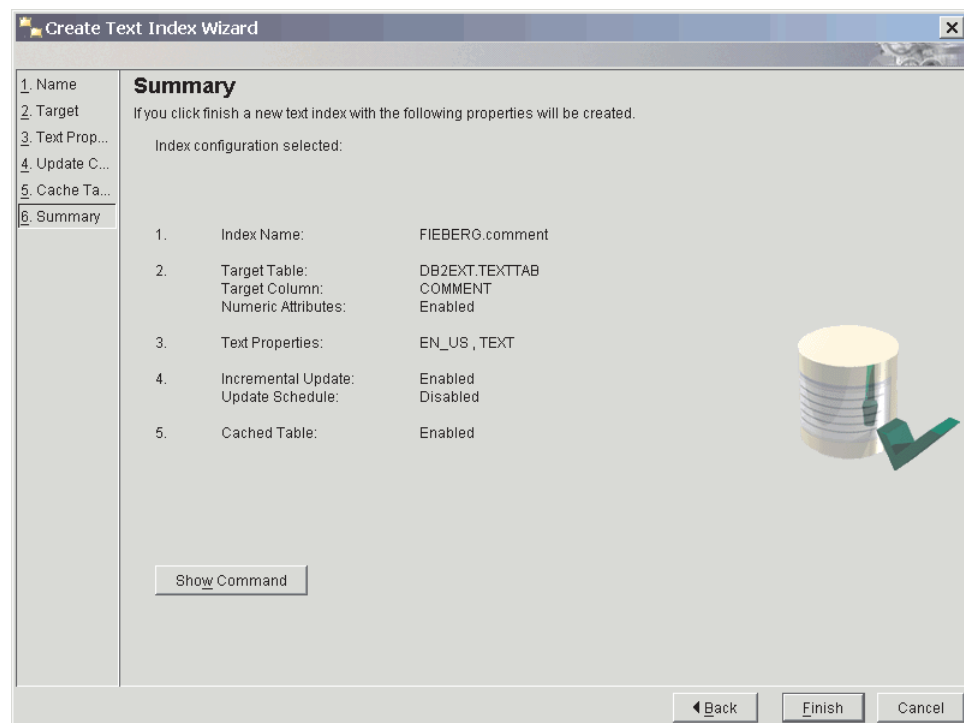


Figure 18. Create Text Index Wizard: Summary panel

Click on the **Show Command** button to view the commands that are run when you click on the **Finish** button. Clicking **Finish** creates the text index.

## Maintaining a text index using the DB2 control center

To maintain the text indexes, select the text index in the content pane and click on the **Select** menu command. You can select one of the following commands from the menu:

1. The ALTER command, for altering a text index.
2. The DROP command, for dropping a text index.
3. The UPDATE command, for updating a text index.
4. The SHOW INDEX EVENTS command, for showing index events.
5. The ACTIVATE INDEX MEMORY command, for activating an index cache.
6. The DEACTIVATE INDEX MEMORY command, for deactivating an index cache.

7. The `SHOW STATUS` command, for showing the index status.

Note that the Activating and Deactivating commands only display if you create the index with a cache option.

## Altering a text index using the DB2 control center

Select the **Alter** command and a dialog displays a series of panels. These provide an overview of the text index parameters. Note that there are some parameters that you cannot change.

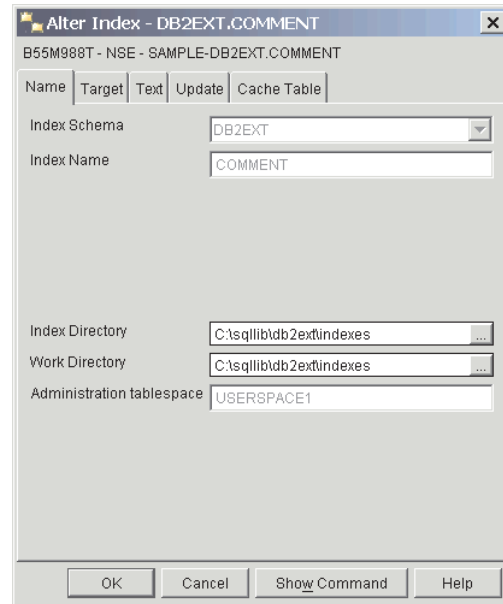


Figure 19. Alter Index dialog: Name tab

The **Name** panel displays the name and storage configurations for the index. You can change the index and work directories.

The **Target** panel displays the target and numeric attribute settings of the index. You cannot change these settings.

The **Text** panel displays the text document configurations. You cannot change these settings.

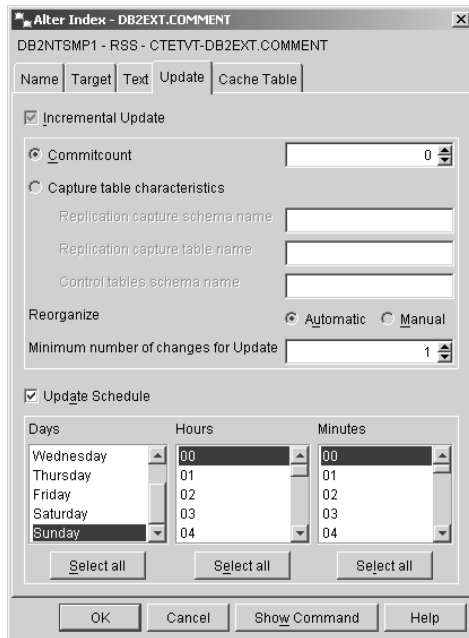


Figure 20. Alter Index dialog: Update tab

The **Update** panel displays the update characteristics of the index configuration. You can alter the update schedule. If the index was created for incremental updates, you can also modify the minimum number of changes. If the index was created with the commitcount option, you can also modify the commitcount value.

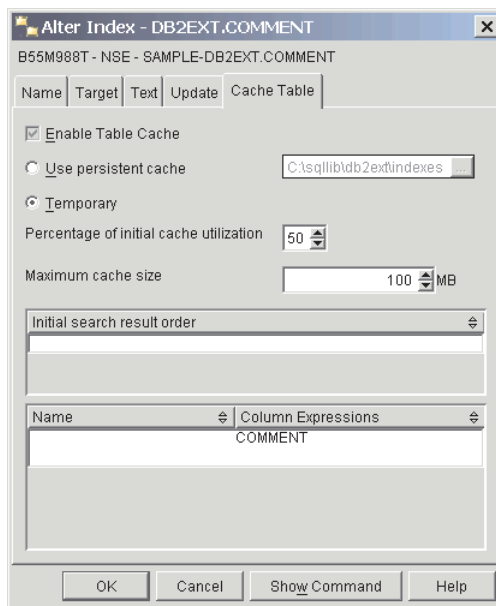


Figure 21. Alter Index dialog: Cache Table tab

The **Cache Table** panel displays the cache option settings. If the result cache is already enabled, you can modify the persistent directory, or make the index cache temporary. You might also change the Maximum cache size and the Percentage of initial cache utilization.

## Dropping a text index using the DB2 control center

Select the **Drop** command and a dialog displays the available text indexes.

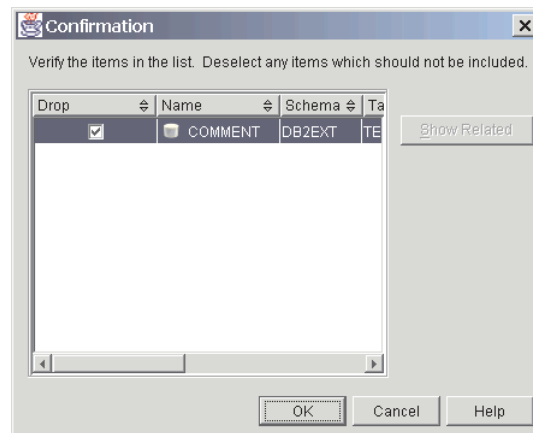


Figure 22. Drop Index dialog

Select the index and click on the OK button.

## Updating a text index using the DB2 control center

Select the **Update** command and a dialog displays a number of update options.

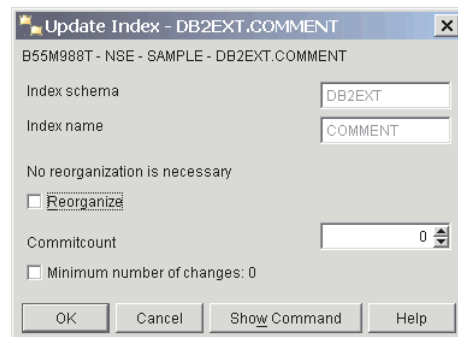


Figure 23. Update Index dialog

You can specify a commitcount for the update operation. If you want to update the minimum specified during create or alter index, select the Minimum number of changes check box. To reorganize the index, select the check box. Note that if reorganization is suggested, the check box is enabled.

## Showing index events using the DB2 control center

Select the **Show index events** command and the contents of the event table display in the dialog. Only the latest 1000 events are listed.

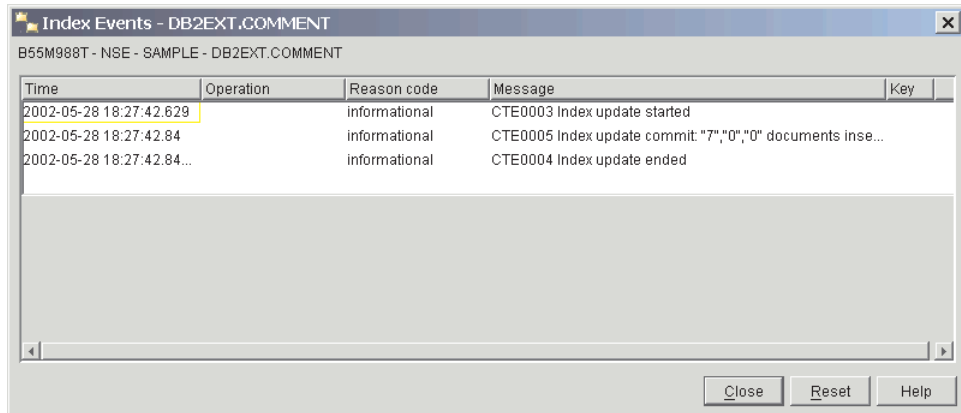


Figure 24. Index Events dialog

To clear the index events, click on the **Reset** button.

### Activating a text index cache using the DB2 control center

Select the **Activate index memory** command and a dialog displays.

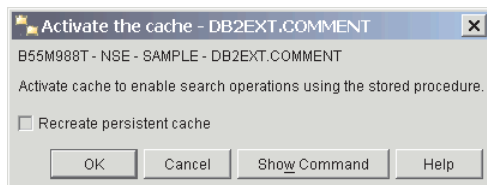


Figure 25. Activate the cache dialog

To activate the cache, click on the **OK** button. If you want to build the cache from scratch, select the check box.

### Deactivating a text index cache using the DB2 control center

Select the **Deactivate index memory** command and a dialog displays.



Figure 26. Deactivate the cached table dialog

To release the cache, click on the **OK** button.

### Showing index status using the DB2 control center

Select the **Show status** command and a dialog displays the status of the text index.

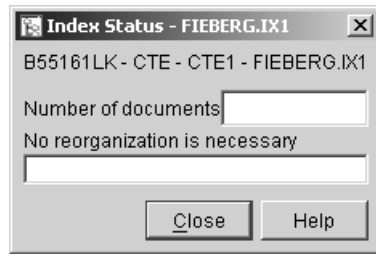


Figure 27. Index Status dialog

This includes information on the number of indexed documents, the reorganization suggested flag, and additional index information.





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## Chapter 6. Developing: creating and maintaining a text index

This section provides information on creating and maintaining a text index and covers the following areas:

- Introducing the db2text commands
- Enabling a database for text search
- Creating a text index for different data types
- Creating a text index on a nickname with incremental index update using DB2 Replication
- Creating a text index which the stored procedure search can use
- Text indexes on views
- Maintaining an index

There is also information on avoiding code page problems which might occur, and performance considerations which you need to take into account.

Before creating a text index, ensure that you have met the prerequisites in Chapter 4, "Planning considerations," on page 19. Also make sure that you have started the Net Search Extender Instance Services using the db2text start command.

### Note

You can also create and maintain a text index by using the DB2 Control Center.

---

## Enabling a database

**When** Once for each server that contains columns of text to be searched in.

**Command**

```
ENABLE DATABASE FOR TEXT
```

**Authorization**

```
SYSADM
```

This command prepares the connected server for use by Net Search Extender.

This command also registers Net Search Extender search functions and procedures that are described in "SQL scalar search function and the SQL table-valued function" on page 155.

When you enable a database, the command additionally creates the following tables and views automatically:

**db2ext.dbdefaults**

Stores the database default values for index, text, and processing characteristics.

**db2ext.textindexformats**

Stores the list of supported formats and the currently active model files used.

**db2ext.indexconfiguration**

Stores the index configuration parameters.

## db2ext.textindexes

A catalog view that keeps track of all text indexes.

When a server is enabled, it remains enabled until you disable it.

---

## Disabling a database

**When** When you no longer intend to make text searches in this server.

**Command**

```
DISABLE DATABASE FOR TEXT
```

**Authorization**

DBADM on the database

When Net Search Extender prepares the database for use, certain administrative changes are made. This section describes functions that help you to reverse this process.

To disable the connected subsystem, use the following command:

```
db2text DISABLE DATABASE FOR TEXT
```

When you disable a server, the command deletes the following objects:

- The Net Search Extender catalog views and tables that were created when the server was enabled.
- The declaration of Net Search Extender's SQL functions (UDFs).

If the DISABLE DATABASE FOR TEXT command returns an error, but you want to disable at all costs (even if indexes are still in use) , use the following command:

```
db2text DISABLE DATABASE for text force
```

**Note:** Disabling a database will fail if there are any text indexes defined in the database. It is recommended to remove these indexes one by one and then check if any problems occur. If you use the disable database for text force command, it only guarantees that Net Search Extender catalog tables in the database are removed.

However, if some of the indexes can not be dropped completely, there may still be resources that need to be manually cleaned up. These include:

- Files in the index, work and cache directory
- Scheduler entries in ctedem.dat
- Where an index was created using the replication capture option, the IBMSNAP\_SIGNAL, IBMSNAP\_PRUNE\_SET, and IBMSNAP\_PRUNCNTL entries in the tables of the remote database must be manually deleted. These entries can be easily identified using the APPLY\_QUAL='NSEDB2' || <instance name> and TARGET\_SERVER= <database name> condition.

In the following example, the instance is DB2 and the database is SAMPLE.

```
DELETE FROM <ccSchema>.IBMSNAP_SIGNAL
WHERE SIGNAL_INPUT_IN IN
      (SELECT MAP_ID FROM <ccSchema>.IBMSNAP_PRUNCNTL
       WHERE APPLY_QUAL= 'NSEDB2' AND TARGET_SERVER= 'SAMPLE');

DELETE FROM <ccSchema>.IBMSNAP_PRUNCNTL
WHERE APPLY_QUAL= 'NSEDB2' AND TARGET_SERVER= 'SAMPLE';
```

```
DELETE FROM <ccschema>.IBMSNAP_PRUNE_SET
WHERE APPLY_QUAL= 'NSEDB2' AND TARGET_SERVER= 'SAMPLE';
```

---

## Creating a text index

**When** Once for each column that contains text to be searched.

**Command**

CREATE INDEX ... FOR TEXT ... (See the following examples)

**Authorization**

CONTROL on the table

You can create a text index on all data types, although there are different requirements for the following data types:

- Binary data types
- Unsupported data types

There are also different requirements for creating a text index for stored procedure search.

DB2 Net Search Extender does not support creating a text index on a table that was created with range partitioning. This will result in error CTE0135: The object "schemaname"."tablename" does not exist.

When you create a text index, Net Search Extender automatically creates the following objects:

**A log table**

This keeps track of all changes to rows in the user table. Note that if you select the **Recreate index on Update** option or use replication capture tables, the log table is not created.

**An event table**

This collects information about all updates and potential problems during an update of the text indexes.

**Triggers on the user table**

These add information to the log table whenever a document in the user table is added, deleted, or changed. The information is necessary for index synchronization during the next scheduled or manual index update.

Note that triggers are only created if you create a log table, and the text index is created on a base table and not on views or nickname tables.

To optimize performance and disk space, the CREATE INDEX command has an option to specify a different table space for the tables.

**Note:** If you use the DB2 LOAD command to import your documents, the triggers do not fire and incremental indexing of the loaded documents is not possible.

Therefore, it is preferable to use the DB2 IMPORT command as this activates the triggers.

The following example creates a text index on text column HTMLFILE in table htmltab.

```
db2text create index DB2EXT.HTMLIDX for text on DB2EXT.HTMLTAB
(HTMLFILE) format HTML
```

A primary key must exist on this table.

The default values for index creation are taken from the `db2ext.dbdefaults` view.

If errors occur during indexing, **index update event** rows are added to the event table. This happens, for example, when a document queued for indexing can not be found or if the document format is invalid. For additional information, see the description of the “Event view” on page 222.

To reverse the changes made by `CREATE INDEX`, use the `DROP INDEX` command. See “Dropping a text index” on page 61 for this information.

To populate the created index with data from the text column, use the following command:

```
db2text update index DB2EXT.HTMLIDX for text
```

Note that you can only search for documents successfully after the text index is synchronized with the table using a `db2text update` command.

**Note: Search summary**

Depending on the options selected during index creation, different ways of searching are possible:

- The SQL scalar search functions work on all text indexes, except those created on views.
- The stored procedure search function only works on text indexes that are created with a cache.
- The SQL table-valued function works on all text indexes, including those created on views.

## Creating a text index on binary data types

When you store data in a column that has a binary data type, for example `BLOB` or `FOR BIT DATA`, DB2 does not convert the data. This means that the documents retain their original code pages (CCSIDs), which can cause problems when creating a text index as you might have two different code pages. Therefore, you need to determine whether you are using the code page of the database, or the code page specified in the `CREATE INDEX` command.

To avoid this problem, specify the code page when creating the text index:

```
db2text CREATE INDEX db2ext.comment FOR TEXT ON db2ext.texttab (comment)
        CCSID 1252
```

If the code page is not specified, check which CCSID has been used to create the index, by calling:

```
db2 SELECT ccsid FROM db2ext.textindexes WHERE INDSHEMA = 'DB2EXT'
        and INDNAME = 'COMMENT'
```

Note that there is no support for documents with different code pages in one text index. For information on how DB2 converts document code page settings, go to the Internationalization Guide.

Note that the problem does not exist when you create indexes on character data types. For character data types, do not specify the `CCSID` parameter.

## Creating a text index on an unsupported data type

To create an index, the text columns must be one of the following data types:

- CHAR
- VARCHAR
- LONG VARCHAR
- CLOB
- GRAPHIC
- VARGRAPHIC
- LONG VARGRAPHIC
- DBCLOB
- BLOB
- XML

If the documents are in a column of a data type that is not contained in this list, such as a user-defined type (UDT), you must provide a conversion function that takes the user type as input and casts it to one of the valid data types as an output type.

Then you must specify the name of this conversion function at index creation time. See “CREATE INDEX command” on page 125 for further information.

Example: You intend to store compressed text in a table.

1. Create a user-defined type (UDT) for the text in an interactive SQL session:  

```
db2 "CREATE DISTINCT TYPE COMPRESSED_TEXT AS CLOB(1M)"
```
2. Create a table and insert the text into it:  

```
db2 "CREATE TABLE UDTTABLE (author VARCHAR(50) not null,  
                             text COMPRESSED_TEXT, primary key (author))"  
db2 "INSERT ..."
```
3. Create a user-defined function (UDF) called, for example, `uncompress`. This receives a value of type `COMPRESSED_TEXT` and returns the corresponding uncompressed text as, for example, a `CLOB(10M)` value.
4. Create your text index in the following way to specify the `uncompress` UDF:  

```
db2text "CREATE INDEX UDTINDEX for text ON UDTTABLE  
        (uncompress(text))  
        ..."
```

## Creating a text index on a nickname with incremental index update using DB2 Replication

Before creating a text index on a nickname using a replication capture table, you must perform the following steps:

1. Set up the DB2 federated database with all server definitions and wrapper definitions.
2. Set up the replication control tables and the capture programs at the remote server. This is where the source table for the nickname resides. If DB2 does not automatically create nicknames, you must create nicknames in the federated DB2 database using one schema name for the following tables:
  - `IBMSNAP_SIGNAL`
  - `IBMSNAP_PRUNE_SET`
  - `IBMSNAP_PRUNCNTL`

- IBMSNAP\_REGISTER
- IBMSNAP\_REG\_SYNC (Non-DB2 remote sources only)

After this step, nicknames for the replication control tables are available as nicknames under one "capture control schema" on the federated DB2 database. This schema name is important for the DB2TEXT CREATE INDEX command.

3. Register the table as a replication source.
4. If DB2 does not automatically create a nickname in the registration step, create a nickname for the replication capture table in the federated database. The replication capture table can either be a Change Data (CD) table or a Consistent Change Data (CCD) table. This nickname is a parameter for the DB2TEXT CREATE INDEX command.

Note that the column names IBMSNAP\_OPERATION, IBMSNAP\_COMMITSEQ, IBMSNAP\_INTENTSEQ, and the names of the primary key columns must not be changed.

5. If you are using DB2 replication source, ensure that your capture program is running. Do not use a cold start for the capture program: if you do, all rows in the IBMSNAP\_SIGNAL table for APPLY\_QUAL LIKE 'NSE%' have to be reinserted. In the following SQL statement you can see how this is done:

```
INSERT INTO <capture control schema>.IBMSNAP_SIGNAL
SELECT CURRENT_TIMESTAMP, 'CMD', 'CAPSTART', MAP_ID, 'P'
FROM <capture control schema>.IBMSNAP_PRUNCNTL
WHERE APPLY_QUAL LIKE 'NSE'
```

6. You can use the following example to create a text index on a nickname using replication:

```
DB2TEXT
CREATE INDEX <indexname> FOR TEXT ON <nickname> (< text column>)
REPLICATION CAPTURE TABLE <capture nickname>
CONTROL TABLE SCHEMA <capture control schema>
```

## Creating a text index which the stored procedure search can use

If you know in advance what subset of data from your table you want to present to the user and are only interested in the top ranked search results and not the complete results list, you can use the stored procedure search. For the stored procedure search, you need to specify cache options during the CREATE INDEX command. Working with a cached index, enables high performance at query time, by moving all the specified data into main memory to avoid costly physical read operations from the table.

Before you update the cached index the first time, ensure that your table already contains documents to avoid updating an index on a non-populated table. This provides better indexing performance and a correct estimate of cache memory requirements.

The stored procedure search allows you to quickly return predefined data that is associated with a document. Use the cache table option to define this in the CREATE INDEX command. The ACTIVATE CACHE command then moves the specified data into the memory cache.

When creating a text index for stored procedure search, you must determine and calculate the following parameters:

- The type of cache (temporary or persistent)

- The type of index update (automatic and incremental, or recreation at each update)
- The maximum amount of memory that Net Search Extender can use, by using `MAXIMUM CACHE SIZE`.
- The amount of free memory necessary for subsequent document updates, by using `PCTFREE`. Note that this is only for incremental updates.

The following types of cache are available:

#### **A temporary cache**

This is rebuilt with each `DB2TEXT ACTIVATE CACHE` command, and requires reloading the data from your DB2 table to memory. Building the cached index from scratch each time Net Search Extender is restarted or the system is rebooted takes longer than reactivating a persistent cache, especially for large tables. Use a temporary cache only if you are dealing with a small amount of fixed data and do not have to consider the time that it takes to build the cached data.

#### **A persistent cache**

This is maintained on disk and can be quickly mapped to memory by using the `DB2TEXT ACTIVATE CACHE` command. In incremental index update scenarios, the cache must remain activated to allow synchronization between the table and the cached indexed. If this does not occur, the next `DB2TEXT ACTIVATE CACHE` command recreates the cache from scratch.

The following methods of updating a text index are available:

#### **Without the Recreate index on update option**

If the Recreate index on update option is not set, automatic index update takes place. The process is triggered by the update index command and the update intervals are determined by the update frequency option. The update process is also known as incremental update.

Avoid deleting and reinserting a document in the table because slots for a deleted document cannot be reused in the cache. As a consequence, you should avoid changing key columns on an activated index.

#### **With the Recreate index on update option**

This recreates the index on each update. Use variable data types in the cache column expressions wherever possible. This will save cache space. Use the corresponding cast expressions in the `CACHE TABLE` clause.

Use this option if your data is not very stable, that is if you expect to insert more than 50% of your documents after the initial index activation.

Net Search Extender provides two SQL functions to help you determine the `CREATE INDEX` memory parameters. These are `MAXIMUM CACHE SIZE` and `PCTFREE`.

- `MAXIMUM CACHE SIZE` specifies the maximum size of the cached index. You can obtain the value of `MAXIMUM CACHE SIZE` in megabytes (MB) by using the following UDF function:

```
DB2EXT.MAXIMUM_CACHE_SIZE(maximumNumberDocs INTEGER,
                           averageRowLength INTEGER, numberOfCacheColumns INTEGER)
```

The following command returns the average row length parameter from your table:

```
SELECT AVG(LENGTH(cache column_1) + ... + LENGTH(cache column_n))
```



Note that the average may change significantly when further documents are inserted into your table. The number of cache columns relates to the number of column expressions used in the CACHE TABLE clause of the DB2TEXT CREATE INDEX command.

For additional information, see “Stored procedure search memory requirements” on page 19.

- PCTFREE specifies what percentage of the cache that is specified in MAXIMUM CACHE SIZE to hold free for additional documents. The following UDF function returns the recommended PCTFREE value based on the actual and maximum numbers of documents.

```
DB2EXT.PCTFREE(actualNumberDocs INTEGER, maximumNumberDocs INTEGER)
```

The actual number of documents is the number of rows in your table at the time of the first ACTIVATE CACHE command, which creates the memory cache.

The maximum number of documents is an estimate of the maximum number of documents in your table before the next DB2TEXT ACTIVATE command (for a temporary cache), or DB2TEXT ACTIVATE CACHE RECREATE command (for a persistent cache) is run.

The default is set to 50%. If you are recreating the index on each update, set the PCTFREE value to 0.

Assume that you have 10 000 rows in your table and you do not expect more than 20 000. Use the following call to calculate the PCTFREE value you require:

```
db2 "values DB2EXT.PCTFREE(10000,20000) "
```

Assume that your maximum row size is 20 000 and that you have 2 columns in your cache with an average size of 76. Use the following call to return the size:

```
db2 " values DB2EXT.MAXIMUM_CACHE_SIZE(20000,76,2) "
```

After determining suitable parameters, you can create your cached index by using the following call:

```
db2text CREATE INDEX db2ext.comment FOR TEXT ON db2ext.texttab (comment)
        CACHE TABLE (docid) PCTFREE 10 MAXIMUM CACHE SIZE 5
```

In this example, the docid column is cached, using main memory for fast result table return. Ten percent of the cache memory is reserved for future documents and the cache is limited to a maximum of 5 MB.

---

## Creating text indexes on views

You can create text indexes on views for use with the stored procedure or table-valued search functions, however, you cannot use any of the scalar functions, for example, CONTAINS.

Another major limitation is that you cannot create triggers on views, so any changes in the underlying base tables are not recognized automatically.

Consequently, for incremental index updates, the user has to know which document has been added, updated, or deleted in order to synchronize the text index with the database. To do this, you must add all the changes to the log table. This process is shown in the following sample:

1. Create a base table using the following command:

```
db2 "create table sample (key INTEGER not null PRIMARY KEY, name
        VARCHAR(50) not null, comment VARCHAR(90))"
```



2. Add some entries using the following commands:
 

```
db2 "insert into sample values(1,'Claus','works in room 301')"
```

```
db2 "insert into sample values(2,'Manja','is in the same office
      as Juergen')"
```

```
db2 "insert into sample values(2,'Juergen','has the longest way to
      Raiko')"
```

```
db2 "insert into sample values(3,'Raiko','is sitting in the office
      besides Claus ')"
```
3. Create a view using the following command:
 

```
db2 "create view sampleview as select key, comment from sample"
```
4. Use the following commands to create, update, and activate the text index:
 

```
db2text "create index indexview for text on hde.sampleview(comment)
      cache table (comment) maximum cache size 1 key columns
      for index on view (key)"
```

```
db2text "update index indexview for text"
```

```
db2text "activate cache for index indexview for text"
```

**Note:** You need to specify the cache table to be able to create a text index on a view. To create the correct log table, you must specify the key columns for the index on a view. If you create an index in this way, you can also search the index using the table-valued function.

When you use the stored procedure search in a distributed DB2 environment, you must explicitly specify a table space for administration tables on a single node and explicitly call on this node. To ensure that you connect to the correct node, use the DB2NODE environment variable.

5. To update the table, use the following commands:
 

```
db2 "insert into sample values(4,'Bernhard','is working on the same floor
      as Manja, but not as Claus')"
```

```
db2 "insert into sample values(5,'Guenther','shares the office with Raiko')"
```
6. Then update the log table. To get the name of the log table, use the following command:
 

```
db2 "select INDSHEMA,INDNAME,LOGVIEWSCHEMA,LOGVIEWNAME
      from db2ext.textindexes"
```

This is the layout of the log table:

sqltype	sqllen	sqlname.data	sqlname.length
496 INTEGER	4	OPERATION	9
392 TIMESTAMP	26	TIME	4
497 INTEGER	4	PK01	4

To add the entries into the log table, use the following commands:

```
db2 "insert into sample values(0,CURRENT TIMESTAMP,4)"
```

```
db2 "insert into sample values(0,CURRENT TIMESTAMP,5)"
```

The first value describes the operation (0 = insert, 1 = update, 2 = delete). The second should always be the CURRENT TIMESTAMP, and the last value is the primary key of the row that has been inserted, updated or deleted.

7. Use the following command to update the index again:
 

```
db2text "update index indexview for text"
```

You can now search with the stored procedure on the new values.

---

## Performance considerations for indexing

To enhance performance during indexing, consider the following issues:

- Use a VARCHAR data type to store the text documents instead of LONG VARCHAR or CLOB.
- Use separate physical disks to store the text index and the database files.
- Use small primary key columns, such as TIMESTAMP and INTEGER instead of VARCHAR types.
- Ensure that your system has enough real memory available for all this data. If there is insufficient memory, the operating system uses paging space instead. This decreases indexing and search performance.
- The update commitcount parameter, used during the automatic or manual updating of the index, slows down the indexing performance during incremental indexing. Note that the parameter is not used during the initial update process.
- Performance may decrease during index update if many error and warning messages are written to the event log table.

<p><b>Note:</b> For the latest performance tips, go to the DB2 Net Search Extender Web site: <a href="http://www.ibm.com/software/data/db2/extenders/netsearch/index.html">http://www.ibm.com/software/data/db2/extenders/netsearch/index.html</a></p>
--

---

## Maintaining text indexes

This section describes how to maintain text indexes and get useful information about their status. The maintenance tasks are:

1. Updating and reorganizing a text index
2. Altering a text index
3. Clearing (deleting) index update event information
4. Dropping a text index
5. Viewing index status

This section also includes information on how to back up and restore indexes and enabled databases.

### Updating and reorganizing a text index

After creating and updating the text index for the first time, you must keep the text index up to date. For example, when you add a text document to a table, or change an existing document in a table, you must index the document to keep the content of the index synchronized with the content of the table. Likewise, when you delete a text document from a table, its term references must be removed from the index.

If the text index was created without the RECREATE INDEX ON UPDATE option, triggers automatically store information about new, changed, or deleted documents in an internal log table. The next time an index update takes place, the documents referenced in the log table are indexed.

If you specify the RECREATE option in the CREATE INDEX command, the index is rebuilt completely for each update. This option creates no log table or triggers. Use this option with care if you have large tables because rebuilding the complete index can be costly.

Typically you update an index automatically at given intervals. You can change the update frequency for an existing index by using the ALTER INDEX command.

You specify the index update frequency in terms of when the update is to be made, and the minimum number of text changes that must be queued in the log table before an index update begins. If there are not enough changes in the log table at the day and time given, the index is not updated.

You should plan periodic indexing carefully; to index large amounts of text documents can be a time- and resource-consuming task. The time it takes depends on many factors. These include the size of the documents, how many text documents have been added or changed since the previous index update, and how powerful the processor is.

You should avoid the combination of a large number of indexes and very high automatic update frequencies, as this might result in deadlock situations. For example, 100 indexes with their update frequency set to every 5 minutes, 24 hours a day, and 7 days a week, generates an internal list of  $100 \times 12 \times 24 \times 7 = 201600$  checkpoints in a week that must be administered.

**Note:** On a DB2 table, rollback and deadlock situations might occur in the following cases:

- High update frequencies
- High frequency change transactions
- Long transactions

When a database table is updated, the changes that must be made to the Net Search Extender index are logged in a log table. After these log table entries have been processed, the entries are deleted from the log table. If these delete operations to the log table coincide with updates in the database table that need to be logged, a deadlock situation might result.

## Updating a text index

The UPDATE INDEX command lets you update an index immediately on request.

**When** When an index must be updated immediately without waiting for periodic indexing to occur.

**Command**

```
UPDATE INDEX
```

**Authorization**

CONTROL on the table

The following command updates the index:

```
db2text UPDATE INDEX comment FOR TEXT
```

This command is useful when you have added several text documents to a database and want to search them immediately.

If you specify AUTOMATIC REORGANIZE during CREATE INDEX, the index will be automatically reorganized when necessary.

If you instead specify MANUAL REORGANIZATION and want to determine if manual reorganization is necessary, query the db2ext.textindexes view by using the following command:

```
db2 "select reorg_suggested from db2ext.textindexes where INDNAME = 'comment'"
```

If you specify `MANUAL REORGANIZATION` and often update a column, bear in mind that the update process becomes slower. To manually reorganize, use the following command:

```
db2text UPDATE INDEX comment FOR TEXT reorganize
```

## Altering a text index

**When** When the update frequency or index and work directories have to be changed.

**Command**

```
ALTER INDEX
```

**Authorization**

CONTROL on the table

Use this command to change the index work directory, the update frequency of an index, or the cache characteristics, principally the `MAXIMUM CACHE SIZE` or `PCTFREE`. If you do not specify an update frequency, the current settings are left unchanged. If an index update or search is running, an error message displays. This states that the index is currently locked and no changes can be made.

The following example changes the update frequency for the index.

```
db2text ALTER INDEX comment FOR TEXT
        UPDATE FREQUENCY d(1,2,3,4,5) h(12,15) m(00) UPDATE MINIMUM 100
```

In this example, the index is to be updated at 12:00 or 15:00, on Monday to Friday, if a minimum of 100 text documents are in the queue.

Use the following command to stop the periodic updating of an index:

```
db2text ALTER INDEX comment FOR TEXT
        UPDATE FREQUENCY NONE
```

If you change the index directories using the `ALTER INDEX` command, the index files are copied from one directory to another, and the index is locked during this process. After the copying process has finished, the index is unlocked and can be used again.

## Clearing index events

**When** When you no longer need the messages in an index's event table.

**Command**

```
CLEAR EVENTS FOR INDEX
```

**Authorization**

CONTROL on the table

Information about indexing events, such as the update start and end times, the number of indexed documents, or document errors that occurred during the update, are stored in the index's event table. This can help you determine the cause of the problem. When you no longer need these messages, you can delete them.

The following example deletes messages from the specified text index:

```
db2text CLEAR EVENTS FOR INDEX comment FOR TEXT
```

## Dropping a text index

**When** When you no longer intend to make text searches on a text column.

**Command**

```
DROP INDEX FOR TEXT
```

**Authorization**

CONTROL on the table

Example:

```
db2text DROP INDEX comment FOR TEXT
```

When dropping a text index, you also drop the following tables and views:

- The log table and view of the index
- The event table and view of the index
- The log table triggers (if present)

**Note:** Always drop the indexes on the table before dropping the table. If you drop the table first, the indexes still exist.

## Viewing text index status

To get information about the current text indexes within the database, use the Net Search Extender catalog views. For example, if you want to know about the current database defaults, use the following command:

```
db2 "select * from db2ext.dbdefaults"
```

For information about the currently available indexes, their corresponding tables, and the number of indexed documents, use this command:

```
db2 "select indschema, indname, tabschema, tablename, number_docs
    from db2ext.textindexes"
```

Use this command for information about the formats of a specific index:

```
db2 "select format, modelname from db2ext.textindexformats where
    indschema = 'DB2EXT' and indname = 'TITLE'"
```

If COMMITCOUNT is not set, then the NUMBER\_DOCS parameter from the db2ext.textindexes is not updated during a running update process. To view the current number of documents updated during the update process, use the following command:

```
db2text CONTROL LIST ALL LOCKS FOR DATABASE sample INDEX db2ext.title
```

## Backing up and restoring indexes

Use the following steps to **back up** enabled databases and text indexes created by Net Search Extender:

1. To find out which indexes Net Search Extender has created and where they are stored, call a select statement on the db2ext.textindexes view:  

```
db2 "select indschema, indname, indexedirectory from db2ext.textindexes"
```
2. Ensure that no index update is running, and then stop Net Search Extender services with the following command:  

```
db2text stop
```
3. After backing up the database, back up the index directories and subdirectories.

4. Restart Net Search Extender services with the following command:  
`db2text start`

Use the following steps to **restore** the enabled databases and text indexes created by Net Search Extender:

1. Stop Net Search Extender with the following command:  
`db2text stop`
2. Restore the backup copies of the index directories to the same path as before.
3. Restart Net Search Extender with the command:  
`db2text start`

## Removing files from the /tmp directory

While the Net Search Extender services are running, the following files must exist in the /tmp directory and must not be deleted:

- Semaphore and shared memory files:  
`<instance_owner>TEXT.0000.LATCH`  
`<instance_owner>TEXT.0000`  
`<instance_owner>CACHE.0000`  
`<instance_owner>SCHEDULER.LATCH`  
`<instance_owner>DEMON.SEM`  
`<instance_owner>DEMON:MEM`
- During create index, if the cache is temporary, you might see files in /tmp similar to the following:  
`<database_name>.IX123456`  
`<database_name>.IX123456.data0`

---

## Chapter 7. Methods for searching text

Net Search Extender provides the following methods for searching text:

### SQL scalar search functions

Text search sub-queries can be embedded in SQL queries. Net Search Extender provides the SQL scalar search functions as extension to the available SQL functions. By including text search sub-queries in SQL queries, it is possible to combine Net Search Extender search functionality with DB2 XQuery processing. Text search queries on XML documents can be used in the `db2-fn:sqlquery()` XQuery input function, and allow for a direct processing of the resulting XML documents with XQuery.

### A stored procedure search function

This enables you to return predefined cached result tables.

### An SQL Table-Valued Function

You can use this search in a similar way to the stored procedure search.

For SQL scalar search functions, this section describes the following areas:

- Searching for text, using the `CONTAINS`, `NUMBEROFMATCHES`, and `SCORE` functions.

Refer to “SQL scalar search function and the SQL table-valued function” on page 155 for a detailed description of the syntax.

- Specifying search arguments by using examples with the `CONTAINS` function.

Refer to “Syntax of search arguments” on page 147 for a complete description of the syntax.

For the stored procedure search function, this section describes the following areas:

- Searching for text using the stored procedure search.
- For specifying search arguments, refer to “Syntax of search arguments” on page 147 for a description of the parameters.

For the SQL Table-Valued Function, this section describes the following areas:

- Searching for text using the SQL Table-Valued Function and the `HIGHLIGHT` function.

Refer to “SQL scalar search function and the SQL table-valued function” on page 155 for a description of the syntax.

- For specifying search arguments, refer to “Syntax of search arguments” on page 147 for a description of the parameters.

There is also information on search performance considerations that you may need to take into account.

Before searching, ensure that all the appropriate indexing steps, described in Chapter 6, “Developing: creating and maintaining a text index,” on page 49, involving the different data types have been performed.

---

## Searching for text using SQL scalar search functions

Using examples, this section describes how to use the SQL scalar search functions in the following ways:

- Using the function CONTAINS to issue a query.
- Using the function NUMBEROFMATCHES to determine how many matches of the search term are found in a text document.
- Using the function SCORE to obtain the relevancy of a found text document.

Refer to “SQL scalar search function and the SQL table-valued function” on page 155 for a description of the syntax.

### Issuing a query

This example demonstrates how the CONTAINS function searches for text in column comment in table texttab. The function returns 1 if the text satisfies the search argument, otherwise it returns 0.

```
SELECT AUTHOR,TITLE
       FROM DB2EXT.TEXTTAB
       WHERE CONTAINS(COMMENT, '"book"') = 1
```

In this example, you search for the term book in the column COMMENT.

Searching for "" is not supported. Using two consecutive quotes in a search term will result in a syntax error message. Also, a query syntax error occurs if a newline character is used within the search string.

#### Note:

If you know that the text search alone will return a very large result set, it is beneficial to add restrictive search criteria, for example:

```
SELECT AUTHOR,TITLE
       FROM db2ext.texttab
       WHERE CONTAINS(COMMENT, '"book"') = 1 AND PRICE < 20
```

### Searching and returning the number of matches found

Use the NUMBEROFMATCHES function to determine how often the search term is found in each text document.

```
SELECT AUTHOR,TITLE,NUMBEROFMATCHES(COMMENT,'"book"')
       FROM DB2EXT.TEXTTAB
       NUMBEROFMATCHES(COMMENT, '"book"') > 0
```

NUMBEROFMATCHES returns an integer value for every row.

### Searching and returning the score of a found text document

SCORE returns a positive number that indicates how well the document meets the search term relative to other found documents in the same index. The value is calculated based on the number of matches that are found in the document in relation to the document's size. In the following example, you can get the score of a found document by using the SCORE function:

```
WITH TEMPTABLE(docid,score)
  AS (SELECT docid,
            SCORE(COMMENT,'"book"')
```



```

FROM DB2EXT.TEXTTAB)
SELECT *
FROM TEMPTABLE
WHERE score > 0
ORDER BY score ASC

```

SCORE returns a DOUBLE value between 0 and 1.

The values returned by SCORE are only meaningful if they are compared to other SCORE values returned for the same index. The values cannot be compared to scores returned for other indexes.

**Note:** You cannot use the CONTAINS, SCORE, and NUMBEROFMATCHES search functions for indexes created on views.

The SCORE values are different depending on the DB2 environment:

- In a non-distributed environment, all the documents are in a single table. The SCORE value is based on a single table, and a document's relationship to all the other documents in the table.
- In a distributed DB2 environment, all the documents are located on different nodes. During indexing, only the documents that are local on every node are used to build the text indexes. In this case, the SCORE value is based on the documents relationship to all documents in only one of the multiple nodes.

---

## Specifying SQL search arguments

The CONTAINS, NUMBEROFMATCHES, and SCORE functions all use search arguments. This section uses the CONTAINS function to show different examples of search arguments in Net Search Extender functions.

Refer to "Search argument syntax" on page 148 for a complete description of the syntax.

### Searching for terms in any sequence

You can have more than one term in a search argument. One way to combine several search terms is to connect them together using commas, like this:

```

SELECT AUTHOR, TITLE
FROM DB2EXT.TEXTTAB
WHERE CONTAINS(COMMENT,
'("kid", "dinosaur")') = 1

```

This form of search argument finds text that contains any of the search terms in any order. In logical terms, an implicit OR operator connects the search terms.

### Searching with the Boolean operators AND and OR

You can combine search terms with other search terms using the Boolean operators "&" (AND) and "|" (OR):

```

SELECT AUTHOR, TITLE
FROM DB2EXT.TEXTTAB
WHERE CONTAINS(COMMENT,
'"author" | "pulitzer"') = 1

```

You can also combine several terms by using Boolean operators:

```
SELECT AUTHOR, TITLE
      FROM DB2EXT.TEXTTAB
      WHERE CONTAINS(COMMENT,
                    "'author" | "pulitzer" & "book"') = 1
```

If you use more than one Boolean operator, these are evaluated from left to right. However, as in regular Boolean logic, the logical AND operator (&) binds stronger than the logical OR operator (|). You can see this evaluation in the following example, which does not include parentheses:

```
"book" & "pulitzer" | "year" & "author"
```

Net Search Extender evaluates the boolean operators in the following way:

```
("book" & "pulitzer") | ("year" & "author")
```

If you want to enforce a different evaluation order of the boolean operators, you must include parentheses:

```
"book" & ("pulitzer" | "year") & "author"
```

You can also combine Boolean operators with search terms that are chained together using the comma separator:

```
("author", "pulitzer") & "book"
```

In this case, the comma is interpreted as a Boolean OR operator:

```
("author" | "pulitzer") & "book"
```

## Searching with the Boolean operator NOT

You can use the Boolean operator NOT to exclude particular text documents from the search:

```
SELECT AUTHOR, TITLE
      FROM DB2EXT.TEXTTAB
      WHERE CONTAINS(COMMENT,
                    '("author", "pulitzer") & NOT "book"') = 1
```

This example excludes any text documents containing the term “book” from the search results for “author” or “pulitzer”.

## Fuzzy search

“Fuzzy” search searches for words that are spelled in a similar way to the search term.

```
SELECT AUTHOR, TITLE
      FROM DB2EXT.TEXTTAB
      WHERE CONTAINS(COMMENT,
                    'fuzzy form of 80 "pullitzer"') =1
```

In this example, the search could find an occurrence of the misspelled word pulitzer.

The match level, in the example “80”, specifies the desired degree of accuracy. Use fuzzy search when misspellings are possible in the document. This is often the case when an Optical Character Recognition device, or phonetic input creates the document. Use values between 1 and 100 to show the degree of fuzziness, where 100 is an exact match and anything below 80 is increasingly “fuzzy”.

**Note:** If the fuzzy search does not provide the appropriate degree of accuracy, search for parts of a term using character masking.

## Searching for parts of a term (character masking)

Masking characters, otherwise known as “wildcard” characters, offer a way to make a search more permissive. They increase the number of text documents that are found by a search.

Net Search Extender uses two masking characters: percent (%) and underscore (\_). Net Search Extender uses these masking characters the same way the DB2 predicate LIKE uses them.

- % represents **any number of arbitrary characters**. Here is an example of % used as a masking character in the middle of a search term:

```
SELECT AUTHOR, TITLE
      FROM DB2EXT.TEXTTAB
      WHERE CONTAINS(COMMENT, '"thr%er"') = 1
```

This search term finds text documents containing the word “thriller”, “throttle”, and “thread-splitter”.

- \_ represents **one character** in a search term. The following example also finds text documents containing the word “thriller”.

```
SELECT AUTHOR, TITLE
      FROM DB2EXT.TEXTTAB
      WHERE CONTAINS(COMMENT, '"th_iller"') = 1
```

You can use more than one wildcard character in a phrase (more than one word in the phrase can contain a wildcard), however the terms resulting from the wildcard expansion can only be single terms, not multi-word terms. For example, the wildcard expression “thr%er” will not match the phrase “the caller”.

Use wildcard characters sparingly as they can increase the size of your result list significantly, thus decreasing performance and returning undesired search results.

## Searching for terms that contain a masking character

If you want to search for a term that contains the “%” character or the “\_” character, you must precede the character with a so-called *escape* character. You must identify the escape character in the query using the ESCAPE keyword.

In the following example, the escape character is a “!”:

```
SELECT AUTHOR, TITLE
      FROM DB2EXT.TEXTTAB
      WHERE CONTAINS(COMMENT,
                    '"100!%" ESCAPE "!"') = 1
```

## Searching for terms in a fixed order

If you search for “primary key”, you will only find the two terms if they are adjacent and occur in the sequence shown:

```
SELECT AUTHOR, TITLE
      FROM DB2EXT.TEXTTAB
      WHERE CONTAINS(COMMENT, '"primary key"') =1
```

## Searching for terms in the same sentence or paragraph

Here is an example of a search argument that finds text documents in which the search term "web" occurs in the same sentence as the term "disk":

```
SELECT AUTHOR,TITLE
FROM DB2EXT.TEXTTAB
WHERE CONTAINS(COMMENT,
  "web" IN SAME SENTENCE AS "disk") = 1
```

You can also search for several words occurring together. In the next example, two phrases are searched for that occur in the same paragraph:

```
SELECT AUTHOR, TITLE
FROM DB2EXT.TEXTTAB
WHERE CONTAINS(COMMENT,
  "linguistic analysis processing" IN SAME PARAGRAPH AS
  "search algorithms") = 1
```

## Searching for terms in sections of structured documents

Here is an example of a search argument that finds text documents where the search term "IBM" occurs in the subsection "H2" of structured documents.

```
SELECT CATEGORY, DATE
FROM DB2EXT.HTMLTAB
WHERE CONTAINS(HTMLFILE,
  'SECTIONS ("H2") "IBM") = 1
```

Note that section names are case-sensitive. Ensure that the section name in the model file and in the query are identical.

## Thesaurus search

Thesaurus search is a powerful search-term expansion function in Net Search Extender. The additional terms you search for are taken from a thesaurus that you build yourself, so you have direct control over the terms. For example, a thesaurus search for "database", might find terms like "repository" and "DB2" if you decide that these terms are related.

Use this type of search for specific areas of interest in which you make frequent searches and produce significantly more effective search results.

The following examples demonstrate the syntax for using thesaurus expansion.

This example takes the term "product" and expands it, adding all related terms of this term found in the thesaurus "nsesamplethes".

```
SELECT CATEGORY, DATE
FROM DB2EXT.HTMLTAB
WHERE CONTAINS(HTMLFILE,
  'THESAURUS "nsesamplethes"
  EXPAND RELATED
  TERM OF "product") = 1
```

The next example takes the search term "product". The search then expands with all the *synonyms* of the search term.

```

SELECT CATEGORY, DATE
      FROM DB2EXT.HTMLTAB
      WHERE CONTAINS(HTMLFILE,
                    'THESAURUS "nseamplethes"
                    EXPAND SYNONYM
                    TERM OF "product"') = 1

```

## Numeric attribute search

You can search on numeric attributes that are stored in a the text index using the following syntax:

```

SELECT AUTHOR, TITLE
      FROM DB2EXT.TEXTTAB
      WHERE CONTAINS(COMMENT,
                    'ATTRIBUTE "PRICE" between 9 and 20') = 1

```

## Free-text search

“Free-text search” is a search in which you express the search term as free-form text. A phrase or a sentence describes in natural language the subject to be searched for. The sequence of words in a free-text query is not relevant. However, at least one of the query terms in the free-text query must occur in the documents to be searched.

Note that there is no support for the masking of characters or words for search strings in a free-text argument.

For example:

```

SELECT AUTHOR, TITLE, SCORE(COMMENT,
                             'IS ABOUT EN_US "something related to dinosaur"')
      FROM DB2EXT.TEXTTAB
      WHERE CONTAINS(COMMENT,
                    'IS ABOUT EN_US "something related to dinosaur"') = 1

```

---

## Additional search syntax examples

To become familiar with additional search syntax examples, run the search script. This contains examples of Net Search Extender search functions that run against the sample table.

Enter the command as follows:

```
db2 -tvf search
```

If the table and indexes have not been created, run one of the following:

- On UNIX platforms: nseample in the <instance\_owner\_home>/sqllib/samples/extenders/db2ext directory.
- On Windows platforms: nseample (.bat) in the <sqllib>/samples/extenders/db2ext directory.

---

## Searching for text using a stored procedure search

Use the stored procedure search interface if you only need a ranked subset of the text search results, and high query performance. Do not use the stored procedure if you require all the search results, or you need to index a large number of documents. The main reason for this is that parts of the user table are copied into memory and so a lot of real memory needs to be available.

You can use the stored procedure to first request results from 0 to 20, then 21 to 40, and so on, in a similar way to cursor navigation. Combining this cursor capability with the use of a cache (calculated during indexing), makes searching extremely fast, especially as no join with the user table is necessary.

If you are going to use the stored procedure, ensure that you consider the following options:

- In a distributed DB2 environment, you must explicitly specify a table space on a single node for the stored procedure and explicitly call the procedure on this node.
- The cache-search-result options have been specified during CREATE INDEX.
- The present and future shared memory requirements, possibly involving incremental updates, have been fully considered.
- The cache of the index has been activated using the db2text activate command.

The following is an example of a stored procedure search:

```
db2 "call db2ext.textSearch('\book\'','DB2EXT','COMMENT',0,2,1,1,?,?)"
```

The first parameter is the search term. The syntax for the search term is the same as in the SQL scalar functions. The next parameters are the index schema and index name. If you have not masked the name, it is translated to uppercase. The following two numeric arguments give you the result slice starting point and the number of results in the slice. The next two integer values specify if score and hit information are requested. The final two values are the function return values.

**Note:** If you request larger result sets, you need a user table space. If there is none available, create a table space. The following example creates a tablespace on a UNIX platform:

```
db2 "create user temporary tablespace tempts managed by system
      using ('/work/tempts.ts')"
```

In a distributed DB2 environment, you must explicitly specify a table space for administration tables on a single node for the stored procedure and explicitly call the procedure on this node.

---

## Searching for text using an SQL Table-Valued Function

Use the SQL Table-Valued Function if you do not need all of the search results, and if you do not have enough memory to use a cached index as used in the stored procedure search.

There are two SQL table-valued functions available, both called db2ext.textsearch. One has additional parameters for use with the db2ext.highlight function.

The SQL Table-Valued Function gives you the same cursor interface as the stored procedure to access only parts of the result. However, you still need to join the results with the user table. You can see this in following example:

```
db2 "select docid , author, score from TABLE(db2ext.textsearch('\book\' ',
      'DB2EXT','COMMENT',3,2,cast(NULL as integer))) as t, db2ext.texttab u
      where u.docid = t.primkey"
```

The following are the values you could return from the SQL Table-Valued Function:

```

--> primKey <single primary key type>
the primary key

--> score          DOUBLE
the score value of the found document

--> NbResults      INTEGER
the total number of found results (same value for all rows)

--> numberOfMatches INTEGER
the number of hits in the document

```

**Note:** Note that only a single primary key column is allowed.

## Using the highlight function

To use the SQL table-valued `db2ext.highlight` function, you must use the `db2ext.textsearch` function with the additional `numberOfHits` and `hitInformation` parameters.

In this example, call the `db2ext.highlight` function to display the whole document without highlighting any hits found by the `db2ext.textsearch` function.

```

select p.docid,
       db2ext.highlight(p.comment, t.hitinformation, 'WINDOW_NUMBER = 0')
       as highlight
from DB2EXT.TEXTTAB p,
     table (db2ext.textsearch('"bestseller" | "peacekeeping" | "soldiers"
                             | "attention"', 'DB2EXT', 'COMMENT', 0, 20,
                             cast(NULL as INTEGER), 10)) t
where p.docid = t.primkey and p.docid = 2

```

The query returns the following result:

DOCID HIGHLIGHT

```

2      A New York Times bestseller about peacekeeping soldiers called
      "Keepers" who devise a shocking scheme to get the worlds
      attention after their tour of duty ends.

```

1 record(s) selected.

In this example, call the `db2ext.highlight` function to display the whole document and highlight all hits found by the `db2ext.textsearch` function.

```

select p.docid,
       db2ext.highlight(p.comment, t.hitinformation, 'WINDOW_NUMBER = 0,
       TAGS = ("<bf>", "</bf>" ) ') as highlight
from DB2EXT.TEXTTAB p,
     table (db2ext.textsearch('"bestseller" | "peacekeeping" | "soldiers"
                             | "attention"', 'DB2EXT', 'COMMENT', 0, 20,
                             cast(NULL as INTEGER), 10)) t
where p.docid = t.primkey and p.docid = 2

```

The search argument returns the following result:

DOCID HIGHLIGHT

```

2      A New York Times <bf>bestseller</bf> about <bf>peacekeeping</bf>
      <bf>soldiers</bf> called "Keepers" who devise a shocking scheme to
      get the worlds <bf>attention</bf> after their tour of duty ends.

```

1 record(s) selected.

In this example, call the `db2ext.highlight` function to display at maximum 10 parts (windows) of the document. Each window size is 24 characters, which is approximately 12 bytes of data on each side of the hit. In addition, hits found by the table function `db2ext.textsearch` are highlighted.

```
select p.docid,  
       db2ext.highlight(p.comment, t.hitinformation, 'WINDOW_NUMBER = 10,  
              WINDOW_SIZE = 24, TAGS = ("<bf>", "</bf>" ) ') as highlight  
from DB2EXT.TEXTTAB p,  
     table (db2ext.textsearch('"bestseller" | "peacekeeping" | "soldiers"  
              | "attention"', 'DB2EXT', 'COMMENT', 0, 20,  
              cast(NULL as INTEGER), 10)) t  
where p.docid = t.primkey and p.docid = 2
```

The search argument returns the following result:

DOCID HIGHLIGHT

```
2      York Times <bf>bestseller</bf> about <bf>peacekeeping</bf> ...  
      <bf>peacekeeping</bf> <bf>soldiers</bf> called "Keepers" ... the  
      worlds <bf>attention</bf> after their
```

1 record(s) selected.

The first hit found is `<bf>bestseller</bf>` and this hit determines the first window. The second hit, `<bf>peacekeeping</bf>` is only 8 bytes away from the first hit and is completely taken into the first window. The third hit, `<bf>soldiers</bf>` is outside the first window and determines a new window. As the second hit `<bf>peacekeeping</bf>` is only 2 bytes away from the left side of the `<bf>soldiers</bf>` hit, it is also taken into the second window and highlighted. The fourth hit `<bf>attention</bf>` is outside the second window and so determines a new window. As no previous or additional hit is contained in the size of this window, only data surrounding the hit is contained in the window.

Additionally, as no `WINDOW_SEPARATOR` is specified, the default window separator, " ... " is taken to separate the three hit windows.

<p><b>Note:</b> To ensure high performance when using the <code>db2ext.highlight</code> function, the user should limit the search results in the <code>db2ext.textsearch</code> table-valued function.</p>
---

---

## Searching on more than one column

In cases where you need to create a text index on more than one column, the easiest way is to use the SQL scalar function and combine the searches on those columns. You can see this in the following example:

```
SELECT AUTHOR, TITLE  
       FROM DB2EXT.TEXTTAB  
       WHERE CONTAINS(COMMENT,  
              "'book'")=1 and CONTAINS(AUTHOR, "'Mike'")=1
```

For a table-valued function it is more difficult, as you might need to use the union of the returned tables for performance reasons. Another possibility with the table-valued function is to use a view and combine your table columns in a view column to create a single text index on this view column. In this way, you avoid two separate text search calls.

Combining your text columns may provide an improvement in performance. However, this strongly depends on your individual search requirements.



---

## Using text search in outer joins

If you use an outer join query that uses the CONTAINS() search function, the query might fail and result in the reason code CTE0129 NULL values are not allowed to be passed as parameters unless the CONTAINS() predicate references the column of a table on the tuple preserving side of the outer join.

For example, T1 is the tuple-preserving side in 'T1 left outer join T2' and T2 is the tuple-preserving side in 'T1 right outer join T2'.

---

## Performance considerations during search

To enhance performance during search, consider the following issues:

- When searching within SQL:
  - If you notice a decrease in performance, Use the explain statement to check the processing plan of the DB2 Optimizer.
  - Parametric search can make searching faster, especially if you use other search predicates to reduce the result size.
  - Use the result limit keyword if you do not require all of the results.
- When searching with the stored procedure:
  - As the specified cache table expression is copied from the database into memory, ensure that your workstation has enough memory available for this data. If there is insufficient memory, paging space is used, which decreases search performance.
- If you use the NUMBEROFMATCHES or the SCORE function without the CONTAINS function, query performance may decrease. Also, to avoid duplicate processing, ensure that the string in the CONTAINS function exactly matches the string used in NUMBEROFMATCHES or SCORE function.

<p><b>Note:</b> For the latest performance tips, go to the DB2 Net Search Extender Web site: <a href="http://www.ibm.com/software/data/db2/extenders/netsearch/index.html">www.ibm.com/software/data/db2/extenders/netsearch/index.html</a></p>
---

---

## User scenarios

Use this chapter to learn about Net Search Extender by using the following walk-through examples:

### The SQL scalar search example

This command line example demonstrates the indexing and search functions available.

### The stored procedure example

This command line example uses the index command from the example above. With the addition of a cache however, the example demonstrates the different indexing and search functions available for stored procedure search.

### The SQL table-valued function example

The SQL table-valued function example is a variant of the stored procedure search example.

<p><b>Note:</b> Before using the examples, ensure that Net Search Extender is installed successfully by using the installation verification procedure.</p>
--

## Simple example with the SQL scalar search function

Use the following steps in the DB2 Net Search Extender example:

1. Creating a database
2. Enabling a database for text search
3. Creating a table
4. Creating a full-text index
5. Loading the sample data
6. Synchronizing the text index
7. Searching with the text index

You can issue the sample commands on the command line of the operating system by using an existing database. For the following examples, the database name is `sample`.

### Creating a database

You can create a database in DB2 by using the following command:

```
db2 create database sample
```

### Enabling a database for text search

You can issue DB2 Net Search Extender commands in the same way as DB2 commands on the command line of the operating system. For example, use the following command to start Net Search Extender Instance Services:

```
db2text START
```

Then prepare the database for use with DB2 Net Search Extender:

```
db2text ENABLE DATABASE FOR TEXT CONNECT TO sample
```

You need to do this step only once for each database.

### Creating a table

```
db2 "CREATE TABLE books (isbn VARCHAR(18) not null PRIMARY KEY,  
author VARCHAR(30), story LONG VARCHAR, year INTEGER)"
```

This DB2 command creates a table called `books`. It contains columns for the author, story, isbn number, and the year the book was published. Note that the table must have a primary key.

### Creating a full-text index

```
db2text "CREATE INDEX db2ext.myTextIndex FOR TEXT ON books (story)  
CONNECT TO sample"
```

This command creates a full-text index for the column `story`. The name of the text index is `db2ext.myTextIndex`

### Loading sample data

```
db2 "INSERT INTO books VALUES ('0-13-086755-1','John', 'A man was  
running down the street.',2001)"  
db2 "INSERT INTO books VALUES ('0-13-086755-2','Mike', 'The cat hunts  
some mice.', 2000)"  
db2 "INSERT INTO books VALUES ('0-13-086755-3','Peter', 'Some men  
were standing beside the table.',1999)"
```

These commands load the isbn, author, story, and publishing year for three books into the table.

### Synchronizing the text index

To update the text index with data from the sample table, use the following command:

```
db2text "UPDATE INDEX db2ext.myTextIndex FOR TEXT CONNECT TO sample"
```

### Searching with the text index

To search the text index, use the following CONTAINS scalar search function:

```
db2 "SELECT author, story FROM books WHERE CONTAINS  
(story, '\"cat\"') = 1 AND YEAR >= 2000"
```

**Note:** Depending on the operating system shell you are using, you might need a different escape character in front of the double quotes surrounding the text search phrase. The above example, uses "\" as an escape character.

This query searches for all books containing the term cat where the year value of the book is greater or equal to 2000. The query returns the following result table:

```
AUTHOR Mike  
STORY The cat hunts some mice.
```

Other functions supported include SCORE and NUMBEROFMATCHES. SCORE returns an indicator on how well the search argument describes a found document. NUMBEROFMATCHES returns how many matches of the query terms are found in a resulting document.

## Simple example with cache usage and stored procedure search

Use the following steps in the DB2 Net Search Extender stored procedure search example:

1. Creating a text index with cache option.
2. Synchronizing the index and activating the cache.
3. Searching with the TEXTSEARCH Stored Procedure.

**Note:** The stored procedure example assumes that the steps from the previous example are complete and that the database is still enabled.

### Creating a text index with cache option

As the database is already enabled, use the following command to create a full-text index:

```
db2text "CREATE INDEX db2ext.mySTPTextIndex FOR TEXT ON books (story)  
        CACHE TABLE (author, story) MAXIMUM CACHE SIZE 1  
        CONNECT TO sample"
```

In this example, the full-text index is for the column story and it specifies a cache table containing the columns author and story. The name of the text index is mySTPTextIndex.

### Synchronizing the index and activating the cache

To update the index with the data inserted into the table, use the following command:

```
db2text "UPDATE INDEX db2ext.mySTPTextIndex FOR TEXT CONNECT TO sample"
```

To activate the cache, use the following command:

```
db2text "ACTIVATE CACHE FOR INDEX db2ext.mySTPTextIndex FOR TEXT  
        CONNECT TO sample"
```

This loads the content of the columns author and story into the cache.

### Searching with the TEXTSEARCH Stored Procedure

You can only use the DB2 Net Search Extender stored procedure in certain cases.

```
db2 "call db2ext.textSearch
      ('\cat\'', 'DB2EXT', 'MYSTPTEXTINDEX', 0, 2, 0, 0, '?', '?")"
```

This query searches for all books about a cat, but only returns the first two results. The result table for a book might be as follows:

```
Value of output parameters
-----
Parameter Name : SEARCHTERMCOUNTS
Parameter Value : 1
Parameter Name : TOTALNUMBEROFRESULTS
Parameter Value : 1

AUTHOR    STORY
Mike      The cat hunts some mice.

Return Status = 0
```

For more samples about the search syntax, check the following file in the DB2 instance directory: `sqllib/samples/extenders/db2ext/search`

## Simple example with the SQL table-valued function

You can use the SQL table-valued function on the text indexes created in the previous examples.

The SQL table-valued function query corresponds to the previously used CONTAINS query. See "Synchronizing the text index" under the topic "Simple example with the SQL scalar search function" on page 74 for information.

```
db2 "SELECT author, story FROM books b, table (db2ext.textsearch
      ('\cat\'', 'DB2EXT', 'MYTEXTINDEX', 0, 2, CAST
      (NULL AS VARCHAR(18)))) T where T.primKey = b.isbn"
```

In the above example, NULL is cast to the data type of the primary key.

---

## Using a thesaurus to expand search terms

You can broaden a query by searching not only for a specific search term, but also for terms that are related to it. You can automate this process by using Net Search Extender's functions for looking up and extracting the related search terms from a thesaurus. A thesaurus is a controlled vocabulary of semantically related terms that usually covers a specific subject area.

Net Search Extender lets you expand a search term by adding additional terms from a thesaurus that you have previously created. Refer to "Syntax of search arguments" on page 147 to find out how to use thesaurus expansion in a query.

To create a thesaurus for using it in a search application requires a thesaurus definition file that has to be compiled into an internal format, the thesaurus dictionary.

This section describes:

- "The structure of a thesaurus" on page 77

A thesaurus is structured like a network of nodes linked together by relations. This section describes Net Search Extender's predefined relations and how to define your own relations.

- **“Creating and compiling a thesaurus” on page 78**

This is a description of the syntax of a thesaurus definition file, and of the tools that you use to compile it into a thesaurus dictionary.

## The structure of a thesaurus

A thesaurus is structured like a network of nodes linked together by relations. Net Search Extender looks up a term in a thesaurus by starting at the term, then following a path through the term relations and delivering the terms found in the process.

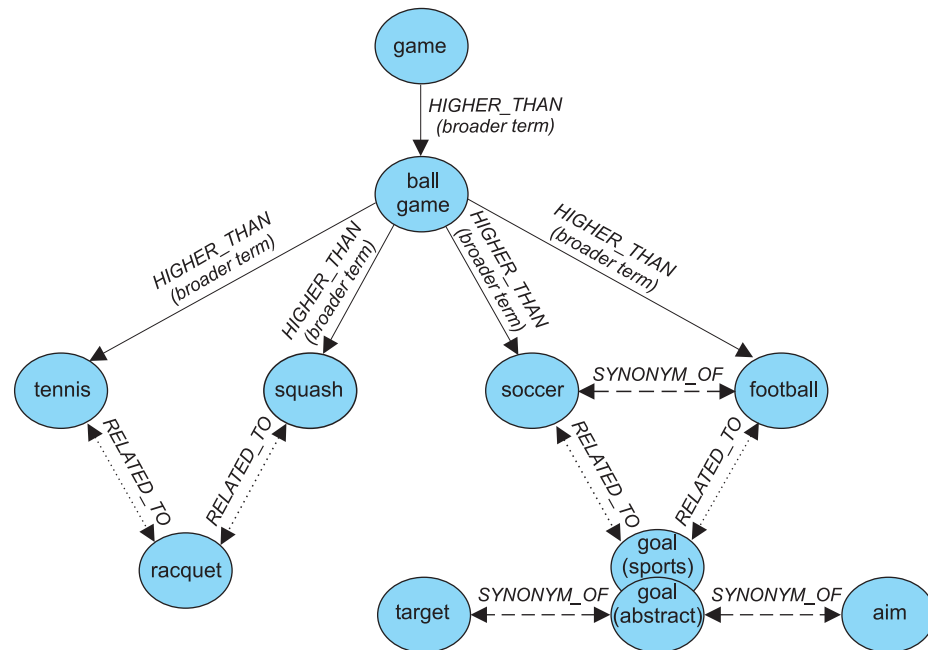


Figure 28. An example of the structure of a thesaurus

Thesaurus entries are connected by relations. Relation names, such as BROADER, let you restrict an expansion to certain named lines in the relation hierarchy. Some relations are bidirectional, others are unidirectional; BROADER, for example, is the name of a unidirectional relation.

### Predefined thesaurus relations

These are the relations that are predefined in the Net Search Extender:

- **Associative relations**

An associative relation is a bidirectional relation between two terms that do not express the same concept but relate to each other.

Predefined associative relation: RELATED\_TO

Examples:

```
tennis RELATED_TO racket
football RELATED_TO goal (sports)
```

- **Synonym relations**

A synonym relation is a bidirectional relation between two terms that have the same or similar meaning and can be used as alternatives for each other. This relation can, for example, be used between a term and its abbreviation.

Predefined synonym relation: SYNONYM\_OF

Examples:

```
spot SYNONYM_OF stain
US SYNONYM_OF United States
```

The figure in Figure 28 on page 77 shows two goal terms in the same thesaurus. One is specified with the comment (sports), the other with the comment (abstract). Even if terms have the same spelling, synonym relations can connect different word groups. You can model this by using different relations when defining the thesaurus.

- **Hierarchical relations**

A hierarchical relation is a unidirectional relation between two terms, one of which has a broader (more global) meaning than the other. Depending on its direction, the relation can be used to look up either more specialized or more global terms.

Predefined hierarchical relations:

- LOWER\_THAN to model narrowing relations

LOWER\_THAN relations are for modelling a sequence of more specialized terms. The deeper you follow a narrowing relation, the more specific the terms become. For example, if you look up the term ball game along a LOWER\_THAN relation, the result could be squash tennis and so on, in a list of increasingly specialized terms.

- HIGHER\_THAN to model broadening relations

HIGHER\_THAN relations are for modelling a sequence of more and more global terms. The deeper you follow such a relation, the less specific the terms become. For example, if you look up the term ball game along a HIGHER\_THAN relation, the result could be game and so on, in a list of increasingly global terms.

## Defining your own relations

Net Search Extender lets you define your own RELATED\_TO, LOWER\_THAN, and HIGHER\_THAN thesaurus relations. Because each relation name must be unique, you must qualify such relations names by the addition of a unique number, like this: RELATED\_TO(42).

You can use the same relation number to define a relationship of a different type, such as LOWER\_THAN(42). The number 0 is used to refer to Net Search Extender's predefined relations.

## Creating and compiling a thesaurus

Use the following steps to create a thesaurus that can be used by the Net Search Extender functions:

1. Create a thesaurus definition file.
2. Compile the definition file into a thesaurus dictionary.

### Creating a thesaurus definition file

To create your own thesaurus, your first step is to define its content in a definition file using a text editor.

**Restrictions.** The length of the file name, including the extension, must not exceed 256 characters. You can have several thesauri in the same directory, but it is recommended that you have a separate directory for each thesaurus.

A sample English thesaurus definition file `nresamplethes.def` is provided. The thesaurus directory for Windows systems is:

```
<sql1lib>\db2ext\thes
```

On UNIX systems, the thesaurus directory is:

```
<instance_owner_home>/sql1lib/db2ext/thes
```

Here are the first few definition groups from that file:

```
:WORDS
  accounting
  .RELATED_TO account checking
  .RELATED_TO sale management
  .SYNONYM_OF account
  .SYNONYM_OF accountant

:WORDS
  acoustics
  .RELATED_TO signal processing

:WORDS
  aeronautical equipment
  .SYNONYM_OF turbocharger
  .SYNONYM_OF undercarriage

:WORDS
  advertising
  .RELATED_TO sale promotion
  .SYNONYM_OF advertisement
:
:
:
```

Figure 29. An extract from the sample thesaurus definition file

For the syntax of each definition group, see “Thesaurus support” on page 80.

Each member must be written to a single line. Each associated term must be preceded by the relation name. If the member terms are related to each other, specify a member relation.

The length of the member terms and associated terms is restricted to 64 characters. Single-byte characters and double-byte characters of the same letter are regarded as the same. Uppercase and lowercase letters are not distinct. A term can contain a blank character and either a single-byte character period “.” or colon “:” can be used.

The user-defined relations are all based on the *associative* type. They are identified by unique numbers between 1 and 128.

## Compiling a definition file into a thesaurus dictionary

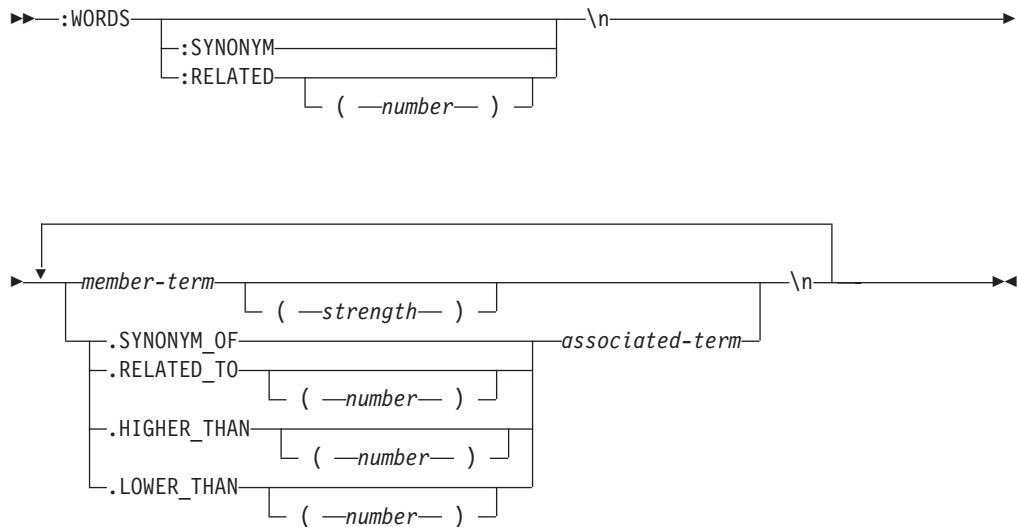
To compile a thesaurus definition file, run the `db2extth` command.

To use a thesaurus dictionary within a partitioned environment, ensure that all the physical nodes can access the created files.

## Thesaurus support

Here is the syntax of each definition group when you create your own thesaurus:

### Syntax of a thesaurus definition



Note that \n is not part of the syntax, but represents the end of a line in the thesaurus definition file.

You can insert comment lines in a thesaurus definition file like this:

```
# my comment text
```

#### **:WORDS**

A keyword that begins a group of related words.

#### **:SYNONYM, :RELATED [(number)],**

A relation name.

Relation names consist of a relation type and a number. If the number is omitted, zero is assumed, which is the system-provided relation name.

:SYNONYM is always the system-provided relation name.

Relation names that begin with a colon, such as :SYNONYM, precede a list of words that are related to each other by the same relation. For example:

```
:WORDS
:SYNONYM
  air steward
  cabin staff member
  flight attendant
```

#### *member-term*

A term to be included in the thesaurus dictionary.

- Maximum length is 64 bytes (42 bytes for code page UTF-8).
- Single-byte characters and double-byte characters of the same letter are regarded as the same.
- Uppercase and lowercase characters are not distinguished.
- A term can contain a blank character.



- The single-byte character period "." or colon ":" cannot be used.

This parameter can be useful if you do not want a thesaurus lookup to include words that have a weak relation to the looked up term. Strength is a numerical value from 1 to 100. The default value is 100.

**.SYNONYM\_OF, .RELATED\_TO [(number)], .HIGHER\_THAN [(number)],  
.LOWER\_THAN [(number)]**

A relation name. The relation name `.HIGHER_THAN` corresponds to the `BROADER` query relation and `.LOWER_THAN` to the `NARROWER` query relation. Relation names consist of a relation type and a number. If the number is omitted, zero is assumed, which is the system-provided relation name. The relation name `.SYNONYM` is always the system-provided relation name.

Relation names that begin with a period, such as `.SYNONYM_OF`, define the relation between one word and another. For example:

```
:WORDS
  air steward
  .SYNONYM_OF cabin staff member
  .SYNONYM_OF flight attendant
```

The optional *number* identifies a user-defined relation. This must be a unique number from the whole thesaurus definition file (currently 1 to 128). For example: `RELATED_TO(42)`.

If you want to use symbolic names for thesaurus relations in your application instead of the relation name and number, your application must handle the name-to-number mapping. For example, if you define the relation `opposite_of` as `RELATED_TO(1)`, your application must map this name to the internal relation name `RELATED_TO(1)`.

#### *associated-term*

Each associated term must be preceded by the relation name. The associated term is related to each member term with respect to the specified relation. If all member terms are related to each other, this can be specified using a member relation.

- Maximum length is 64 bytes (42 bytes for code page UTF-8).
- Single-byte characters and double-byte characters of the same letter are regarded as the same.
- Uppercase and lowercase characters are not distinguished.
- A term can contain a blank character.
- The single-byte character period "." or colon ":" cannot be used.

Here is an example of an associated term:

```
:WORDS:SYNONYM
  reject
  decline
  RELATED_TO(1) accept
```

## Thesaurus supported CCSIDs

The following CCSIDs are supported by the thesaurus:

<b>819</b>	Latin 1
<b>850</b>	PC Data Latin 1
<b>874</b>	Thai
<b>932</b>	Combined Japanese

943	Combined Japanese
949	Combined Korean
950	Combined Traditional Chinese
954	Japanese
970	Combined Korean
1208	UTF 8
1250	Latin 2
1252	Latin 1
1253	Czech
1254	Turkish
1255	Hebrew
1256	Arabic
1258	Vietnamese
1363	Combined Korean
1381	Combined Simplified Chinese
1383	Chinese (simplified), combined SBCS/DBCS
1386	Chinese (simplified), combined SBCS/DBCS
5039	Japanese (combined SBCS/DBCS)

## Messages returned by the thesaurus tool

### ADM\_MSG\_INVALID\_CCSID

Invalid CCSID specified.

The requested code page is not supported.

### ITL\_THES\_MSG\_BUFFER\_OVERFLOW

Buffer overflow.

### ITL\_THES\_MSG\_DICT\_EXIST

Thesaurus dictionary *dictionary name* already exists.

Cannot be overwritten.

### ITL\_THES\_MSG\_DICT\_INTEGRITY\_ERROR

Integrity of dictionary *dictionary name* is lost.

The thesaurus dictionary file is corrupted.

### ITL\_THES\_MSG\_DICT\_NOT\_EXIST

Thesaurus dictionary *dictionary name* does not exist.

### ITL\_THES\_MSG\_DICT\_VERSION\_ERROR

Dictionary *dictionary name* version error.

The thesaurus dictionary was created with an incompatible earlier version.

### ITL\_THES\_MSG\_ERROR\_IN\_FILE

Error in file *file name*.

**ITL\_THES\_MSG\_FILE\_ACCESS\_ERROR**  
Could not access file *file name*.

**ITL\_THES\_MSG\_FILE\_CLOSE\_ERROR**  
Could not close file *file name*.

**ITL\_THES\_MSG\_FILE\_EOF\_ERROR**  
Unexpected end of file in *file name*.  
Error in definition file.

**ITL\_THES\_MSG\_FILE\_OPEN\_ERROR**  
Could not open file *file name*.

**ITL\_THES\_MSG\_FILE\_REACHED\_END**  
Unexpected end of file in *thesaurus definition file*.  
There is an error in the definition file.

**ITL\_THES\_MSG\_FILE\_READ\_ERROR**  
Could not read file *file name*.

**ITL\_THES\_MSG\_FILE\_REMOVE\_ERROR**  
Could not remove file *file name*.

**ITL\_THES\_MSG\_FILE\_RENAME\_ERROR**  
Could not rename file *file name 1* to *file name 2*.

**ITL\_THES\_MSG\_FILE\_WRITE\_ERROR**  
Could not write file *file name*.

**ITL\_THES\_MSG\_IE\_BLOCK\_START**  
No block starting line was found in file *file name* at line *line number*.

**ITL\_THES\_MSG\_IE\_EMPTY**  
The thesaurus definition file *file name* is empty.

**ITL\_THES\_MSG\_IE\_NO\_TERM**  
No terms are defined in *file name* at line *line number*.

**ITL\_THES\_MSG\_IE\_REL\_SYNTAX**  
Relationship is specified incorrectly in *file name* at line *line number*.

**ITL\_THES\_MSG\_IE\_STRENGTH\_DOMAIN**  
Strength is out of range.  
Valid values are 1 - 100; the default is 100.

**ITL\_THES\_MSG\_IE\_STRENGTH\_SYNTAX**  
A strength value is specified incorrectly.  
Syntax: After the term, type [ :20 ] for a strength of 20.

**ITL\_THES\_MSG\_IE\_TERM\_LEN**  
A thesaurus term is longer than 64 characters.

**ITL\_THES\_MSG\_IE\_USER\_DEF**

Relationship is specified incorrectly in *file name* at line *line number*.

**ITL\_THES\_MSG\_IE\_USER\_DEF\_DOMAIN**

A relationship number is out of range in *file name* at line *line number*.

**ITL\_THES\_MSG\_INPUT\_ERROR**

Error in the thesaurus definition file *file name* at line *line number*.

**ITL\_THES\_MSG\_INTERNAL\_ERROR**

Internal error.

**ITL\_THES\_MSG\_LOCKED**

Thesaurus dictionary *dictionary name* is in use.

**ITL\_THES\_MSG\_LOCKING\_ERROR**

Could not lock dictionary *file name*.

**ITL\_THES\_MSG\_MEMORY\_ERROR**

Memory error.

**ITL\_THES\_MSG\_NAMELEN\_ERROR**

Parameter error *file name*. The thesaurus definition file name is too long.

**ITL\_THES\_MSG\_NO\_TARGET\_DIR\_ERROR**

Parameter error. No target directory specified.

**ITL\_THES\_MSG\_NONAME\_ERROR**

Parameter error. No thesaurus definition file name specified.

**ITL\_THES\_MSG\_NORMALIZE\_ERROR**

Error in normalizing a term.

Error in the thesaurus definition file.

**ITL\_THES\_MSG\_OUTFILE\_EXIST**

Output file *file name* already exists.

**ITL\_THES\_MSG\_PARAMETER\_ERROR**

Internal parameter error.

**ITL\_THES\_MSG\_PATHLEN\_ERROR**

Parameter error *file name*. The thesaurus definition file path is too long. The path length must not exceed the maximum length supported for directory names in the operating system.

**ITL\_THES\_MSG\_UNEXPECTED\_ERROR**

Internal unexpected error.

---

## Text Search Engine

Net Search Extender provides the following Text Search Engine information:

- Tokenization
- Stop words
- Configuration

## Tokenization

During indexing, Net Search Extender processes document text in the following way, breaking the text up into tokens.

### Words

All alphanumeric characters ("a".."z,"A".."Z", "0".."9") are used to create the full-text index. Separation characters are blank characters and the characters described in the sentence recognition section below. Control characters, such as line feed (also known as a new line character) and blank characters, are interpreted as follows: Control characters (less than 0x20) in the middle of the line are regarded as blank characters. Blank characters and control characters before and after a line feed (0x0A) are ignored. Line feed before and after a 1-byte character are regarded as blank characters and 2-byte characters for the same character are always regarded as the same characters. Capital letters and small letters for the same character, for example, "A" and "a", are regarded as the same characters if nothing is specified during search, or as different characters if exact matching is required during search.

### Sentences

Net Search Extender recognizes ".", "!", "?" followed by blank characters, and the Japanese and Chinese full-stop at the end of a line as the end of a sentence.

### Paragraphs

Paragraph recognition is dependent on the document format. In Plain Text format, any two consecutive new line characters (possibly with an intervening carriage return) are recognized as a paragraph boundary. In HTML, the paragraph tag <p> is interpreted as paragraph boundary. The other document formats do not support paragraph recognition.

## Stop words

Stop words are words with a high frequency and no relevant content for the text retrieval process. Usually, all function words (in a linguistic sense) are considered stop words, for example "and", "or", and "in". Searching an index for stop words can reduce the precision of a text retrieval system significantly.

Net Search Extender provides stop word processing for a list of languages. The configuration parameter `IndexStopWords` can be set at index creation time and determines if stop words are indexed or not. The default is 1 meaning that stop words are indexed.

If you do not want to index stop words, you must set `IndexStopWords` to 0, and specify the language of your input documents using the language parameter during create index. If stop words are not indexed, the index is smaller and faster. Do not alter this value in the configuration `.ini` file template after you have created the index, as this leads to documents being treated differently depending on the time that they were indexed and consequently results in incoherent stop word handling.

Ignoring stop words during indexing is effective only if all of the documents in your collection are in the same language.

## Languages supporting stop words

The following languages provide stopword processing.

### AR\_AA

Arabic as spoken in Arabic countries

### CA\_ES

Catalan as spoken in Spain

### DA\_DK

Danish as spoken in Denmark

### DE\_CH

German as spoken in Switzerland

### DE\_DE

German as spoken in Germany

### EL\_GR

Greek as spoken in Greece

### EN\_GB

English as spoken in the U.K.

### EN\_US

English as spoken in the U.S

### ES\_ES

Spanish as spoken in Spain

### FI\_FI

Finnish as spoken in Finland

### FR\_CA

French as spoken in Canada

### FR\_FR

French as spoken in France

### HE\_IL

Hebrew as spoken in Israel

### IS\_IS

Icelandic as spoken in Iceland

### IT\_IT

Italian as spoken in Italy

### IW\_IL

Hebrew as spoken in Israel

### NB\_NO

Norwegian Bokmal as spoken in Norway

### NL\_BE

Dutch as spoken in Belgium

### NN\_NO

Norwegian Nynorsk as spoken in Norway

### PT\_BR

Portuguese as spoken in Brazil

### PT\_PT

Portugese as spoken in Portugal

### RU\_RU

Russian as spoken in Russia

### SV\_SE

Swedish as spoken in Sweden

## Configuration

Net Search Extender is able to search for words which may have characters used in different combinations, for example, alphanumeric, numbers, and special characters. To do this, Net Search Extender provides the following configurations:

### Character normalization

Character normalization ensures that words that can be written in two ways can be both searched for. For example, the German word 'Überbau' can also be written as 'Ueberbau'. Normalization ensures that both words can be searched for, by using either 'Überbau' or 'Ueberbau'. The functionality also normalizes accented letters, for example, 'accès' to the matching simple character, for example, 'access'.

### Using specific characters as part of a word

Using specific characters as part of a word ensures that product names which can involve a series of alphanumeric characters, special characters and numbers can be searched on as a single word. For example, by treating the alphanumeric combination 'DT9' as one word, or by enabling the '/' special character, so that AS/400® or OS/390® are searched on as whole words rather than as 'AS' and '400', or 'OS' and '390'.

For these configuration settings, switches are available. To customize the switches, change the .ini file template before creating an index.

The .ini file template is stored in `sql1lib/db2ext/cteixcfg.ini`. As you can also make changes to most of the values in this template file using the CREATE INDEX command, it is recommended that you only change the following values:

AccentRemoval (for character normalization)  
UmlautNormalization (for character normalization)  
TreatNumberAsWords (for treating numeric characters as part of the word)  
AdditionalAlphanumCharacters (for using specific characters as part of a word)

### AccentRemoval

This parameter specifies if accented characters are normalized to the matching simple character. For example, événement is also indexed as evenement. The default is true.

### UmlautNormalization

This parameter specifies if an umlaut character is also indexed as two characters with the same meaning. For example, 'Übersee' is also indexed as 'Uebersee'. The default is true.

### TreatNumbersAsWords

This parameter specifies if numeric characters next to a word are part of the word. For example, 'DT9' is treated as one word and not as one word 'DT' and the number '9'.

### AdditionalAlphanumCharacters

The string value of this parameter defines which characters are treated as part of a word. The string of special characters must be a sequence of one or more characters in UTF-8. The default string contains the characters `" / - @ "`.

You are not allowed to use the wildcard characters `%` and `_` in the list of characters that are treated as being part of a word. This results in problems during query execution.

If you want to change any of these configuration values, edit the `.ini` file before you create your index. To activate inactive switches, remove the `;"` from the beginning of the line. For further information, see the `ctexcfg.ini` file.

You are recommended not to alter any of the other values in the `.ini` file.



---

## Chapter 8. Working with structured documents

Net Search Extender allows you to index and search text or numeric fields, such as title, author, or price in a structured document. The documents can be in XML, Outside In, HTML format, or contain user-defined tags (GPP).

Use markup tags and their field names in a *document model* to define which fields in the documents are indexed and, therefore, are available for searching. You can use the name of the field (also known as the section name) in queries against that field.

To be able to search in these fields, you must specify a `FORMAT` and a `MODEL` file when you create the text index containing the documents.

---

### Searching natively stored XML documents

The following sections address search on natively stored XML documents. You are shown how the concepts of section search can be applied to natively stored XML documents and how to integrate this functionality into XQuery processing.

Generally, when creating an index on an XML data column, you are not required to specify a `FORMAT`. Net Search Extender selects format XML by default when a text index is created on a column of type XML. The format specifiers `TEXT` and `HTML` are not allowed on XML data columns.

In the subsequent samples that illustrate the creation and use of a text index on XML columns, the following XML document is used. It is stored in table `t1`, column `c2` of type XML.

```
<?xml version="1.0">
<purchaseOrder orderDate="2001-01-20">
  <shipAddress countryCode="US">
    <name>Alice Smith</name>
    <street>123 Maple Street</street>
    <city>Mill Hill</city>
    <zip>90999</zip>
  </shipAddress>
  <item partNo="123" quantity="1">
    <name>S&B Lawnmower Type ABC-x</name>
    <price>239.90</price>
    <shipDate>2001-01-25</shipdate>
  </item>
  <item partNo="987" quantity="1">
    <name>Multifunction Rake ZYX</name>
    <price>69.90</price>
    <shipDate>2001-01-24</shipdate>
  </item>
</purchaseOrder>
```

### Using the default document model

If no document model is specified in the `CREATE INDEX` statement, Net Search Extender uses the default document model.

One characteristic of the default document model is that section names are in XPath notation specifying the absolute path to each element and attribute. Note

that section names in the search query are not XPath expressions that are evaluated during query execution. Instead they are names referring to specific parts (elements and attributes) within structured documents.

If you are not using a model file, define a text index for XML documents as follows:

```
db2text CREATE INDEX i1 FOR TEXT ON t1(c2) CONNECT TO mydbname
```

As column c2 is of datatype XML, you can omit the FORMAT specification. The FORMAT specification is set to XML by default in this case.

When no document model is specified, each XML element is assigned a name automatically depending on its absolute XPath within the document. For example, element price can be accessed by the section name /purchaseOrder/item/price in the search query. The attribute countryCode can be accessed by using the section name /purchaseOrder/shipAddress/@countryCode.

After the index is updated by using the db2text update command, a possible SQL expression using SECTION search with the scalar search function might be as follows:

```
SELECT c2 FROM t1
WHERE CONTAINS(c2, SECTIONS("/purchaseOrder/item/name") "Rake") = 1
```

The query returns the sample XML document shown above.

## Using a customized document model

If you want to define customized section names, you must specify a model file that assigns user defined names to certain parts of a document. An advantage of using a document model is that you can specify which parts of an XML document you want to index and use XPath expressions to specify these parts.

A model file for the above XML document might look as follows:

```
<?xml version="1.0"?>
<XMLModel>
  <XMLFieldDefinition
    name="itemName"
    locator="/purchaseOrder/item/name" />
  <XMLFieldDefinition
    name="customerName"
    locator="//shipAddress/name" />
  <XMLAttributeDefinition
    name="partNumber"
    type="NUMBER"
    locator="/purchaseOrder//item/partNo" />
  <XMLFieldDefinition
    name="none"
    locator="/purchaseOrder/orderDate"
    exclude="yes" />
</XMLModel>
```

Note that the document model assigns the name itemName to the element /purchaseOrder/item/name which is referenced in the previous search query above.

The index definition, using the model file, is:

```
CREATE INDEX i1 FOR TEXT ON t1(c2) DOCUMENTMODEL XMLModel IN
  /mydir/myfilename/xmlmodel.xml CONNECT TO mydbname
```

The document model name (using the parameter DOCUMENTMODEL) specifies the root element in the model file. This is XMLModel for XML document models. The path /mydir/ ... points to the file that defines the model.

The document model syntax supports a subset of the W3C XPath syntax which allows for the convenient identification of elements.

After creating the text index using the model file above, and updating the index using the db2text update command, it is possible to search for the element /purchaseOrder/item/name as follows:

```
SELECT c2 FROM t1
WHERE CONTAINS(c2, SECTIONS("itemName") "Rake") = 1
```

Note the difference to the search query where no document model was specified. Both queries return the same sample XML document mentioned above.

The XML document model also defines an attribute partNumber on the XML attribute partNo of element item. The data type of Net Search Extender attribute definitions must always be NUMBER.

The attribute definition in the sample model file above allows searching on value ranges like:

```
SELECT c2 FROM t1 WHERE CONTAINS
(c2, ATTRIBUTE "partNumber" BETWEEN 300 AND 500) = 1
```

## XQuery support

While searching for XML documents in the database, it is also possible to process the search results by using XQuery. By exploiting DB2's hybrid database engine, an SQL text search query can be combined with XQuery processing.

This is done by using the db2-fn:sqlquery() input function in the XQuery context. In order to use the XQuery input function, you must switch from SQL to XQuery by using the set language XQuery command, or the query has to be prefixed with the keyword XQuery. This is an important indicator to the parser that it is working with an XQuery expression and must follow the case sensitivity rules and syntax rules that apply to the XQuery language.

The db2-fn:sqlquery() function takes a string literal that represents a full-select. The db2-fn:sqlquery() function returns an XML sequence that represents the concatenation of the XML column values that are selected by the full-select.

The following expression can be used to combine text search and XQuery processing on natively stored XML documents:

```
XQUERY db2-fn:sqlquery('SELECT c2 FROM t1
WHERE CONTAINS(c2,
''SECTIONS ("/purchaseOrder/item/name") "Rake" '')
= 1 ')//shipAddress/name
```

The above query returns all the name elements under the shipAddress element in XML documents that contain a purchasing order item named "Rake". You must explicitly select the XML column (in our case c2) in the SELECT statement.

The above sample can be extended by a FLWOR construct as follows, and embedded in your application:

```
XQUERY FOR $item in db2-fn:sqlquery('SELECT c2 FROM t1
    WHERE CONTAINS(c2, '' SECTIONS ("/purchaseOrder/item/name") "Rake" '')
    = 1 ')
    WHERE $item[@partNo > "800"]
RETURN $item/price
```

Note that the full-select of the `db2-fn:sqlquery()` input function always returns the complete XML document in which a hit occurs.

Consider the following XML document that is stored natively in the database:

```
<?xml version="1.0" ?>
<dept bldg="101">
  <employee id="901">
    <name>Sabine</name>
    <resume>DB2 programmer</resume>
  </employee>
  <employee id="902">
    <name>Holger</name>
    <resume>XML expert</resume>
  </employee>
</dept>
```

Searching for an employee in your department where the term “XML” is contained in the resume might look as follows:

```
SELECT c2 FROM t1 WHERE CONTAINS(c2, SECTIONS("/dept/employee/resume") "XML")=1
```

The above select returns the complete XML document. Embedding the search query in XQuery as follows:

```
XQUERY db2-fn:sqlquery('SELECT c2 FROM t1
    WHERE CONTAINS(c2,
    ''SECTIONS ("/dept/employee/resume") "XML" '' =1') //employee/name
```

returns the following two results:

```
<name>Sabine</name>
<name>Holger</name>
```

Notice that although the employee Sabine does not have the term “XML” in her resume, she appears in the resulting sequence in the above XQuery. This happens because the full-select returns the whole document, that is, it returns the complete XML document that has at least one employee with the term “XML” in the resume.

If you want the query to return only the result `<name>Holger</name>`, issue the following XQuery statement:

```
XQUERY for $d in db2-fn:sqlquery('SELECT c2 FROM t1
    WHERE CONTAINS(c2,
    ''SECTIONS ("/dept/employee/resume") "XML" '' =1')
    return $d/dept/employee/name[contains(parent::employee/resume,"XML")];
```

Net Search Extender filters out all XML documents that have the term XML in the section `/dept/employee/resume` by using a structure sensitive full-text index on the XML column. Base on the returned subset of XML documents, the return statement `return $d/dept/employee/name[contains(parent::employee/resume,"XML")]` returns only those `<name>` elements that have XML in their sibling element called `<resume>` by navigating the XML document using the XPath axis.

---

## Structured document support

### How a document model describes structured documents

Documents in HTML or XML format are examples of structured documents; they contain tags that identify text fields and document attributes. Text fields can contain information like the title, author, or a description of the document.

The following is an extract from a structured plain-text document. It contains text that is delimited by HTML-like tags.

```
[head]Handling structured documents
[/head]
```

```
[abstract]This document describes the concept of structured documents
and the use of document models to...
[/abstract]
:
:
```

When Net Search Extender indexes structured documents, it has to recognize the structure so that it can index the text field and the attributes, and store them together with a unique name. This enables Net Search Extender to selectively search in a particular text field or to find documents that have a particular attribute by using the SECTION or ATTRIBUTE clause.

To enable Net Search Extender to understand the structure of a particular document format, you must pass Net Search Extender a definition of the structure in a *document model*. Alternatively, you can use the default document models provided by Net Search Extender.

You specify the name of the document model as an argument when you call the CREATE INDEX command to index the documents. For example, CREATE INDEX i1 FOR TEXT ON t1(c2) DOCUMENT MODEL GPPModel IN mymodel.xml CONNECT TO db

The parameter GPPModel refers to the type of document model you are using.

Before you can index documents using a document model, you must first define a document model and then make the document model known to the index.

**Note:** If XML documents use indexes that are not well-formed, the indexing process will stop at the point where the problem is encountered in the document. This means that only a part of the document will be indexed. If you do not correct the document, you will only be able to search in the parts of the document that were indexed. This will occur only if your table column type is not XML.

### An example of a document model

You must define one document model for each document format that you intend to index. Here is a simple document model for plain-text structured documents. Note that GPP in the example stands for General Purpose Parser.

```
<?xml version="1.0"?>
<GPPModel>                                - the GPP document model begin here

  <GPPFieldDefinition                       - a field definition begins here
    name="Head"                             - the name you assign to this field
    start="[head]"                         - the boundary string at the beginning of the field
    end="[/head]"                          - the boundary string at the end of the field
    exclude="YES" />
```

```

    <GPPFieldDefinition      - the next field definition begins here
    name="Abstract"
    start="[abstract]"
    end="[/abstract]"
    exclude="NO" />
:
:
</GPPModel>

```

Document models are specified in the XML language using tags as defined in “Document model reference” on page 105. A document model consists of text field definitions and attribute definitions. The example above illustrates only text field definitions defined in GPPFieldDefinition elements. In a similar way, you can use GPPAttributeDefinition to define document attributes.

The first line `<?xml version="1.0"?>` in the example specifies that the document model is written using XML tags. Each of the text field definitions specifies boundary strings to identify the start and end of the field definition in the source document. So, whenever a document contains the sequence of characters `[head]` followed by some text and the sequence of characters `[/head]`, the text between those boundary strings is taken to be the content of the text field that is identified by the name `head`.

You assign a field name to each field definition. This field name is the means by which a query can restrict search to the content of a text field using a SECTION clause in the CONTAINS function. The name of the field can be either fixed or can be derived by a rule from the structural unit’s content. Such a name could be, for example, the tag name of an XML entity, or the name of an XML attribute.

## Document models

A document model primarily controls what parts of a document’s structure need to be indexed and how they are indexed. Its purpose is to:

- Identify text fields that should be distinguished in the source document
- Determine the type of such a text field
- Assign a field name to the text field

When the document model identifies text as belonging to a text field, the text is considered to be part of the textual content of the document, and terms are extracted and stored in the index.

The elements of a document model vary depending on the parser used for that document format:

- For HTML format, a document model uses the HTML tag names to define which tags should be indexed, and how to handle meta-tag information.
- For XML format, there is no predefined set of tags, so a document model must first define which tags are of interest. XML elements of the same name can also be distinguished based on what other elements they are embedded in.
- For GPP (general purpose parser) format, the document model interacts even more deeply with the parser, because it has to determine the boundaries of the text fields. Here the field definition must specify strings for detecting the boundaries of fields.
- For Outside In formats, a document model uses tags similar to HTML tag names to define which tags should be indexed, and how to handle meta-tag information. Note that the Outside In Transformation Technology is also known as INSO.

## Text fields

A document model lets you identify document parts or sections as either belonging to a particular text field or as being a document attribute, or both.

The text of a document is fully indexed regardless of whether or not it is part of a text field. Meaningful terms are extracted and stored in the index. This means that unrestricted text searches include a search of that text.

However, by defining text fields, you can search for text selectively in a particular field. For example, you can search for documents that contain the word `structure` in the text field `Abstract`. For example, `SELECT doc from my_docs WHERE CONTAINS (doc, SECTIONS(Abstract) "structure" = 1.`

A text field can occur several times in a document. For instance, you can define a text field that contains all figure captions. A text field may also overlap with another text field.

If you want to avoid indexing the content of certain text fields, you can specify a field definition that contains `exclude="YES"`. You can find a list of limitations for text fields and document attributes in “Limitations for text fields and document attributes” on page 108.

## Document attributes

Document attributes contain short, formatted information of type number. In contrast to text fields, you can use value ranges to search documents containing such attributes.

Attributes are not stored with indexed text, but in a separate item index. So, to search for documents by content of an attribute, you must make an attribute search explicitly on the attribute. For example, `SELECT doc FROM my_docs WHERE CONTAINS (doc,ATTRIBUTE "year" BETWEEN 2001 AND 2005) = 1.`

### Number attributes:

Net Search Extender provides a parser that recognizes floating-point numbers. The following are examples of correct and incorrect formats for attribute values.

*Table 6. Supported formats for attribute values*

Correct format	Incorrect format
1000 1 000 1.000 - where the period is a decimal character	1,000
100 000 100 000.00123	1 000 000 - two spaces between 1 and 0

Note that space characters are not allowed in the decimal fraction of a number. For example, `1 000.000 100` is treated as two numbers, `1000.000` and `100`.

Language-specific separators and language-specific monetary formats are not supported.



## Default document models

For HTML, XML, and Outside In filtered documents, Net Search Extender provides default document models that are used if you do not specify a document model during index creation. For structured plain text documents, you must provide and specify a document model.

If you use one of the default document models:

- All fields are indexed, and no special information, such as meta information, is extracted.
  - For HTML and INSO formats, each field is assigned the name of the corresponding tag.
  - For XML, all XML nodes of an XML document are mapped to overlapping fields which are identified by the fully qualified element paths of the corresponding nodes. For example, the path `/play/role/name`.
- No numeric attribute is indexed (as no numeric attribute is defined in the default document model).

Table 7. Behavior of the default document models for the supported document formats

Document type	Behavior of the default document model
HTML	Accepts these as text fields: <code>&lt;a&gt;</code> <code>&lt;address&gt;</code> <code>&lt;au&gt;</code> <code>&lt;author&gt;</code> <code>&lt;h1&gt;</code> <code>&lt;h2&gt;</code> <code>&lt;h3&gt;</code> <code>&lt;h4&gt;</code> <code>&lt;h5&gt;</code> <code>&lt;h6&gt;</code> <code>&lt;title&gt;</code> . Field name is the tag name, for example "address".
XML	Accepts all tags as text fields. The field name is the fully qualified element path name, for example <code>/play/title</code> .
Structured plain text (GPP)	No default document model.
Outside In (INSO)	Accepts as text fields, the document properties shown in "Defining a document model for Outside In filtered documents" on page 104 as returned by the Outside In filters. The Field name is the name of the document property used by Outside In, for example: "SCCCA_TITLE".

For each type of document, a default document model is defined. As each model is different, an example and explanation is provided for each one in the following sections.

### Note:

Although the default document models do correctly process documents, for better indexing and search you should define your own document models.

With the default document model, the text of a document is fully indexed regardless of whether or not it is part of a text field. This means that unrestricted text searches include a search of that text.

## Defining a document model for structured plain-text documents

Here is an example of a general-purpose (GPP) structured plain-text document:

```
[head]Handling structured documents
[/head]
[year]2002
```



```
[/year]
[abstract]This document describes the concept of structured documents
and the use of document models to...
[/abstract]
```

Here is an example of a GPP document model:

```
<?xml version="1.0"?>
<GPPModel>

  <GPPFieldDefinition
    name="Head"
    start="[head]"
    end="[/head]"
    exclude="YES" />

  <GPPFieldDefinition
    name="Abstract"
    start="[abstract]"
    end="[/abstract]"
    exclude="NO" />
    - This is the start of text field
    - This is the end of a text field

  <GPPAttributeDefinition
    name="year"
    start="[year]"
    end="[/year]"
    type="NUMBER" />
    - This is the start of a document
      attribute
    - This is the end of a document
      attribute

</GPPModel>
```

The first line, `<?xml version="1.0"?>` specifies that the document model is written using XML tags. Note that this model is not written for XML format documents.

Each field is defined within a `GPPFieldDefinition` or `GPPAttributeDefinition` tag, which contain element parameters.

All the definitions must be contained within the `<GPPModel>` tag. The tag name is passed as a parameter during index creation: `CREATE INDEX i1 FOR TEXT on ti(c2) DOCUMENTMODEL GPPModel IN mymodel.xml CONNECT TO db.`

## Element parameters

These are the parameters of the document model elements:

**name** You assign a name to the text field or document attribute for each definition. The names enable you to restrict a search query to the content of a specific text field or document attribute. Using the above examples, you could search for documents containing the word structure in the text field named Abstract.

**start** A boundary string in codepage UTF-8 that marks the beginning of the text field or document attribute. There are no rules for specifying boundary strings; they can be any arbitrary UTF-8 string. Here are some examples: `start="introduction:"`, `start="note!"`, `start="$$...."`.

Nonprintable characters and the special XML characters "<" and "&" must be specified using the default XML character entries ("`&lt;`" for "<", and "`&amp;`" for "&").

**end** Optional. A boundary string in codepage UTF-8 that marks the end of the text field or document attribute. If you do not specify an end tag, the next

found start tag is assumed to be the end of the field. If no subsequent start tag is found, the field extends to the end of the document, and no further fields are identified.

**type** The type of document attribute must always be "NUMBER". The parameter does not apply to field definitions.

**exclude**

YES or NO. A parameter that determines whether the text in a field definition should be excluded and therefore, not indexed. This parameter does not apply to attribute definitions.

In the example, the field definition "head" would be excluded, but definition "abstract" included.

**Restrictions:**

- There must not be two field definitions or attribute definitions with the same start tag. However, a field definition and attribute definition may have the same start tag and end tags.
- A start tag must not be a proper prefix of another. For example, you cannot have a start tag "author" and a start tag "authority".
- Start tags and end tags must not be empty strings.

**What happens when a GPP document is indexed**

The general-purpose parser scans the document looking for one of the start boundary strings. When it finds a start boundary string, it parses the subsequent field until it finds the corresponding end boundary string.

The content of the field is then indexed according to the definition term, that is, as a text field or document attribute. If the text field and document attribute have the same start and end boundary strings, the content of the field is indexed as both a text field and a document attribute.

No nesting of fields is allowed; if a new start boundary string is found in a field before the end boundary string has been reached, the new start boundary string is interpreted as normal text.

If no corresponding end boundary string is found, the field is assumed to extend to the end of the document, and an appropriate reason code is reported.

If no end boundary string is specified in the document model, the new start boundary string signals the end of the previous field.

## Defining a document model for HTML documents

The HTML parser converts the text to codepage UTF-8. It performs HTML tag recognition and classifies them into tag classes:

- Tagged information to be ignored, such as font information
- Tags that provide positional information, such as <p>; for new paragraph
- Tags that provide structural information, such as <Title>

It recognizes all character entity references defined in HTML 4, like "&auml;" (ä) and resolves them to the corresponding code points in UTF-8.

It recognizes meta tags and parses the meta tag text.

Here is an example of an HTML document:

```
<HTML>
<HEAD>
<META NAME="year" CONTENT="2002">
<TITLE> The Firm </TITLE>
</HEAD>
<BODY>
<H1>Synopsis</H1>;

<H1>Prologue</H1>;:
:
</BODY>
```

Here is an example of an HTML document model:

```
<?xml version="1.0"?>
<HTMLModel>

  <HTMLFieldDefinition
    name="subtitle"
    tag="title"
    exclude="NO" />

  <HTMLFieldDefinition
    name="header1"
    tag="h1"
    exclude="YES" />
    - This is the start of text field
    - This is the end of the text field

  <HTMLAttributeDefinition
    name="year"
    tag="meta"
    meta-qualifier="year"
    type="NUMBER" />
    - This is the start of the document
      attribute
    - This is the end of the document
      attribute

</HTMLModel>
```

The first line, `<?xml version="1.0"?>`, specifies that the document model is written using XML tags. Note that this model is not written for XML format documents.

Each field is defined within a `HTMLFieldDefinition` or `HTMLAttributeDefinition` tag, which contain element parameters.

All the text field definitions must be contained within the `<HTMLModel>` tag. The tag name is passed as a parameter during index creation: `CREATE INDEX iA FOR TEXT ON T1(C2) DOCUMENTMODEL HTMLModel IN myModel.xml CONNECT TO db.`

## Element parameters

These are the parameters of the document model elements:

**name** You assign a name to the text field or document attribute for each definition. The names enable you to restrict a search query to the content of a specific text field or document attribute. Using the above examples, you could search for documents containing the word `firm` in the text field named `subtitle`.

**tag** Identifies an element whose start and (implied) end tags mark the text field or document attribute. The text that is inside an element of that name makes up the content of the defined field.

The case of the tag is ignored.

Using the above examples, the text following any H1 tag is indexed as being part of the field "header1". Based on the sample document, "synopsis" and "prologue" would be indexed.

### meta-qualifier

This tag has to be used with the **tag** element. By specifying tag="meta", the value of the content that matches the meta-qualifier is extracted.

In the HTML document example, the meta tag has the following elements:

```
<META NAME="year" CONTENT="2002">
```

In the document model example, meta-qualifier="year". Therefore, the content "2002" is indexed as the value of the attribute "year".

**type** The type of document attribute must be "NUMBER". The parameter does not apply to field definitions.

### exclude

YES or NO. A parameter that determines whether the text in a field definition should be excluded and therefore, not indexed. This parameter does not apply to attribute definitions.

In the example, the field definition "header1" would be excluded, but definition "subtitle" included.

All other text of a document is indexed, but not as part of any field.

## Defining a document model for XML documents

A document model for XML documents allows you to define how an element found in an XML document is mapped to a field, a document attribute, or both.

Here is an example of an XML document:

```
<?xml version="1.0"?>
<purchaseOrder orderDate="2001-01-20"> [4]
  <shipAddress countryCode="US"> [1]
    <name>Alice Smith</name> [2]
    <street>123 Maple Street</street>
    <city>Mill Hill</city>
    <state>CA</state>
    <zip>90999</zip>
  </shipAddress>
  <item partNo="123" quantity="1"> [3]
    <name>S&B Lawnmower Type ABC-x</name>
    <price>239.90</price>
    <shipDate>2001-01-25</shipDate>
  </item>
  <item partNo="987" quantity="1"> [3]
    <name>Multifunction Rake ZYX</name>
    <price>69.90</price>
    <shipDate>2001-01-24</shipDate>
  </item>
</purchaseOrder>
```

Here is an example of an XML document model that matches the sample document from above:

```
<?xml version="1.0"?>
<XMLModel>

  <XMLFieldDefinition [1]
    name="addresses"
```

```

locator="/purchaseOrder/shipAddress" />

<XMLFieldDefinition                [2]
name="customerName"
locator="//shipAddress/name"
exclude="yes" />

<XMLAttributeDefinition            [3]
name="partNumber"
type="NUMBER"
locator="/purchaseOrder//item/@partNo" />

<XMLFieldDefinition                [4]
name="none"
locator="/purchaseOrder/@orderDate" />

</XMLModel>

```

The first line, `<?xml version="1.0"?>`, specifies that the model is written using XML. Each field is defined within a `XMLFieldDefinition` or `XMLAttributeDefinition` tag, which contains element parameters.

Note that all the text field definitions must be contained within the `<XMLModel>` tag. This tag name is passed as a parameter during index creation: `CREATE INDEX i1 FOR TEXT ON T1(C2) DOCUMENTMODEL XMLModel in myModel.xml CONNECT TO db.`

The fields and attributes in the sample are marked with numbers that correspond to the definitions in the example model file.

Nesting of fields is allowed, for example, if the XPath location of one specification selects a node that lies inside an XML element selected by another attribute definition. Nested fields is shown in the sample XML document above. The field `addresses` selects a node in the XML document that dominates the node selected by field `customerName`. The content of that embedded node therefore, logically belongs to both fields. Although text fields may be overlapping, the text inside those fields is indexed only once. In this example, when searching with a field restriction, Alice Smith is found in `addresses` as well as in `customerName`. However, due to the matching semantics of the locator expression, it is not possible to map one and the same XML node to multiple fields.

Net Search Extender does not attempt to detect the code page of an XML document. The DB2 code page is taken.

The content of fields is determined by the following rules:

- For a field whose locator matches a comment, a processing instruction, or an XML attribute, the field content is the actual comment text, processing instruction text, or attribute value text.
- For a field that matches an XML element or the root node, the field content consists of any text from any embedded element except for elements that are matched by fields having the specification `exclude="YES"`.

The document must contain well-formed XML, but it is not necessary for a DTD to be specified in the XML document. No DTD validation or external entity resolution is carried out; Net Search Extender only matches the XML document against the document model. Internal entities are substituted as required by XML.

## Element parameters

These are the parameters of the document model elements:

**name** You assign a name to the text field or document attribute for each definition. These names enable you to restrict a search query to the content of a specific text field or document attribute.

You can use one of the following variables in a name. The variable is replaced by a string generated from the matching element in the source document.

### Variable

#### Value

#### \$(NAME)

The actual qualified name (QName) of the XML element that matched the XPath.

#### \$(LOCALNAME)

The actual local name (without prefix) of the XML element that matched the XPath.

#### \$(PATH)

The actual absolute path as a sequence of slashes and tags of the XML element that matched the XPath (used as name in the default document model).

**type** The type of document attribute must be "NUMBER". The parameter does not apply to field definitions.

### locator

Expressions in the XPath language that select the parts of the source documents to be used as search fields.

When writing a XML Document Model file, the qualified names, known as QNames, inside a locator must be identical to some tags in the XML document, otherwise no fields will be recognized and the queries on fields will not return a result.

The following are examples of locators.

#### **purchaseOrder | salesOrder**

All purchaseOrder elements and salesOrder elements

#### **shipAddress**

All shipAddress elements

**\*** All elements (this is the abbreviation of `child::*` – see the syntax for further information)

#### **name/item**

All item elements that have a name parent

#### **purchaseOrder//item**

All item elements that have a purchaseOrder ancestor

**/** The root node

#### **comment()**

All comment nodes

#### **processing-instruction()**

All processing instructions

**attribute::\* (or @\*)**

All attribute nodes

A literal is a string enclosed either in single or double quotes. For an exact definition of terminal tokens see the XML recommendations.

The XPath locators that are supported by the Net Search Extender document model are similar to XML Stylesheet Language Transformation (XSLT) patterns. They comprise exactly the subset of XSLT patterns that do not contain any predicates nor the functions 'id' and 'key' nor the node tests 'text()' and 'node()'.

**ignore** YES or NO. Use the parameter to make exceptions to the locator.

Sometimes you may want to specify a general locator, such as \*, to match the nodes you want to index. But you may also specify that some nodes matching a more specific locator should not be indexed.

To formulate this, include a field definition with the more specific locator for the nodes to be ignored during indexing. You then give this locator a higher priority than the one with the general locator (see below), and specify ignore="yes". This indicates to the indexer that it must not generate field information for the matching nodes.

Note that when such an ignored node is embedded in a field-generating node, the content of the ignored node gets indexed, because it also belongs to the contents of the field-generating node.

**priority**

A floating point number between -1 and +1 that specifies the priority to be given to a definition found by a particular locator.

If you do not specify a priority, the default priorities are used:

- Multiple alternatives separated by | are treated as a set of definitions, one for each alternative.
- Locators that match by a single name; that is, locators of either of the following forms have default priority 0:
  - ChildOrAttributeAxisSpecifier QName
  - ChildOrAttributeAxisSpecifier processing-instruction(Literal))
- Locators of the form ChildOrAttributeAxisSpecifier NCName:\* have default priority -0.25.
- Other locators of the form ChildOrAttributeAxisSpecifier NodeTest have default priority -0.5.
- Any other locator has default priority 0.5.

Note that the more specific the locator is, the higher the default priority. For example, the unspecific locator \* gives a low priority to the found definition, whereas a name is a more specific locator and gives a higher priority.

Also note that when a node is matched by more than one locator, you can determine which of the definitions are chosen by assigning priorities to them. The definition with the highest priority is chosen. If two definitions have the same priority, the latest is chosen.

This conflict resolution is the same as that used in XML Stylesheet Language Transformation (XSLT).

### **exclude**

YES or NO. A parameter that determines whether the text in a field definition should be excluded and therefore, not indexed. This parameter does not apply to attribute definitions.

In the example, the field definition "customerName" would be excluded, but definition "addresses" included.

## **Defining a document model for Outside In filtered documents**

Document models for the Outside In format are very similar to HTML document models in that they allow you to map structural elements identified by a given set of tags to Net Search Extender text fields and document attributes. Assume you have a set of Microsoft Word documents and want to index the document properties "title", "subject", and "keyword" as fields, and the document properties "author" and "category" as document attributes. The following example for an Outside In document model will achieve this mapping:

```
<?xml version="1.0"?>
<INSOModel>

<INSOFieldDefinition
name="title"
tag="SCCCA_TITLE"/>

<INSOFieldDefinition
name="title"
tag="SCCCA_SUBJECT"/>

<INSOFieldDefinition
name="title"
tag="SCCCA_KEYWORDS"/>

<INSOAttributeDefinition
name="author"
tag="SCCCA_AUTHOR"
type="STRING"/>

<INSOAttributeDefinition
name="category"
tag="SCCCA_CATEGORY"
type="STRING"/>

</INSOModel>
```

## **Element parameters**

These are the parameters of the document model elements:

- name** A name that you assign to the text field or document attribute. You assign a field name to each field definition, and an attribute name to each attribute definition. These names are the means by which a query can restrict search to the content of a certain text field and can search for documents having a certain attribute.
- tag** Identifies a tag whose begin and end or implied-end elements mark the text field or the document attribute. The text that is inside an element of that name makes up the content of the defined field or attribute. The case of the tag is disregarded. Possible values are described below.
- type** The type of document attribute can be either "NUMBER", "DATE", or "STRING". This parameter does not apply to field definitions.



## exclude

YES or NO. A parameter that determines whether the text in a field definition should be excluded and therefore, not indexed. This parameter does not apply to attribute definitions.

Outside In document models consist of field and/or attribute definitions that each define a name and a tag. For attribute definitions a type is also required, whereas field definitions have an optional "exclude" flag. As with HTML models, the name attribute of such a definition defines the name of the Net Search Extender field or attribute that the document part is to be mapped on. This can be an arbitrary UTF-8 text string. For additional information, see the Outside In Content Access Specification, Version 7.5.

For a list of possible values for the tag attribute relating to the Outside In begin, end and document property tags.

## What happens when an Outside In document is indexed

By default, all the text is indexed as not belonging to any field. Whenever a begin tag that appears in the stream of text matches a definition item in the document model that is currently active, the text between the begin tag and its corresponding end tag is treated according to that definition term. For example, as an indexed field, an excluded field, or as an attribute or both.

If no matching definition exists, the begin tag and its corresponding end tag are ignored.

As Outside In filters automatically recognize the format and code page of the document, the CCSID specification has no effect. If the Outside In filters are unable to determine the correct format and code page, the document is treated as an ASCII file.

---

## Document model reference

Net Search Extender provides the following reference information for document models:

- The DTD for document models
- The semantics of locator (XPath) expressions
- Limitation for text fields and document attributes
- Outside In tag attribute values

## DTD for document models

Here is a formal description of the syntax of document models in the form of a document type definition (DTD):

```
<!ELEMENT GPPModel (GPPFieldDefinition|GPPAttributeDefinition)+>
<!ELEMENT HTMLModel (HTMLFieldDefinition|HTMLAttributeDefinition)+>
<!ELEMENT XMLModel (XMLFieldDefinition|XMLAttributeDefinition)+>

<!ELEMENT GPPFieldDefinition EMPTY>
<!ATTLIST GPPFieldDefinition name CDATA #REQUIRED>
<!ATTLIST GPPFieldDefinition start CDATA #REQUIRED>
<!ATTLIST GPPFieldDefinition end CDATA #IMPLIED>
<!ATTLIST GPPFieldDefinition exclude (YES|NO) NO>

<!ELEMENT GPPAttributeDefinition EMPTY>
<!ATTLIST GPPAttributeDefinition name CDATA #REQUIRED>
```

```

<!ATTLIST GPPAttributeDefinition start CDATA #REQUIRED>
<!ATTLIST GPPAttributeDefinition end CDATA #REQUIRED>
<!ATTLIST GPPAttributeDefinition type NUMBER #REQUIRED>

<!ELEMENT HTMLFieldDefinition EMPTY>
<!ATTLIST HTMLFieldDefinition name CDATA #REQUIRED>
<!ATTLIST HTMLFieldDefinition tag CDATA #REQUIRED>
<!ATTLIST HTMLFieldDefinition meta-qualifier CDATA #IMPLIED>
<!ATTLIST HTMLFieldDefinition exclude (YES|NO) NO>

<!ELEMENT HTMLAttributeDefinition EMPTY>
<!ATTLIST HTMLAttributeDefinition name CDATA #REQUIRED>
<!ATTLIST HTMLAttributeDefinition tag CDATA #REQUIRED>
<!ATTLIST HTMLAttributeDefinition meta-qualifier CDATA #IMPLIED>
<!ATTLIST HTMLAttributeDefinition type NUMBER #REQUIRED>

<!ELEMENT XMLFieldDefinition EMPTY>
<!ATTLIST XMLFieldDefinition name CDATA #REQUIRED>
<!ATTLIST XMLFieldDefinition locator CDATA #REQUIRED>
<!ATTLIST XMLFieldDefinition ignore (YES|NO) NO>
<!ATTLIST XMLFieldDefinition priority CDATA #IMPLIED>
<!ATTLIST XMLFieldDefinition exclude (YES|NO) NO>

<!ELEMENT XMLAttributeDefinition EMPTY>
<!ATTLIST XMLAttributeDefinition name CDATA #REQUIRED>
<!ATTLIST XMLAttributeDefinition locator CDATA #REQUIRED>
<!ATTLIST XMLAttributeDefinition ignore (YES|NO) NO>
<!ATTLIST XMLAttributeDefinition priority CDATA #IMPLIED>
<!ATTLIST XMLAttributeDefinition type NUMBER #REQUIRED>

```

## Semantics of locator (XPath) expressions

According to the XML data model, XML documents are viewed as trees containing these kinds of nodes:

- The root node
- Element nodes
- Text nodes
- Attribute nodes
- Namespace nodes
- Processing instruction nodes
- Comment nodes

The links between those nodes, in other words the tree-forming relationship, reflect the immediate containment relationship in the XML document.

The **root node** can appear only at the root and nowhere else in the tree. It contains, as its children, the document element and optional comments and processing instructions.

**Element nodes** can contain any kinds of nodes except for the root node. The other kinds of nodes are only allowed as leaf nodes of the tree.

There are three kinds of **containment links**: 'child', 'attribute', and 'namespace'. The 'attribute' and 'namespace' containment links must lead to attribute and namespace nodes, respectively. In other words, to access the children of an element node (in terms of graph theory) you need to follow 'attribute' links to find all contained attributes, follow 'namespace' links to find all contained namespace declarations, and follow 'child' links to find contained elements, text nodes, processing instructions, and comments.

An XPath expression needs to be interpreted with respect to a context node, and denotes a set of nodes. When used as Net Search Extender selector patterns, the context node is free, that is, a relative path pattern *p* is interpreted as *//p*.

These are the Net Search Extender XPath selector patterns:

- Pattern '| ' LocationPathPattern in context N denotes the union of the nodes matched by Pattern and LocationPathPattern, both in context N.
- '/'RelativePathPattern in context N denotes whatever this RelativePathPattern denotes in the context of the root.
- '//'RelativePathPattern in context N denotes the union of the denotations of this RelativePathPattern interpreted in any context that is a descendant (on the child axis) of the root.
- RelativePathPattern '/' StepPattern matches a node in context N, if and only if that node is matched by StepPattern in the context of its parent, and its parent node is matched by RelativePathPattern in context N.
- RelativePathPattern '//' StepPattern matches a node in context N, if and only if that node is matched by StepPattern in the context of its parent, and it has an ancestor node that is matched by RelativePathPattern in context N.
- 'child'::NodeTest (abbreviated syntax: NodeTest) in context N matches a node that is a child of N (on the child axis) and that satisfies NodeTest.
- 'attribute'::NodeTest (abbreviated syntax: @NodeTest) in context N matches a node that is an attribute of N and that satisfies NodeTest.
- NodeType '(' ' ' )' is satisfied for a node if and only if it is of the specified type.
- 'processing-instruction' '(' ' Literal ' )' is satisfied for any processing-instruction-type node that has Literal as its name.
- '\*' is satisfied for any element or attribute node (name mask for element name).
- NCName ':' ' '\*' is satisfied for any element node that has NCName as its name prefix.
- QName is satisfied for any node with the specified name.

## Note

A NodeTest of the form NameTest assumes the node to be of the principal type on the selected axis, which is attribute type on the attribute axis and child type on the child axis. Consequently, NameTest cannot be used to choose comments or processing instruction nodes, but only child and attribute nodes. Moreover, the patterns allow for the selection of any kind of node, except for namespace nodes, because the axis specifier 'namespace' is not allowed.

Examples of patterns:

- chapter | appendix denotes all chapter elements and appendix elements
- table denotes all table elements
- \* denotes all elements (note that this is the abbreviation of child::\*)
- ulist/item denotes all item elements that have a ulist parent
- appendix//subsection denotes all subsection elements with an appendix ancestor
- / denotes the singleton set containing just the root node
- comment() denotes all comment nodes
- processing-instruction() denotes all processing instructions
- attribute::\* (or @\*) denotes all attribute nodes

This is the syntax of the locator element:

```
Locator ::= LocationPathPattern
         | Locator '|' LocationPathPattern
LocationPathPattern ::= '/' RelativePathPattern ?
                   | '//'? RelativePathPattern
RelativePathPattern ::= StepPattern
                   | RelativePathPattern '/' StepPattern
                   | RelativePathPattern '//'? StepPattern
StepPattern ::= ChildOrAttributeAxisSpecifier NodeTest
ChildOrAttributeAxisSpecifier ::=
    ('child' | 'attribute') '::'
    | '@'?
NodeTest ::= NameTest
         | NodeType '(' ')'
         | 'processing-instruction' '(' Literal ')'
NameTest ::= '*' | NCName ':' '*' | QName
NodeType ::= 'comment' | 'processing-instruction'
```

NCName and QName are as defined in the XML Names Recommendation:

#### NCName

An XML name containing no colons

#### QName

A NCName that can be preceded by a NCName followed by a colon. For example: NCName:NCName

## Limitations for text fields and document attributes

The following lists the limitations for text fields and document attributes:

- Maximum number of fields in an index: 32767
- Maximum number of values for one attribute of type STRING in one document: 1024
- Maximum number of attributes of type STRING: 253
- Number of characters in a STRING attribute value is truncated to 128
- Maximum number of attributes of types DATE and NUMBER: 32766
- Number of characters in a DATE or NUMBER attribute value is truncated to 128
- For NUMBER attributes, a double precision floating point number is accepted as a value.
- Maximum number of values that can be specified for one attribute of type DATE or NUMBER in one document: unlimited

These are the tags that can be included in an HTML document model:

- <A>
- <ADDRESS>
- <AU>
- <AUTHOR>
- <H1>
- <H2>, <H3>, <H4>, <H5>
- <H6>
- <TITLE>

Tags like <HEAD> and <BODY> that can contain other tags, cannot be specified in an HTML document model as a text field.

## Outside In tag attribute values

Possible values for the tag attribute relating to Outside In document property tag types:

SCCCA\_ABSTRACT  
SCCCA\_ACCOUNT  
SCCCA\_ADDRESS  
SCCCA\_ATTACHMENTS  
SCCCA\_AUTHORIZATION  
SCCCA\_BACKUPDATE  
SCCCA\_BASEFILELOCATION  
SCCCA\_BILLTO  
SCCCA\_BLINDCOPY  
SCCCA\_CARBCOPY  
SCCCA\_CATEGORY  
SCCCA\_CHECKEDBY  
SCCCA\_CLIENT  
SCCCA\_COMPANY  
SCCCA\_COMPLETEDDATE  
SCCCA\_COUNTCHARS  
SCCCA\_COUNTPAGES  
SCCCA\_COUNTWORDS  
SCCCA\_CREATIONDATE  
SCCCA\_DEPARTMENT  
SCCCA\_DESTINATION  
SCCCA\_DISPOSITION  
SCCCA\_DIVISION  
SCCCA\_DOCCOMMENT  
SCCCA\_DOCTYPE  
SCCCA\_EDITMINUTES  
SCCCA\_EDITOR  
SCCCA\_FORWARDTO  
SCCCA\_GROUP  
SCCCA\_KEYWORD  
SCCCA\_LANGUAGE  
SCCCA\_LASTPRINTDATE  
SCCCA\_LASTSAVEDBY  
SCCCA\_MAILSTOP  
SCCCA\_MANAGERSCCCA\_MATTER  
SCCCA\_OFFICE  
SCCCA\_OPERATOR  
SCCCA\_OWNER  
SCCCA\_PRIMARYAUTHOR  
SCCCA\_PROJECT  
SCCCA\_PUBLISHER  
SCCCA\_PURPOSE  
SCCCA\_RECEIVEDFROM  
SCCCA\_RECORDEDBY  
SCCCA\_RECORDEDDATE  
SCCCA\_REFERENCE  
SCCCA\_REVISIONDATE  
SCCCA\_REVISIONNOTES  
SCCCA\_REVISIONNUMBER  
SCCCA\_SECONDARYAUTHOR  
SCCCA\_SECTION  
SCCCA\_SECURITY  
SCCCA\_SOURCE  
SCCCA\_STATUS  
SCCCA\_SUBJECT  
SCCCA\_TITLE  
SCCCA\_TYPIST  
SCCCA\_USERDEFINEDPROP  
SCCCA\_VERSIONDATE  
SCCCA\_VERSIONNOTES  
SCCCA\_VERSIONNUMBER

Possible values for the tag attribute relating to Outside In begin and end tag subtypes:

SCCCA\_ALTFONTDATA  
SCCCA\_ANNOTATIONREFERENCE  
SCCCA\_CAPTIONTEXT  
SCCCA\_CHARACTER  
SCCCA\_COMPILEDFIELD  
SCCCA\_COUNTERFORMAT  
SCCCA\_CUSTOMDATAFORMAT  
SCCCA\_DATEDEFINITION  
SCCCA\_DOCUMENTPROPERTYNAME  
SCCCA\_ENDNOTEREFERENCE  
SCCCA\_FONTANDGLYPHDATA  
SCCCA\_FOOTNOTEREFERENCE  
SCCCA\_FRAME  
SCCCA\_GENERATEDFIELD  
SCCCA\_GENERATOR  
SCCCA\_HYPERLINK  
SCCCA\_INDEX  
SCCCA\_INDEXENTRY  
SCCCA\_INLINEDATAFORMAT  
SCCCA\_LISTENTRY  
SCCCA\_MERGEENTRY  
SCCCA\_NAMEDCELLRANGE  
SCCCA\_REFERENCEDTEXT  
SCCCA\_STYLE  
SCCCA\_SUBDOCTEXT  
SCCCA\_TOA  
SCCCA\_TOAENTRY  
SCCCA\_TOC  
SCCCA\_TOCENTRY  
SCCCA\_TOF  
SCCCA\_VECTORSAVETAG  
SCCCA\_XREF

Note that the tables include any document property, as well as all the tag subtypes recognized by the INSO filters. There are two subtype exceptions: SCCCA\_DOCUMENTPROPERTY and SCCCA\_BOOKMARK.

## Chapter 9. Reference

### Administration commands for the instance owner

This section describes the syntax of administration commands for the instance owner. Instance owner administration consists of checking the status of Net Search Extender locking and update services, and starting and stopping these services.

The commands are subcommands of the DB2TEXT command and allow for the administration of Net Search Extender Services that are specific to a DB2 instance.

Command	Purpose
"CONTROL command"	Lists and deletes full-text index locks. Also lists the cache states.
"START command" on page 112	Starts the Net Search Extender instance services.
"STOP command" on page 113	Stops the Net Search Extender instance services.

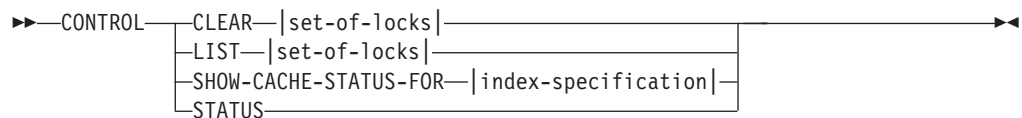
### CONTROL command

#### Purpose

This command lets you list and delete full-text index locks managed by the Net Search Extender Instance Services. If the locking and update services are running, you can view their status as well as information on the activated cache.

In a distributed DB2 environment this only affects the current partition. The user is responsible for invoking the DB2 command db2\_all for the desired partitions.

#### Command syntax



#### set-of-locks:



#### index-specification:



#### Database-specification:



## Command parameters

### CLEAR

Use CLEAR to force a cleanup for a set of locks. Use this command carefully after checking what leads to a locking problem.

Do not use the CLEAR command if any index administration commands, like an index update, are still active.

**LIST** Use LIST to get information about the current locks held for a specific index or database. If there is an update lock, the command also prints information about the number of documents that have been processed so far.

Note this is only for the time that the lock is holding the index.

When using a replication capture table, there are no update operations. Instead, insert operations can be either from an insert or an update operation on the source table the index was created on.

### set-of-locks

Works with locks only in the specified database or index.

### SHOW CACHE STATUS FOR

Shows the activation status for a cached table of the specified index. This can be either: "Not Activated" or "Currently Activated". If the cache is activated, it displays details about cache memory usage. For example, the maximum cache size (in megabytes), the maximum number of documents to insert, and the space left in the cache table (in kilobytes).

### STATUS

By using the STATUS keyword, the command displays whether the locking and update Net Search Extender Instance Services are up and running.

### DATABASE database name

The name of the database on the server that is being used.

### INDEX index-schema.index-name

The schema and name of the text index that is currently being used. This is specified in the CREATE INDEX command.

## Usage

When an administration command error message indicates that there is a locking problem, ensure that no conflicting task is running. For example, attempting an ALTER command while an UPDATE command is running.

Use SHOW CACHE STATUS for an incremental index update to check that the specified memory size is still large enough to hold all the update information during the next update, or to check if an activation has been done.

## START command

### Purpose

This command starts a demon that controls the locking of full-text indexes and the automatic updating of full-text indexes on the DB2 server.

**Note:** As the command does not activate any temporary cached table for indexes, individual ACTIVATE CACHE commands are necessary before you can start searching with a stored procedure.



## Authorization

You must run this command as the DB2 instance owner on a server, or any of the servers in a distributed DB2 environment.

## Command syntax

▶▶—START—◀◀

## Command parameters

None.

## Usage

On Windows, the command starts a service `db2ext-<InstanceName>`. You can also start this command using normal Window methods. However, you cannot start Net Search Extender through a Terminal Service Client.

If START fails, there might still be obsolete entries in the scheduler referring to indexes that no longer exist. Edit the file `../sql11ib/db2ext/ctedem.dat` and remove any obsolete entries. Rerun the START command.

After successfully starting Net Search Extender, the process `ctelock` (`ctelock.exe` on Windows) is active on your system. Several shared resources (shared memory and semaphores) are created and stored in the `/tmp` directory on UNIX machines. These files are required by Net Search Extender and must not be deleted as long as the instance is running. However, if after a STOP, the START command is not successful, make sure that all of the old anchor files in the `/tmp` directory have been removed. The `/tmp` directory must be read, write and execute accessible by all.

To lock full-text indexes, you can modify a configuration file to meet your requirements.

## STOP command

### Purpose

This command stops the locking and update services of Net Search Extender.

### Authorization

You must run this command as the DB2 instance owner on a server, or any of the servers in a distributed DB2 environment.

### Command syntax

▶▶—STOP—◀◀  
    └─FORCE─┘

### Command parameters

#### FORCE

Stops services even if processes are holding locks or if the cached table is

activated for any index. If you do not specify FORCE, the command will fail in these cases with a warning about active caches.

## Usage

Stopping the Net Search Extender instance services disallows any further use of specific Net Search Extender commands. When restarting the services, you must activate the temporary cache again if you previously used an activated cache with your index.

After successfully stopping Net Search Extender, the process `ctelock` (`ctelock.exe` on Windows) is terminated. The shared resources and the anchor files in the `/tmp` directory on UNIX machines are deleted.

---

## Administration commands for the database administrator

This section describes the syntax of administration commands for the database administrator. Database administration consists of setting up databases for use by Net Search Extender and then disabling this setup.

Only the ENABLE DATABASE and DISABLE DATABASE commands are a variation of the DB2TEXT command, although all these commands allow for administration on the database level.

Command	Purpose
“ENABLE DATABASE command”	Enables the current database to create full-text indexes.
“DISABLE DATABASE command” on page 115	Resets preparation work completed by Net Search Extender for a database.
“DB2EXTHL (utility) command” on page 117	The default UDF takes a 100 KB document and returns a 200 KB CLOB.

## Tip

If no database connection information has been specified as part of the `db2text` command, the `db2text` executable causes an implicit connection to be made to the default subsystem specified in the environment variable `DB2DBDFT`.

## ENABLE DATABASE command

### Purpose

This command enables a database to create and exploit full-text indexes on text columns.

### Authorization

You must run this command as a database administrator to enable the database. This requires SYSADM authority to be able to grant DBADM to the DB2 instance owner.

## Command syntax

►►—ENABLE DATABASE FOR TEXT—  
└──|connection-options|──┘

### connection-options:

└──CONNECT TO—*database-name*──  
└──USER—*userid*—USING—*password*──┘

## Command parameters

### CONNECT TO *database-name*

The name of the database that is a target for this command. You can omit this parameter, if the environment variable DB2DBDFT is set and the user is running the command under a user ID with the necessary DB2 authorizations.

### USER *userid* USING *password*

Use a password and *userid* to connect to the database.

## Usage

This command prepares the connected database for use by Net Search Extender. It is a mandatory step before you can create a Net Search Extender index on tables/columns in the database.

You can view the database defaults established after running the command by using the DB2EXT.DBDEFAULTS catalog view.

### Changes to the database

This command grants DBADM authority to the DB2 instance owner associated with the DB2 instance of the enabled database.

The ENABLE DATABASE command creates various database objects in the schema DB2EXT, such as Net Search Extender catalogs, UDFs, and stored procedures. After running the command, the following catalog views are available:

```
db2ext.dbdefaults  
db2ext.textindexes  
db2ext.textindexformats  
db2ext.indexconfiguration
```

Also note that the above tables are located in the default table space of the database, known as IBMDEFAULTGROUP. This is distributed over all the nodes defined in db2nodes.cfg

### Changes to the file system

None.

## DISABLE DATABASE command

### Purpose

This command undoes Net Search Extender changes to a database.

## Authorization

You must run this command as a database administrator to disable the database. This requires you having DBADM authority.

## Command syntax

```
►►—DISABLE DATABASE FOR TEXT—┌FORCE┐┌|connection-options|┐◄◄
```

### connection-options:

```
|┌CONNECT TO—database-name┐┌USER—userid—USING—password┐|
```

## Command parameters

### CONNECT TO *database-name*

The name of the database that is a target for this command. You can omit this parameter, if DB2DBDFT is set and the user is running the command under a user ID with the necessary DB2 authorizations.

### USER *userid* USING *password*

Use a password and *userid* to connect to the database.

### FORCE

Forces the dropping of all Net Search Extender indexes in the database.

## Usage

This command resets the connected database, so that it can no longer be used by other Net Search Extender commands. If full-text indexes exist in the database, this command fails unless the FORCE option is used.

This command does not remove DBADM authority from the DB2 instance owner.

**Note:** Disabling a database will fail if there are any text indexes defined in the database. It is recommended to remove these indexes one by one and then check if any problems occur. If you use the disable database for text force command, it only guarantees that Net Search Extender catalog tables in the database are removed.

However, if some of the indexes can not be completely dropped, there may still be resources that need to be manually cleaned up. These include:

- Files in the index, work and cache directory
- Scheduler entries in ctedem.dat
- Where an index was created using the replication capture option, the IBMSNAP\_SIGNAL, IBMSNAP\_PRUNE\_SET, and IBMSNAP\_PRUNCNTL entries in the tables of the remote database must be manually deleted. These entries can be easily identified using APPLY\_QUAL="NSE" || <instance name> and TARGET\_SERVER= <database name> command.

In the following example, the instance is DB2 and the database is SAMPLE.

```
DELETE FROM <ccSchema>.IBMSNAP_SIGNAL
WHERE SIGNAL_INPUT_IN IN
      (SELECT MAP_ID FROM <ccSchema>.IBMSNAP_PRUNCNTL
       WHERE APPLY_QUAL= 'NSEDB2' AND TARGET_SERVER= 'SAMPLE');
```

```
DELETE FROM <ccSchema>.IBMSNAP_PRUNCNTL
WHERE APPLY_QUAL= 'NSEDB2' AND TARGET_SERVER= 'SAMPLE';
```

```
DELETE FROM <ccschema>.IBMSNAP_PRUNE_SET
WHERE APPLY_QUAL= 'NSEDB2' AND TARGET_SERVER= 'SAMPLE';
```

### Changes to the database

The following modifications made in the database to enable Net Search Extender are deleted:

- The Net Search Extender catalog views in the database.
- All the database objects created by Net Search Extender.

### Changes to the file system and shared memory

If you use the FORCE option, the index files are deleted.

If you use the FORCE option, the cache is deleted for any activated cache of indexes.

## DB2EXTHL (utility) command

### Purpose

The DB2EXTHL utility changes the maximum size of the input parameter of the highlight UDF.

By default, the highlight UDF takes as input a document up to a maximum size of 100 KB and returns a 200 KB CLOB. Depending on the size of the largest document in the database, you can increase the input value to a maximum size of 1 GB.

## Authorization

You must run this command as a database administrator to enable the database. This requires SYSADM authority to be able to grant DBADM to the DB2 instance owner.

## Command syntax

►—db2exth1—*new-highlight-input-size*—◄

## Command parameters

### **new-highlight-input-size**

The new result size of the highlight UDF in kilobytes. This is a positive integer < 1048576.

---

## Administration commands for the text table owner

This section describes the syntax of administration commands for the text table owner.

The commands are subcommands of the DB2TEXT command. These allow the owner of a table to create and manipulate full-text indexes on columns of the table.

Command	Purpose
“ACTIVATE CACHE command” on page 119	Activates the cache so that search operations using the stored procedure are possible
“ALTER INDEX command” on page 120	Changes the characteristics of an index
“CLEAR EVENTS command” on page 123	Deletes index events from an index event table used during index update
“CREATE INDEX command” on page 125	Creates a full-text index
“DEACTIVATE CACHE command” on page 137	Deactivates the cache so that search operations using the stored procedure are no longer possible
“DB2EXTTH (utility) command” on page 140	Compiles the thesaurus definition file
“DROP INDEX command” on page 138	Drops a full-text index for a text column
“ENABLE DATABASE command” on page 114	Enables the current database to create full-text indexes
“UPDATE INDEX command” on page 141	Starts the indexing process based on the current contents of the text columns
“HELP command” on page 144	Displays the list of DB2TEXT command options
“COPYRIGHT command” on page 144	Displays the Net Search Extender product and copyright information

### Tip:

If no database connection information has been specified as part of the `db2text` command, the `db2text` executable causes an implicit connection to be made to the default subsystem specified in the environment variable `DB2DBDFT`.

## ACTIVATE CACHE command

This command activates the cached table from either the DB2 user table or the persistent cache files. After completion, search operations using the stored procedure are possible.

This command is only available if the index was created with a `CACHE TABLE` option.

### Authorization

According to the DB2 catalog views, the user ID in this command must have `CONTROL` privilege on the table for which the full-text index was created.

### Command syntax

```
▶▶ ACTIVATE CACHE FOR INDEX index-schema-"." index-name FOR TEXT ▶▶
  |_____|
  RECREATE | connection-options |
```

#### connection-options:

```
|_____|
| CONNECT TO database-name |
| USER userid USING password |
```

### Command parameters

#### index-schema

The schema of the text index, as specified in the `CREATE INDEX` command. If no schema is specified, the user ID of the DB2 connection is used.

#### index-name

The name of the text index, as specified in the `CREATE INDEX` command.

#### RECREATE

Applies only to indexes using a persistent cache; an existing cache is deleted. If an update without activation has completed, the persistent cache is automatically reconstructed from the database.

#### CONNECT TO database-name

The name of the database that is target for this command. You can omit this parameter, if `DB2DBDFT` is set and the user is running the command on the server. Note that the user ID must have the required DB2 authorizations.

#### USER userid USING password

Use a password and `userid` to connect to the database. If not specified, a connection is attempted from the current user ID without a password.

## Usage

You cannot issue the command if one of the following commands is currently running on the index:

- UPDATE INDEX
- ALTER INDEX
- DROP INDEX
- CLEAR EVENTS
- DEACTIVATE CACHE

**Note:** Activation of a cached table may require its recreation from scratch, even though a persistent cache was used. This occurs if an update operation was performed while the persistent cache was deactivated.

The amount of memory used to build the cache is dynamically calculated from the current number of documents and the size of the result columns. Use the PCTFREE value to increase the calculated minimal amount of memory by a factor of  $100/(100-PCTFREE)$ . The PCTFREE value is specified in the CREATE or ALTER INDEX command.

Thereby, PCTFREE describes the percentage of the allocated cache that is reserved for insert operations while the cache is activated. Note that for each ACTIVATE CACHE command, the actual memory size is re-evaluated.

### Changes to the file system

Files for implementing the persistent cache are created.

## ALTER INDEX command

### Purpose

The command changes the characteristics of a full-text index, for example, the update options and the storage options.

### Authorization

According to DB2 catalog views, the user ID in this command must have CONTROL privilege on the table for which the full-text index was created.

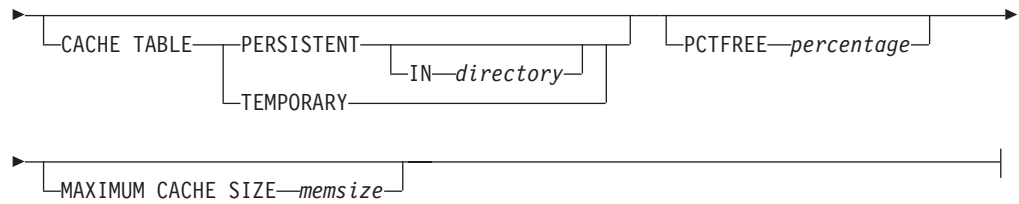
### Command syntax

```
▶▶ ALTER INDEX index-schema-".." index-name FOR TEXT ▶▶
  [update-characteristics] [storage-options]
  [connection-options]
```

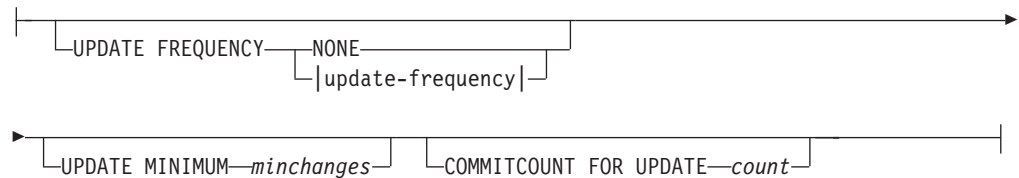
### storage-options:

```
| [INDEX DIRECTORY—directory] [WORK DIRECTORY—workdirectory] ▶▶
```

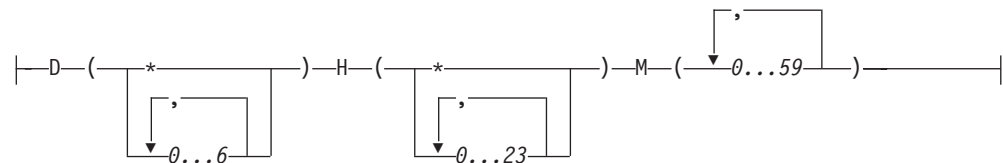




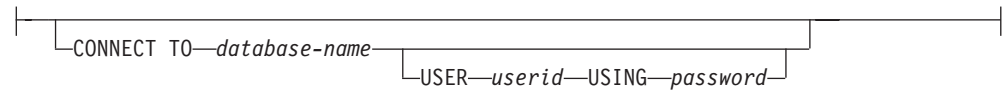
**update-characteristics:**



**update-frequency:**



**connection-options:**



**Command parameters**

**index-schema**

The schema of the text index as specified in the CREATE INDEX command. If no schema is specified, the user ID of the DB2 connection is used.

**index-name**

The name of the text index as specified in the CREATE INDEX command.

**INDEX DIRECTORY directory**

The directory path where the text index is stored. As the directory will contain index data, ensure that the directory has read, write, and execute permissions for the DB2 instance owner user ID.

Note that in a distributed DB2 environment, this directory has to exist on every node. A subdirectory, NODE<nr>, is created under the directory to distinguish indexes on logical nodes of a server. Any index files from the previous index directory are deleted.

**WORK DIRECTORY workdirectory**

Stores temporary files during search and administration operations. You can change the separate work directory independently of a new index directory.

If the directory does not exist, it is created using the DB2 instance owner user ID. If it exists, ensure that the directory has read, write and execute permissions on UNIX platforms for the instance owner.

Note that in a distributed DB2 environment, this directory has to exist on every node. A subdirectory, NODE<nr>, is created under the directory to distinguish indexes on logical nodes of a server. Any temporary index files from the previous index directory are deleted.

#### **CACHE TABLE PERSISTENT IN directory**

Specifies that the cached table in CREATE INDEX is persistent even after a deactivation or system reboot. In either case, this allows for a fast ACTIVATE CACHE execution. The persistent cache is stored in the specified directory.

The previously created persistent cache is moved to a new location. This operation always requires a deactivated index.

#### **CACHE TABLE TEMPORARY**

Specifies that the cached result table is now temporary and any previously existing persistent cache has been deleted. Note that this change operation requires a deactivated index.

#### **MAXIMUM CACHE SIZE memsize**

Specifies the new maximum size of the cached table to be built during ACTIVATE CACHE. Specify the memsize parameter in megabytes as a positive integer.

If memsize is too small, the ACTIVATE CACHE command fails. The actual cache size is calculated during the ACTIVATE CACHE command. This change requires a deactivated index.

#### **PCTFREE percentage**

Specifies the percentage of the cache held free for additional documents. The percentage must be an integer value less than 100 and greater or equal to 0. Note that the previous persistent cache is deleted and that this change requires a deactivated index.

#### **UPDATE FREQUENCY**

Using the following parameters, the index update frequency determines when the update occurs:

- **D.** The day(s) of the week when the index is updated: \* (everyday) or 0..6 (0=Sunday)
- **H.** The hour(s) when the index is updated: \* (every hour) or 0..23
- **M.** The minute(s) when the index is updated: 0..59
- **NONE.** No further index updates occur. This is intended for a text column in which no further changes are made, or where only manual update are run in the future.

If you do not specify the UPDATE FREQUENCY keyword, the frequency settings are left unchanged.

#### **UPDATE MINIMUM minchanges**

The minimum number of changes allowed for text documents before the index is incrementally updated. If you do not specify the UPDATE MINIMUM keyword, the setting does not change.

Note that you can only change the UPDATE MINIMUM if you did not create the index using the RECREATE ON UPDATE option.

### **COMMITCOUNT FOR UPDATE count**

For update processing, you can specify a commitcount. This applies to both the UPDATE command and the UPDATE FREQUENCY specification, which schedules update processing.

The COMMITCOUNT value is ignored during initial update.

Note that you can only change COMMITCOUNT if you did not create the index using the RECREATE ON UPDATE option.

Also note that you cannot change COMMITCOUNT if you did create the index with the REPLICATION clause.

### **CONNECT TO database-name**

The name of the database that is target for this command. You can omit this parameter, if DB2DBDFT is set and the user is running the command on the server. Note that the user ID must have the required DB2 authorizations.

### **USER userid USING password**

Use a password and userid to connect to the database. If not specified, a connection is attempted from the current user ID without a password.

## **Usage**

You cannot issue the alter index command if one of the following commands is running on the index:

- ALTER INDEX
- CLEAR EVENTS
- ACTIVATE CACHE
- DROP INDEX
- UPDATE INDEX
- DEACTIVATE CACHE

If you create the index with a cache option, you can not use the ALTER INDEX command for the index directory when the index is activated. You must first deactivate the cache.

In a distributed DB2 environment, a text index with cache options is only allowed on a single-noded tablespace.

### **Changes to the database**

Change Net Search Extender catalog views.

### **Changes to the file system**

- Creation of NODE<nr> subdirectories in the index, and work directories
- Moving of index files
- Creation of persistent cache directories
- Moving of persistent cache files

## **CLEAR EVENTS command**

### **Purpose**

This command deletes indexing events from an index's event view. The name of the event view is found in the EVENTVIEWNAME column of the DB2EXT.TEXTINDEXES view.

## Command syntax

```
► CLEAR EVENTS FOR INDEX index-schema"." index-name FOR TEXT ►  
◄ COMMITCOUNT count | connection-options ◄
```

### connection-options:

```
| CONNECT TO database-name | USER userid USING password |
```

## Command parameters

### index-schema

The schema of the text index as specified in the CREATE INDEX command. If no schema is specified, the user ID of the DB2 connection is used.

### index-name

The name of the text index as specified in the CREATE INDEX command.

### COMMITCOUNT count

An INTEGER value  $\geq 0$  displays the number of rows deleted in one transaction by DB2.

### CONNECT TO database-name

The name of the database that is target for this command. You can omit this parameter, if DB2DBDFT is set and the user is running the command on the server. Note that the user ID must have the required DB2 authorizations.

### USER userid USING password

Use a password and `userid` to connect to the database. If not specified, a connection is attempted from the current user ID without a password.

## Usage

When you schedule regular updates using the UPDATE FREQUENCY option in the CREATE or ALTER INDEX commands, regularly check the event table. Use CLEAR EVENTS to clean up the event tables, after you have checked the reason for any events indicating an error and removed the source of the error that is mentioned in the event table.

You cannot issue the clear events command if one of the following commands is running on the index:

- UPDATE INDEX
- ALTER INDEX
- ACTIVATE CACHE
- DEACTIVATE CACHE
- DROP INDEX

# CREATE INDEX command

## Purpose

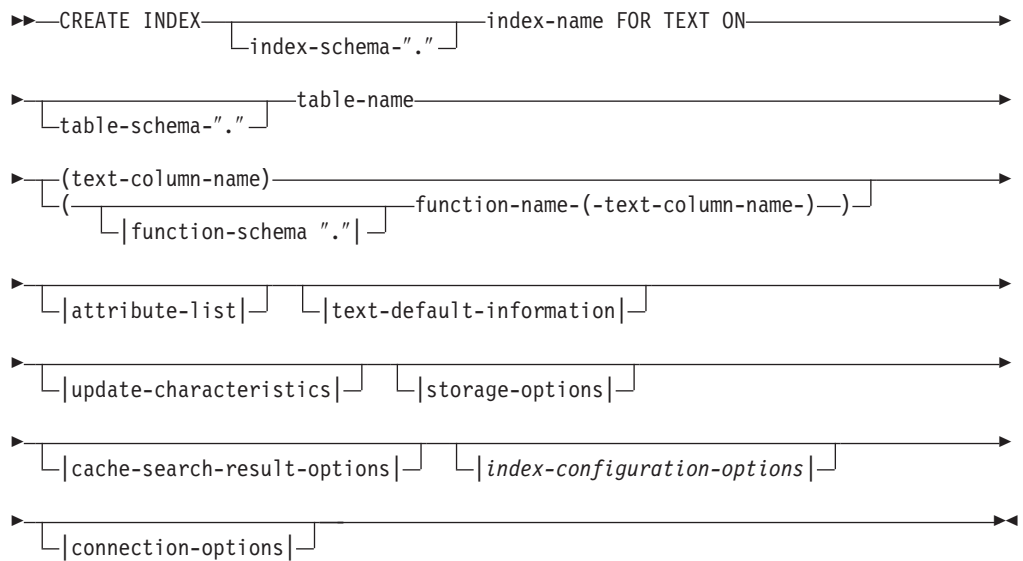
This command creates a full-text index on a text column for use in Net Search Extender full-text queries.

In a distributed DB2 environment, a full-text index is created on every partition of the table space the user table is defined on. Subsequent changes to the distribution of the table space are not allowed and will lead to unexpected behavior in the administration commands and during the search process.

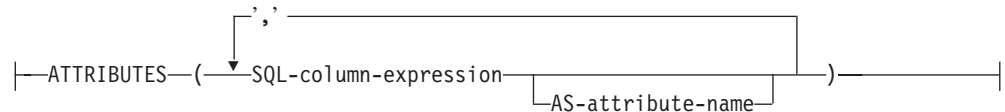
## Authorization

According to DB2 catalog views, the user ID in this command must have the CONTROL privilege on the table where the full-text index was created.

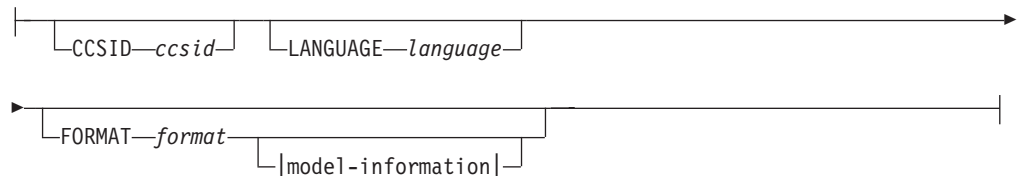
## Command syntax



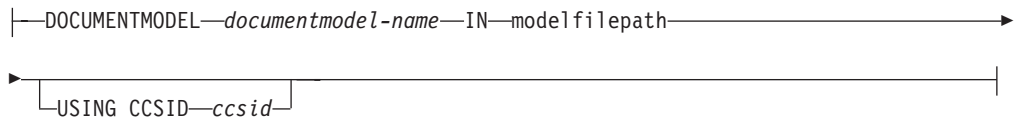
### attribute list:



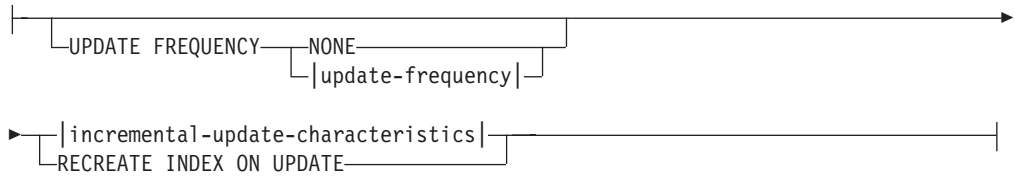
### text-default-information:



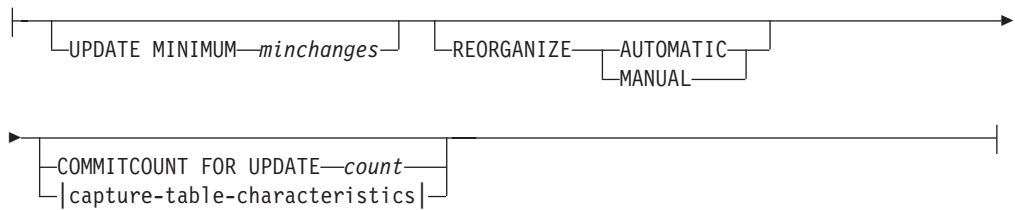
**model-information:**



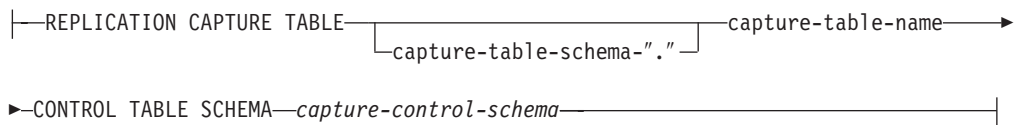
**update-characteristics:**



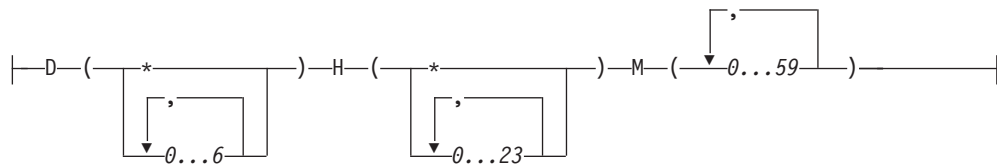
**incremental-update-characteristics:**



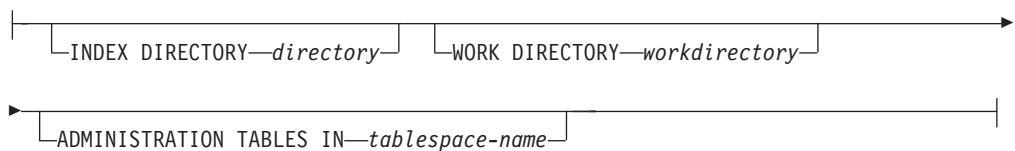
**capture-table-characteristics:**



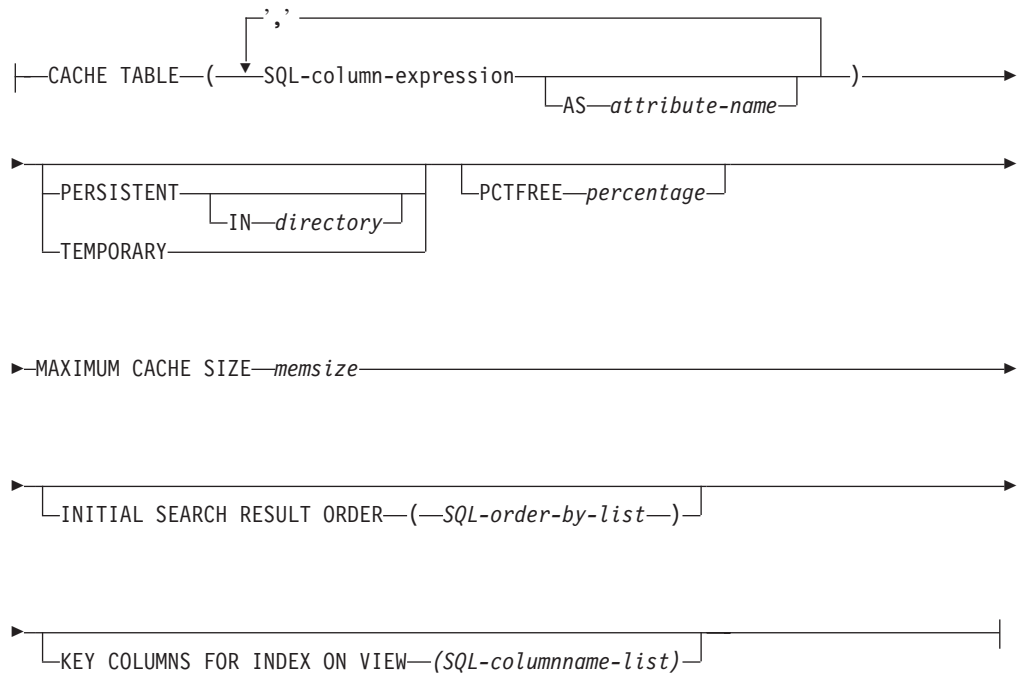
**update-frequency:**



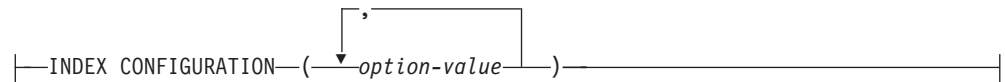
**storage-options:**



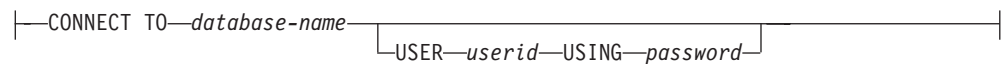
### cache-search-results-options:



### index-configuration-options:



### connection-options:



## Command parameters

### index schema

The schema of the text index. Use this as a DB2 schema name for the index-specific administration tables. If no schema is specified, the user ID of the DB2 connection is used. Note that the index schema must be a valid DB2 schema name.

### index name

The name of the index. Together with the index schema, this uniquely identifies a full-text index in a database.

Note that the index name must be a valid DB2 index name.

### table schema

The schema for which of the table, nickname, or view the index is created. If no schema is specified, the user ID of the DB2 connection is used.

**table name**

The name of the text table, nickname, or view in the connected database that contains the column the full-text index is created for.

Note that when the table name does not refer to a DB2 base table, there are the following restrictions:

- A view only allows a stored procedure or table-valued function search. Therefore, you must specify the key columns for the index or views using the KEY COLUMNS FOR INDEX ON VIEW clause.
- For incremental index updates on nicknames without capture tables, a log table is created. If any changes occur to the data in the nickname table or view, you must manually fill in the log table. With base tables this is done automatically, so the user **must not** touch the log table.
- The DB2 predicates CONTAINS, SCORE, and NUMBEROFMATCHES are only allowed for indexes on base tables or nicknames, but not on views.
- Indexes on views are only allowed if you specify cache-search-result options in the command.

**text-column-name**

The name of the column containing the text used for creating the full-text index. The column must have one of the following data types:

- CHAR (FOR BIT DATA)
- VARCHAR (FOR BIT DATA)
- LONG VARCHAR (FOR BIT DATA)
- CLOB
- DBCLOB
- BLOB
- GRAPHIC
- VARGRAPHIC
- LONG VARGRAPHIC
- XML

If the column data type is none of these, specify a transformation function using **function-schema.function-name** to convert the column type to a supported one.

Note that several indexes on the same columns are allowed, but **only** under either one of the following conditions:

**The index is created on a view**

Therefore, you can not use the index in the CONTAINS, SCORE, or NUMBEROFMATCHES search arguments.

**The index is created on a table**

If all the indexes are synchronized, they have identical properties on the same column in the following CREATE INDEX command details:

- Function name and schema
- ATTRIBUTES
- CCSID
- LANGUAGE
- FORMAT
- DOCUMENTMODEL



- INDEX CONFIGURATION

Therefore, it does not matter which index is chosen by the CONTAINS, SCORE, or NUMBEROFMATCHES arguments.

**function-schema.function-name**

The schema and the name of a user-defined function used to access text documents that are in a column of an unsupported type. The function performs a column type conversion, using as input parameter an arbitrary column type. It returns the value as one of the Net Search Extender supported types.

**ATTRIBUTES (SQL-column-expression AS Attribute-name, ...)**

Ensures that the content of a column expression is indexed in addition to the text column. This content can then be searched by the ATTRIBUTE clause in a search statement. The SQL-column expressions have to be defined using unqualified column names of the table on which the index is created. The only data type allowed is DOUBLE. Cast operators can be used in the column expressions, but implicit casting of DB2 is **not** possible. The attribute-names must follow the rules for attribute-names in document models and must be distinct from all attribute names in the indexes model-definition file.

Determine the attribute names for expressions by using the following rules:

- If explicitly named by the SQL AS clause in the column expression, use the specified name. An example would be: ATTRIBUTES (C1+C2 AS myname)
- If a column of the specified table is used without AS, the name of the column is used. For example: ATTRIBUTE (C1)
- If an expression is used without AS and it does not refer to a named column, CREATE INDEX reports an error.

For example: ATTRIBUTES (CAST(JULIAN\_DAY(date) AS DOUBLE) as day, (price1+price2)/2 as avg\_price)

Note that attributes that are not enclosed by single quotes are mapped to uppercase, and must be specified in uppercase during search.

**CCSID ccsid**

The Coded Character Set Identifier is used when indexing text documents. The default value is from the DB2EXT.DBDEFAULTS view where DEFAULTNAME='CCSID'.

Only set a CCSID if the data type of the column is binary.

**LANGUAGE language**

The language parameter specifies the language of the stop word dictionary that is selected if the index configuration value IndexStopWords is set to 0 (ignore stop words during indexing). This parameter must always be set for Thai (TH\_TH) to enable Thai word breaking, and Turkish to correctly distinguish the use of the dotted and dotless "i".

**FORMAT format**

The format of text documents in the column, for example, HTML. This information is necessary for indexing documents.

For structured document formats, you can specify information in a document model file. If no document model is specified, the text of the document is indexed using a default document model.

If the format keyword is not specified, the default value is taken from the DB2EXT.DBDEFAULTS view where the DEFAULTNAME='FORMAT'. The initial default set by Net Search Extender is TEXT. For data type XML, format defaults to XML in the case where no format is specified. XML is the only value you are allowed to specify for FORMAT if your data type is XML.

#### **DOCUMENTMODEL documentmodel-name IN modelfilepath**

The modelfilepath specifies the location of a model file. The modelfilepath must be a fully qualified path. The model file contains a model definition for the format in the FORMAT clause. It must be readable by the DB2 instance owner. A document model enables you to index and search specific sections of a document. You can define markup tags and section names in a document model. A document model is bound to a document format that supports HTML, XML, or GPP structures. You can only specify one document model in a model file.

Note that because the document model is only read during the CREATE INDEX command, any later changes are not recognized for this index.

Note that in a distributed DB2 environment, a shared file system must be used to ensure that the modelfilepath is accessible on every node.

#### **USING CCSID ccsid**

Specify a CCSID to interpret the contents of the model file. The default value is from the DB2EXT.DBDEFAULTS view where DEFAULTNAME='MODELCCSID'.

#### **UPDATE FREQUENCY**

The index update frequency determines when the update occurs. If changes to the user table are less than that specified by the UPDATE MINIMUM option, the index is not updated. If you do not specify the UPDATE FREQUENCY, the default NONE is used, so that no index updates are made. This is useful when you expect no further changes to a text column or want to have manual control over the update process.

- **D.** The day(s) of the week when the index is updated: \* (everyday) or 0..6 (0=Sunday)
- **H.** The hour(s) when the index is updated: \* (every hour) or 0..23
- **M.** The minute(s) when the index is updated: 0..59
- **NONE.** No further index updates are made. The update must be started manually.

The default value is from the DB2EXT.DBDEFAULTS view where DEFAULTNAME='UPDATEFREQUENCY'.

If you decide not to use the UPDATE FREQUENCY parameter to schedule automatic index updates, you can use operating system functions, for example crontab, instead.

#### **UPDATE MINIMUM minchanges**

The minimum number of changes required to text documents before the index is updated based on the UPDATE FREQUENCY settings. Only positive integer values are allowed. The default value is taken from the DB2EXT.DBDEFAULTS view, where DEFAULTNAME='UPDATEMINIMUM'.

Note that this value is ignored if the DB2TEXT UPDATE command is executed manually. This option cannot be used with the RECREATE

INDEX ON UPDATE option, as the number of changes is not available without a log table and triggers for incremental update.

For distributed databases, the UPDATE MINIMUM is checked on every node.

### **REORGANIZE AUTOMATIC/MANUAL**

Updates performed based on the update frequency settings will only reorganize the index if REORGANIZE AUTOMATIC is specified. This step is completed automatically according to the value of select REORG SUGGESTED from DB2EXT.TEXTINDEXES after the update.

REORGANIZE MANUAL can only be performed with a manual UPDATE command, using the REORGANIZE option.

If the REORGANIZE clause is omitted, the default is taken from the DB2EXT.DBDEFAULTS view, where DEFAULTNAME='AUTOMATICREORG'.

### **REPLICATION CAPTURE TABLE `capture-table-schema.capture-table-name` CONTROL TABLE SCHEMA `capture-control-schema`**

For incremental update processing, the specified replication capture table is taken instead of a log table that is normally created for the index. Therefore, schemaname, tablename, and the replication capture table name relate to objects in the local DB2 (federated) database.

The capture-control-schema is the schema name of the replication control tables, for example IBMSNAP\_PRUNE\_SET on the local DB2. The replication control tables must be available as nicknames on the local DB2 system after setting up the replication.

At minimum, there must be nicknames available for the following capture control tables:

- IBMSNAP\_SIGNAL
- IBMSNAP\_PRUNE\_SET
- IBMSNAP\_PRUNCNTL
- IBMSNAP\_REGISTER
- IBMSNAP\_REG\_SYNC (Non-DB2 remote sources only)

As DB2 Replication Center does not automatically guarantee to create local nicknames for a remote capture table and capture control tables, this can be a manual task. The task is similar to creating a nickname for the table that the text index is to be created on.

The column names of primary key columns in the user table nickname and the capture table nickname must match. In addition, the names of the columns IBMSNAP\_OPERATION, IBMSNAP\_COMMITSEQ and IBMSNAP\_INTENTSEQ must not be changed in the capture table nickname.

After index creation, the column names DB2EXT.TEXTINDEXES(LOGVIEWNAME) and DB2EXT.TEXTINDEXES(LOGVIEWSCHEMA) both refer to the local name of the replication capture table.

As Net Search Extender does not require all the functionality of the DB2 Replication Center, the Change Data table (CD) or the Consistent-Change Data (CCD) table must obey following rules:

- Use change capture registration and not the full refresh copying option.

- No horizontal subsetting of capturing changes is allowed. For example, by triggers. See Chapter 6, "Subsetting data in your replication environment" in the *DB2 Replication Guide and Reference, Version 8*.
- Registering changes for a subset of columns is only allowed if the primary key columns, the text column, and all columns involved in the attribute and cache table expressions of the DB2TEXT CREATE INDEX command are included.
- The primary key columns must be included in the capture table. Note that the after-image is sufficient.
- The capture tables must not be condensed. For each primary key there must be one entry with the latest data. However, Net Search Extender requires a full history to be available.
- The table must use the D/I option. This enables updates to primary keys on the source table to be transformed into a pair of inserts/deletes.

Other prerequisites include:

- The server type and version of the source table the index is created on is one of the following:
  - DB2 Version 9.1 or later running on AIX operating systems
  - DB2 Version 9.1 or later running on HP-UX operating systems
  - DB2 Version 9.1 or later running on Linux operating systems
  - DB2 Version 9.1 or later running on Solaris operating systems
  - Informix® IDS 9.3
  - ORACLE 9i
  - SYBASE ASE 12.5
  - Microsoft SQL Server 2000
- The following are a list of supported wrappers:
  - DB2: DRDA®
  - Informix: Informix
  - ORACLE: NET8, (SQLNET)
  - SYBASE: CTLIB
  - MSSQLSERVER: MSSQLODBC3

**Note:** Ensure that the correct source table name is inserted into the registration table. Depending on the type of remote DBMS, the remote tablename or the local nickname must be used:

- DB2: remote table name (the tablename on the remote server)
- Non-DB2: local nickname (the corresponding nickname in the federated DB2 database)

A user mapping must exist for the local user to access the remote data source via nicknames and the remote user must have control privilege on the tables.

If the DB2 instance owner user ID is different from the local user ID, an additional user mapping for the DB2 instance owner user ID is needed.

The specified base table name must not be a view on a nickname. This is because a view can be over several nicknames and several CD and CCD tables can also be involved. As only one CD or CCD table can be specified in the replication capture clause, a view on nicknames can not be supported. In addition, nicknames on a remote views can not be supported because the primary key is missing.

The CD or CCD table must be a nickname and can not be a view or an alias.

### **COMMITCOUNT FOR UPDATE count**

For **incremental** update processing a commitcount can be specified. If not specified, a default value is taken from the DB2EXT.DBDEFAULTS view, where DEFAULTNAME='COMMITCOUNT'.

The COMMITCOUNT FOR UPDATE value for the index can be found in DB2EXT.TEXTINDEXES.COMMITCOUNT. This can be changed for each index using the ALTER INDEX command. It also applies to the scheduled update processing according to the UPDATE FREQUENCY specification. A value of 0 means that the update is completed in one transaction, with values >0 specifying the number of documents to process in one transaction. You are recommended not to use a non-zero COMMITCOUNT or, if you must, to set the value high enough so that the number of immediate commits during a single incremental update remains very small. Each commit involves moving index files and cleaning up the index log file which takes a considerable amount of time particularly if performed repeatedly.

If COMMITCOUNT is not set, then the NUMBER\_DOCS parameter from the db2ext.textindexes is not updated. Therefore, to view the number of documents already processed during the updating process, use the CONTROL LIST command.

### **RECREATE INDEX ON UPDATE**

This does not allow incremental index updates, but recreates the index when an update operation is performed (by command or scheduled update).

**Note:** No triggers are created on the user table and no log table is created if RECREATE INDEX ON UPDATE is specified.

### **INDEX DIRECTORY directory**

The directory path in which the text index is to be stored. As the directory will contain index data, ensure that the directory has read/write and execute permissions for the DB2 instance owner user ID.

The default value is taken from the DB2EXT.DBDEFAULTS view, where DEFAULTNAME='INDEXDIRECTORY'. A subdirectory, NODE<nr>, is created under the directory to distinguish indexes on logical nodes of a server.

Note that in a distributed DB2 environment, this directory has to exist on every physical node.

### **WORK DIRECTORY directory**

A separate work directory may be specified optionally, that will be used to store temporary files during index search and administration operations. The directory must exist and have read/write and execute permissions for the DB2 instance owner user ID.

The default value is taken from the DB2EXT.DBDEFAULTS view, where DEFAULTNAME='WORKDIRECTORY'. A subdirectory, NODE<nr>, is created under the directory to distinguish indexes on logical nodes of a server.

Note that in a distributed DB2 environment, this directory has to exist on every physical node.

If a WORK DIRECTORY is not specified, a directory called work is created under INDEX DIRECTORY.

### **ADMINISTRATION TABLES IN `tablespace-name`**

The name of the regular table space for administration tables created for the index. The table space must exist. If not specified, the table space of the user table is chosen, if the index is created on a base table.

In case of a nickname or a view, a default table space is chosen by DB2.

When creating text indexes on views, nicknames, or text indexes for stored procedure search on a distributed DB2 environment, the table space for administration tables must be specified on a single node and must be called explicitly on this node.

To ensure that you connect to the correct node, use the DB2NODE environment variable.

### **CACHE TABLE (SQL-column-expression-list)**

A cached table is built in addition to the index, which consists of the specified column expressions. This cache is used to return the result set via a stored procedure search without joining full-text search results with a DB2 table. Note that a regular DB2 search using the full-text index with the CONTAINS function is always possible.

Define the SQL-column expressions using unqualified column names of the table the index is created on. The allowed SQL-column expression types are all built-in and user-defined distinct types. The column names in the result set are determined using the following rules:

- If explicitly named by the SQL AS clause in the column expression, the specified name is used. For example: `CACHE TABLE (C1+C2 AS myname)`
- If a column of the specified table is used without the AS clause, the name of the column is used. For example: `CACHE TABLE(C1)`
- If an expression is used without AS, and which does not refer to a named column, CREATE INDEX reports an error.
- No duplicate column names are allowed.

CLOB data types are not supported as cache data types. You need to cast these to VARCHARS.

**Note:** Note that if the column names of the result set are not disjunct, the CREATE INDEX command returns an error. Also note that the cached table is not implicitly activated after creation, for example search by stored procedure is not possible until DB2TEXT ACTIVATE CACHE is performed.

This option may be used in a distributed DB2 environment only if the user table is stored in a single-noded table space.

### **PERSISTENT IN directory**

Specifies that the cache is also created persistently. A persistent cache can be reactivated more rapidly after a deactivation or a system restart than a non-persistent cache. The persistent cache is stored in the specified directory.

Note that if the directory is not specified, the default is taken from the `db2ext.dbdefaults` view, where `DEFAULTNAME='CACHEDIRECTORY'`.

### **TEMPORARY**

Specifies that the cache is not stored persistently. If neither PERSISTENT or TEMPORARY is specified, the default is taken from the `DB2EXT.DBDEFAULTS` view, where `DEFAULTNAME='USEPERSISTENTCACHE'`.



### MAXIMUM CACHE SIZE memsize

Specifies the maximum size of the cached table to be built during DB2TEXT ACTIVATE CACHE. The memsize parameter must be specified in megabytes as a positive integer. There is no default value for memsize. If the integer is too small, the ACTIVATE CACHE command will fail. The actual cache size is calculated during the ACTIVATE CACHE command.

The limit for the maximum cache size on the different 32-bit platforms is:

- Windows: 1024 MB (1 GB = 1073741824 bytes)
- Linux: 2048 MB (2 GB = 2147483647 bytes)

On 64-bit installations, the maximum cache size limit depends on the available memory.

### PCTFREE percentage

Specifies the percentage of the cache to be held free for additional documents. The percentage must be an integer value lower than 100 and greater or equal to 0. If not specified, the default is taken from the db2ext.dbdefaultsv view, where DEFAULTNAME='PCTFREE' The default is 50%.

### INITIAL SEARCH RESULT ORDER (SQL-order-by-list)

Specifies the order used for retrieving the user table contents during initial indexing. When using this option and skipping the dynamic ranking of full-text search results, the documents are returned in their indexing order, as stored in the cached result table.

You can work with presorted indexes and predefined search result ordering only if you are using the Stored Procedure search interface. For example: INITIAL RESULT ORDER(length(column1) asc, column2+column3 desc).

Predefined search result ordering is not implemented for the SQL scalar search functions and the table valued function.

<b>Note:</b> The index order can <b>not</b> be ensured for the new or changed documents after incremental update.
---

### KEY COLUMNS FOR INDEX ON VIEW (SQL-columnname-list)

If indexes on views are created, the KEY COLUMNS FOR INDEX ON VIEW clause must be specified, otherwise it MUST NOT be specified. The list of column names specifies the columns that UNIQUELY identify a row in the view.

As this uniqueness cannot be checked by DB2 as in case of primary keys, the user is responsible to ensure the equivalent uniqueness. The specified columns build part of the log table for the index.

### INDEX CONFIGURATION (option-value), ...

These are the index configuration values. The default values are underlined.

Option	Values	Description
TreatNumbersAsWords	<u>0</u> or 1	Interprets sequences of digits as separate words if set to 1, even if they are adjacent to characters. The 0 default means that, for example, tea42at5 is considered as one word.

Option	Values	Description
IndexStopWords	0 or <u>1</u>	Ignores or considers stop words during indexing. The default 1 indexes all text including stop words. Currently, the stopword list is an UCS-2 file <language>.tsw in directory <instance>/sql1lib/db2ext/resources. Changes to this file have <b>no effect</b> after index creation. Also note that <language> is the LANGUAGE value from the CREATE INDEX command.
UpdateDelay	seconds	Specifies the duration in seconds for incremental update without capture tables. Only entries older than this duration will be taken from the log table. This is to avoid lost updates. For example, document changes that are not reflected in the index in transaction scenarios where user transactions interfere with update commands. Therefore, the UpdateDelay parameter should be set to the maximum duration of a user write transaction on the table the index was created on.
IgnoreEmptyDocs	<u>0</u> or 1	If IgnoreEmptyDocs is set to 1, empty documents (with content length 0, or a null value) are not represented in the index. If this option is used, and the document content is null (empty), the next incremental update will delete the documents from the index.

#### CONNECT TO database-name

The name of the database that is target for this command. You can omit this parameter, if DB2DBDFT is set and the user is running the command on the server. Note that the user ID must have the required DB2 authorizations.

#### USER userid USING password

Use a password and userid to connect to the database. If not specified, a connection is attempted from the current user ID without a password.

#### Changes to the database

- Change Net Search Extender catalog views.
- Create an index log table in the specified table space. This is only if the RECREATE INDEX option is not specified and the capture table is not specified.
- Create an index event table in the specified table space.
- Deferred to first update: Creation of triggers on the user text table (only if RECREATE INDEX is not specified and no capture table is used)
- If a replication capture table is used, the following change is made to the capture control tables:
  - an insert into the IBMSNAP\_PRUNCTNL and IBMSNAP\_PRUNE\_SET tables

The entries in these tables are uniquely identified by the columns:

- APPLY\_QUAL='NSE' || <DB2 instance running NSE>
- SET\_NAME= <internal index identifier>
- TARGET\_SERVER=<DB2 database name target to DB2TEXT operation>



### Changes to the shared memory

Deferred to ACTIVATE execution: If CACHE TABLE clause is used, a cache for the result table is built in *shared memory*.

### Changes to the file system

- Subdirectories NODE<nr> are created under index, work and cache directories.
- The directory <internal index name> is created under <indexdirectory>/NODE<nr> where indexdirectory refers to the corresponding parameter of this command and NODE<nr> is related to the node number in a distributed DB2 environment.

## Usage

Creation of a full-text index requires a primary key on the user table. In DB2 Net Search Extender Version 9.1, a multicolumn DB2 primary key can be used without type limitations. However, to use the table-valued search, no compound primary key is allowed.

The number of primary key columns is limited to 62, the total length of all primary key columns is limited to 1007 bytes for tablespaces with pagesize 4k, 2031 bytes for tablespaces with pagesize 8k, 4079 bytes for tablespaces with pagesize 16k and 4096 bytes for tablespaces with pagesize 32k. Note that if the primary key consists of more than one column, the mentioned limits must be reduced by 2 bytes for each additional column.

- The total size of the SQL expressions for ATTRIBUTES, CACHE TABLE and INITIAL SEARCH RESULT ORDER must not exceed 24 K-bytes.
- Initial index updates are always done as one logical transaction, there is no commitcount in this case.

**Note:** After creating the index, the length of primary key columns or the view key columns must not be changed by ALTER TABLE commands.

The synchronization between user table, full-text index and the cached result table is completed during the update index command.

## DEACTIVATE CACHE command

### Purpose

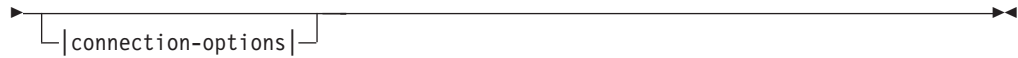
This command releases a cached table. A persistent cache is kept to be reused on the next ACTIVATE command. Until the next activation, search operations via the stored procedure are no longer possible on the deactivated cache.

### Authorization

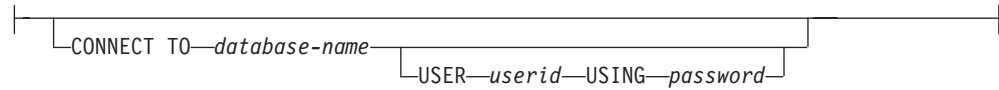
According to the DB2 catalog views, the userid in this command must have the CONTROL privilege on the table the full-text index was created for.

### Command syntax

```
DEACTIVATE CACHE FOR INDEX index-schema-".." index-name FOR TEXT
```



**connection-options:**



**Command parameters**

**index-schema**

The schema of the text index as specified in the CREATE INDEX command. If no schema is specified, the userid of the DB2 connection is used as schema name.

**index-name**

The name of the text index as specified in the CREATE INDEX command.

**CONNECT TO database-name**

The name of the database that is target for this command. You can omit this parameter, if DB2DBDFT is set and the user is running the command on the server. Note that the user ID must have the required DB2 authorizations.

**USER userid USING password**

Use a password and userid to connect to the database. If not specified, a connection is attempted from the current user ID without a password.

**Usage**

Note that this command could not be issued when one of the following commands is running on the index:

- ACTIVATE CACHE
- DEACTIVATE CACHE
- UPDATE INDEX
- ALTER INDEX
- DROP INDEX
- CLEAR EVENTS

**Note:** After deactivation of a persistent cache, the cache is made inaccessible for search by the stored procedure. However, this can be used for fast ACTIVATE, unless an update was performed in the meantime.

In this case, the persistent cache is automatically recreated from scratch using the ACTIVATE CACHE command.

**DROP INDEX command**

**Purpose**

This command drops a full-text index for a text column. If the cache for the index is activated, it is deleted using this command.

## Authorization

According to DB2 catalog views, the userid in this command must have the CONTROL privilege on the table the full-text index was created for. Alternatively, the user can be the database administrator (DBADM).

Alternatively, the database administrator (DBADM), can drop the index as they must be able to disable the database using the FORCE option.

## Command syntax

```
► DROP INDEX index-schema-"." index-name FOR TEXT ►  
|  
| connection-options |
```

### connection-options:

```
|  
| CONNECT-TO database-name |  
| USER userid USING password |
```

## Command parameters

### index schema

The schema of the text index as specified in the CREATE INDEX command. If no schema is specified, the userid of the DB2 connection is used as the schema name.

### index-name

The name of the index as specified in the CREATE INDEX command. With the index schema, it uniquely identifies the full-text index in a database.

### CONNECT TO database-name

The name of the database that is target for this command. You can omit this parameter, if DB2DBDFT is set and the user is running the command on the server. Note that the user ID must have the required DB2 authorizations.

### USER userid USING password

Use a password and userid to connect to the database. If not specified, a connection is attempted from the current user ID without a password.

## Usage

The index is deleted, irrespective of the activation status of its cached table.

Note that the command must not be issued when one of the following commands is running on the index:

- UPDATE INDEX
- CLEAR EVENTS
- ALTER INDEX
- ACTIVATE CACHE
- DEACTIVATE CACHE

- DROP INDEX

**Note:** Indexes must be manually dropped before or after the user table in DB2 is dropped. If not, the index directories are not correctly cleaned up.

#### Changes to the database

- Change Net Search Extender catalog views
- Drop the DB2 index
- Drop the index log/event tables
- Delete triggers on the user text table

When using the replication capture tables, entries in the IBMSNAP\_PRUNE\_SET and IBMSNAP\_PRUNCTRNL tables are removed.

#### Changes to the shared memory

The cached table is deleted.

#### Changes to the file system

- The directory <internal index name> is deleted in the index and the work directories of the dropped index
- Delete a persistent cache for the index

## DB2EXTTH (utility) command

### Purpose

This independent utility compiles a thesaurus definition file. After running the thesaurus compiler, the THESAURUS-related features of the search argument syntax can be used.

### Authorization

None. This command is not necessarily restricted for the table owner, but makes only sense in the context of querying.

### Command syntax

```

▶▶ db2extth [quiet] -ccsid code page -f definition-file-name ▶▶
├── quiet
├── -h
├── -H
├── -?
└── -copyright

```

### Command parameters

#### -f definition-file-name

The name of the file containing the thesaurus definition. The file name must contain either the absolute path or the relative path to the file. The file name is restricted to 8+3 characters, the extension being optional.

The thesaurus dictionary is generated in the same directory as the definition file and has the same name. The only difference is that the dictionary has the following extensions: wdf, wdv, grf, grv, MEY, ROS, NEY, SOS, and lkn, where n is a digit. Note that if existing thesaurus files have the same name, they are overwritten.

**-ccsid code page**

The code page in which the thesaurus definition file is written.

**-quiet** Output information is not displayed.

**-copyright**

Returns the internal build number of the product. Use this number when reporting problems.

**-h, -H, or -?**

Displays help information.

**Usage**

Use this command to compile a thesaurus definition file into a binary thesaurus definition format.

**UPDATE INDEX command**

**Purpose**

This command immediately starts the indexing process by bringing the index up to date to reflect the current contents of the text columns with which the index is associated.

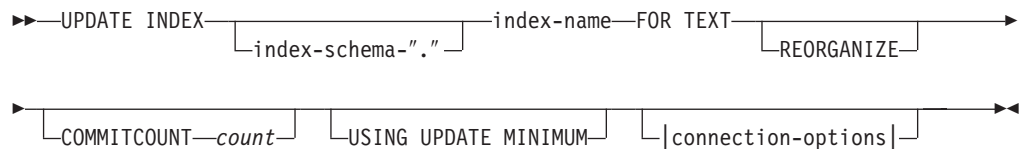
While the update is being performed, search using the CONTAINS predicate is possible. For an index with an activated cached result table, search by stored procedure is also possible during update. However, columns in the cached table may show new values, even though the changed text is not yet committed to the full-text index.

Using the RECREATE INDEX ON UPDATE option in the CREATE INDEX command will clear the index before recreation. Until completion of the update, empty results will be returned.

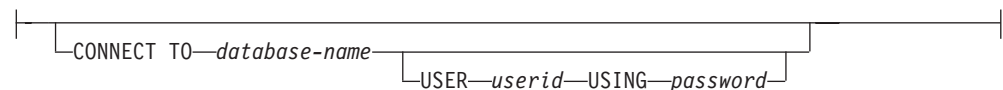
**Authorization**

According to the DB2 catalog views, the user ID in this command must have the CONTROL privilege on the table the full-text index was created for.

**Command syntax**



**connection-options:**



## Command parameters

### **index-schema**

The schema of the text index. This is specified in the CREATE INDEX command. If no schema is specified, the user ID of the DB2 connection is used.

### **index-name**

The name of the text index. This is specified in the CREATE INDEX command.

### **REORGANIZE**

If a text column is frequently updated, then subsequent updates to the index can become inefficient. To make the update process efficient again, reorganize the index. Use the DB2EXT.TEXTINDEXES view to determine if an index needs to be reorganized.

Use the REORGANIZE AUTOMATIC option of the CREATE INDEX command to avoid manually checking and reorganizing the index.

<b>Note:</b> The reorganization process takes place after a regular update.
---

### **USING UPDATE MINIMUM**

Uses the UPDATE MINIMUM settings from the CREATE INDEX command and starts an incremental update only if the specified number of changes was reached. The default is to unconditionally start the update.

For distributed databases, the UPDATE MINIMUM is checked on every node.

### **COMMITCOUNT count**

An INTEGER value  $\geq 0$  determines the number of documents processed in one transaction by the search engine and by DB2 for incremental index updates. You can change this value using the ALTER INDEX command.

However, for initial updates, such as the first update after the CREATE INDEX command, or any update with RECREATE INDEX ON UPDATE option, there is only one logical transaction which ignores COMMITCOUNT.

Using a non-zero COMMITCOUNT is not recommended.

### **CONNECT TO database-name**

The name of the database that is target for this command. You can omit this parameter, if DB2DBDFT is set and the user is running the command on the server. Note that the user ID must have the required DB2 authorizations.

### **USER userid USING password**

Use a password and userid to connect to the database. If not specified, a connection is attempted from the current user ID without a password.

## Usage

This command runs synchronously. It starts the update processing on all required DB2 logical/physical nodes in a distributed DB2 environment. The duration depends on the number of documents to indexed and the number of documents already indexed. The status of the update can be seen through a view that is created for each index. The name of this view can be retrieved from DB2EXT.TEXTINDEXES in column EVENTVIEWNAME.

There are two options to view the number of committed documents that have been processed. To determine if an update is still running and how many documents have been committed to the index, use the DB2EXT.TEXTINDEXES (NUMBER\_DOCS) view. Use the event view associated with the index for information on starting, committing changes, and finishing update processing.

To view the number of documents that have been processed, use the CONTROL LIST ALL LOCKS FOR INDEX command.

**Note:** The views only display information from the connected node.

For incremental updates on a base table with multiple physical nodes, the time on each node must be synchronized. If the times are not synchronized, updates may be lost or may not occur at all.

You cannot issue the command if one of the following commands is running on the index:

- CLEAR EVENTS
- ALTER INDEX
- DROP INDEX
- ACTIVATE CACHE
- DEACTIVATE CACHE
- UPDATE INDEX

After updating an index with a deactivated persistent cached result table, the persistent cache is deleted, such that the next ACTIVATE CACHE command recreates it based on the database content.

If the user interrupts this command, all processes involved in the update function will stop. If a commitcount was used in an incremental update, some updates might have been committed and are visible in the index, while others may require a new update command. Forcefully interrupting the update index process has the potential to corrupt the index.

To stop the automatic updating of an index, look for the DB2 instance owner process running the update index command on the partition used for update services. Stop this process and the update processing on all the partitions.

**Note:** As the command works in two separate phases for index creation on all partitions and initial index updates, issue a db2text drop index command to ensure that the index is not partly available. If this command is not issued, the next update, which can be triggered by a manual update command or the update frequency option, would perform a complete re-indexing to ensure a consistent state.

### Changes to the database

- Inserts to the event table
- Delete from the index log table

When using the replication capture tables, the following changes are made to the database.

- A signal is added to the IBMSNAP\_SIGNAL table before starting the initial update
- The synchpoint of IBMSNAP\_PRUNE\_SET is changed after the incremental update

## HELP command

### Purpose

This displays the list of available DB2TEXT commands, or the syntax of an individual DB2TEXT command.

### Authorization

None required.

### Command syntax



### Command parameters

#### HELP or ?

Provides help for the specified command or reason code.

#### command

The first keywords that identify a DB2TEXT command:

- ENABLE
- DISABLE
- CREATE
- DROP
- ALTER
- UPDATE
- CLEAR
- START
- STOP
- CONTROL
- ACTIVATE
- DEACTIVATE

#### reasoncode

Reason code from a Net Search Extender command.

### Usage

If more than the first keyword is specified, the rest are ignored and the syntax of the identified command is displayed.

If no 'command' parameter is specified after '?' or 'HELP' (or no parameter at all), DB2TEXT lists all available DB2TEXT command parameters.

## COPYRIGHT command

### Purpose

Provides Net Search Extender product and copyright information.



## Authorization

None required.

## Command syntax



## Command parameters

### COPYRIGHT / LEVEL

Provides the version copyright statement, version number, and build information for the product.

---

## Net Search Extender install and uninstall command reference for UNIX

This section describes the syntax of the Net Search Extender install and uninstall commands for UNIX. It also includes the `db2nse1s` command that displays the installed copies of the Net Search Extender product starting with version 9.

## db2nse\_install command

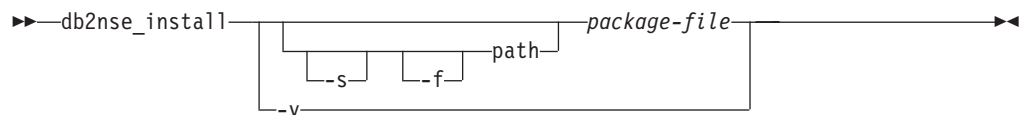
### Purpose

This command installs a new version of Net Search Extender on a UNIX system.

### Authorization

You must run this command as a root user.

### Command syntax



### Command parameters

#### package-file

The name of the file containing the Net Search Extender product.

**path** The DB2 path where you now want to install Net Search Extender.

**-s** Silent installation. Checks are carried out and a log file is written to the /tmp directory.

**-f** Force installation. No checks are done.

**-v** Displays the program version and exits.

### Usage

This command installs Net Search Extender contained in the package file passed as a parameter. If you do not specify any additional parameters, the installation program checks the system for eligible copies of DB2 where Net Search Extender

can be installed. All DB2 installation paths are listed but only a viable subset is selectable. You are asked by the system to select an installation path.

If you select to install silently, there is no user interaction. The outcome of the installation process is passed as a return code to the calling program which might be a command shell or a shell script. It is up to you to handle the return code correctly. A log file that documents the installation is written to the /tmp directory.

If you select to force install, there is no user interaction and there are no additional checks. The outcome of the installation process is passed as a return code to the calling program which might be a command shell or a shell script. It is up to you to handle the return code correctly. A log file that documents the installation is written to the /tmp directory.

Both the parameters **-s** and **-f** require that a **path** is passed. No default path exists for these parameters.

If the **-v** parameter is passed, only the version of the program is displayed and the program exits without any further action.

## db2nse\_deinstall command

### Purpose

This command removes Net Search Extender on a UNIX system. The `db2nse_deinstall` command is located in each install subdirectory of a DB2 copy where Net Search Extender is installed.

### Authorization

You must run this command as a root user.

### Command syntax

▶▶ `db2nse_deinstall` \_v\_ ▶▶

### Command parameters

**-v** Displays the program version and exits.

### Usage

This command removes Net Search Extender beginning with V9. The command removes the copy of Net Search Extender in the directory where it is issued. It does not remove other copies of Net Search Extender installed elsewhere.

## db2nsels command

### Purpose

This command displays a table containing all of the installed copies of Net Search Extender. It only displays versions starting with version 9. The `db2nsels` command is located in the /usr/local/bin directory.

## Authorization

You must run this command as a root user.

## Command syntax



## Command parameters

- c Displays the installed Net Search Extender versions as a simple compact list separated by colons, and exits.
- v Displays the program version, for example 9.0.0.0, and exits.

## Usage

This command lists all of the installed copies of Net Search Extender starting with version 9. The result is displayed either in a table or as a compact list where the items are separated by colons. The results include the path, the version and the fix pack number of the Net Search Extender installation.

For example, if you call `db2nse1s` with no parameter, the output might be as follows:

```
db2nse1s
```

Install path	Level	FP
/opt/ibm/db2/V9.0	9.0.0.0	0
/test/V9.0	9.0.0.0	0

If you use the `-c` parameter, the returned output is a compact list where each information item is separated by a colon. This type of output is easy to handle using a program or a shell script. For example:

```
db2nse1s -c

#PATH:VRMF:FIXPACK
/opt/ibm/db2/V9.0:9.0.0.0:0
/test/V9.0:9.0.0.0:0
```

---

## Syntax of search arguments

A search argument is the condition that you specify when searching for terms in text documents. It consists of search parameters and one or more search terms.

Examples of search arguments are given in “Specifying SQL search arguments” on page 65, and in a file called `search` in the Net Search Extender samples directory.

The SQL scalar search functions that use search arguments are:

### CONTAINS

This function uses a search argument to search for text in a particular text document. It returns the INTEGER value 1 if the document contains the text, or any relation specified in the search argument. Otherwise, it returns 0.

## NUMBEROFMATCHES

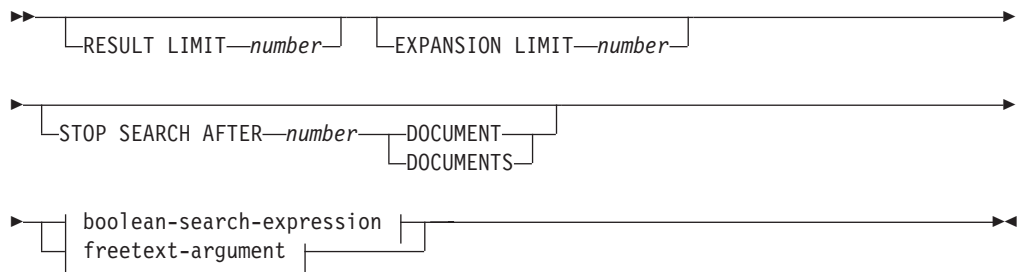
This function uses a search argument to search in text documents and returns an INTEGER value indicating how many matches resulted per document.

## SCORE

This function uses a search argument to search in text documents. It returns a value for each document found, indicating how well the found document is described by the search argument compared to other documents in the same index.

**Note:** The same syntax is used in the search arguments of the stored procedure search and the SQL table-valued function.

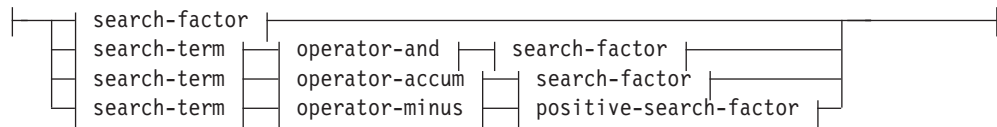
## Search argument syntax



### Boolean-search-expression:



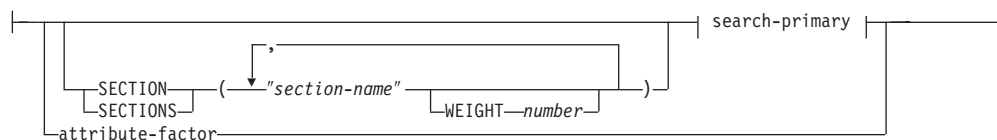
### search-term:



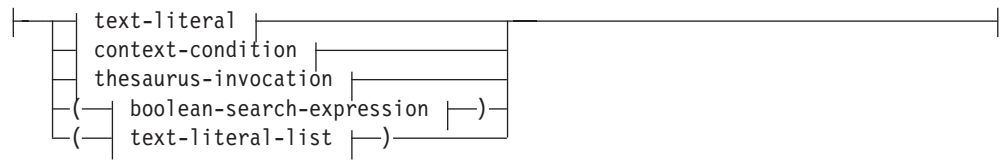
### Search-factor:



### Positive-search-factor:



**Search-primary:**



**Operator-and:**



**Operator-or:**



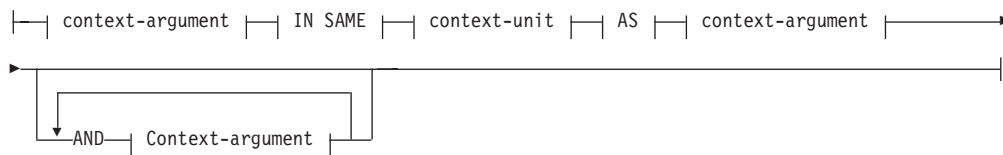
**Operator-accum:**



**Operator-minus:**



**Context-condition:**



**Context-argument:**



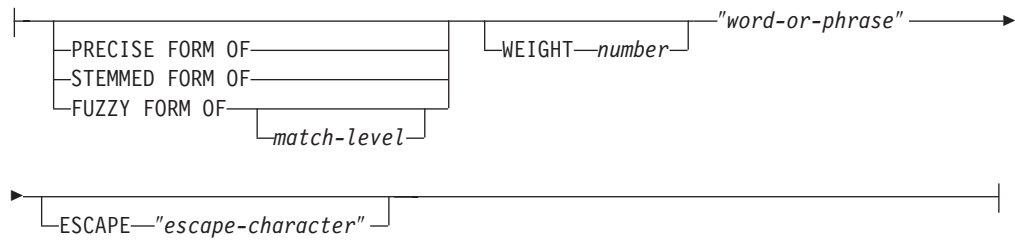
**Text-literal-list:**



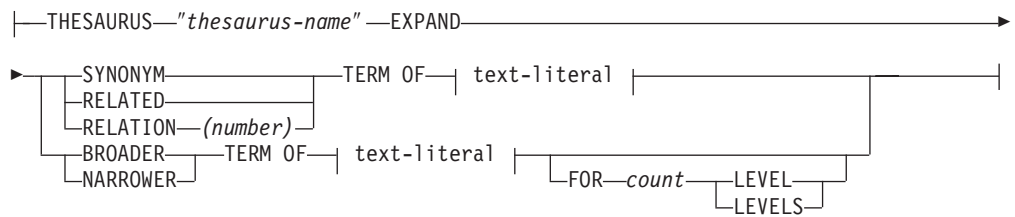
**Context-unit:**



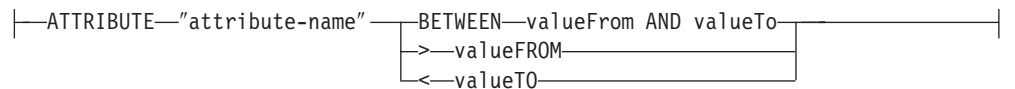
### Text-literal:



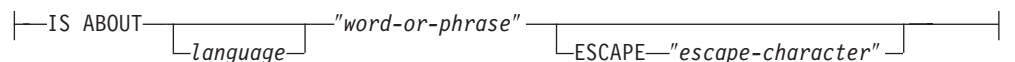
### thesaurus-invocation:



### Attribute-factor:



### freetext-argument:



## Examples

Examples are given in "Specifying SQL search arguments" on page 65.

## Search parameters

### Parameters

#### RESULT LIMIT number

A keyword specifying the maximum number of results to be returned by the full-text search.

The RESULT LIMIT should be used together with the SCORE function to ensure that the returned results are scored and only the best matching results are processed.

#### EXPANSION LIMIT number

A keyword specifying the maximum number of terms that a wildcard term can be expanded to for searching. For example, to determine how many times you can expand the search term 'a\*'. If your index is very large and you are using many wildcard terms, you must adjust the value of this keyword if you want to obtain a larger result set. The expansion order depends on the internal organization of the text index and cannot be predetermined.

### **STOP SEARCH AFTER number DOCUMENTS(S)**

A keyword specifying the search threshold. The search is stopped when the given number of documents is reached during the search, and an intermediate result is returned. A lower value will increase the search performance, but may lead to fewer results and omit documents with a potentially high rank.

Note that there is no default value and the *number* value must be a positive integer.

### **boolean-search-expression**

The search-terms and search-factors can be combined using the boolean operators NOT, AND, OR, ACCUM, and MINUS according to the syntax diagrams. The operators have the following precedence order (with the strongest first): NOT > MINUS = ACCUM = AND > OR. This can be seen in the following example:

```
"Pilot" MINUS "passenger" & "vehicle" | "transport" & "public"
```

is evaluated as:

```
(( "Pilot" MINUS "passenger" ) & ( "vehicle" )) | ( "transport" & "public" )
```

The operator ACCUM evaluates to true, if one of the boolean arguments evaluates to true (which is comparable to the OR operator). The rank value is computed by accumulating rank values from both operands. The ACCUM operator has the same binding (precedence) as AND. The operator MINUS evaluates to true, if the left operand evaluates to true. The rank value is computed by taking the rank value for the left operand and subtracting a penalty, if the right operand evaluates to true.

### **search-primary**

A search-primary, consisting of a text-literal-list evaluates to true, if any of the text-literals is found in the (specified section of the) document. A search-primary consisting of a thesaurus-invocation evaluates to true, if any of the expanded text-literals is found in the (specified section of the) document.

### **SECTION(S) section-name**

A keyword specifying one or more sections in a structured document that the search is to be restricted to. The section name must be specified in a model file specified at index creation time or be expressed in XPath notation.

Section names are case sensitive. Ensure that the case of the section name in the model file and query is identical.

This model describes the structure of documents that contain identifiable sections, so that the content of these sections can be individually searched. Section names cannot be masked using masking characters. The *positive-search-factor* using the SECTION clause evaluates to true, if the search primary is found in one of the specified sections.

Section names are not valid XPath expressions that are evaluated during query execution. If no model file is used, the default section names are phrased in XPath notation. The absolute path expression to the element (such as `/father/child/grandchild`) is used as the name for identifying the section. Full XPath expressions are not supported as section names.

### **context-argument IN SAME context-unit AS context-argument AND context-argument ...**

This condition lets you search for a combination of text-literals occurring in the same paragraph or same sentence. Context arguments are always equivalent to text-literal-lists, and thesaurus expansion may be used to expand a text-literal to such a list.

The condition evaluates to true, if there is a context-unit (paragraph or sentence, respectively ) in the document, which contains at least one of the text-literals of each expanded context-argument. This can be seen in the following example:

```
("a","b") IN SAME PARAGRAPH AS ("c","d")  
AND THESAURUS "t1" EXPAND SYNONYM TERM OF "e".
```

Assuming e1, e2 are synonyms of e, the following paragraphs would match:

```
".. a c e .." , ".. a c e1.." , "a c e2..",  
".. a d e .." , ".. a d e1.." , "a d e2..",  
".. b c e .." , ".. b c e1.." , "b c e2..",  
".. b d e .." , ".. b d e1.." , "b d e2..".
```

### **PRECISE FORM OF**

A keyword that causes the word (or each word in the phrase) following PRECISE FORM OF to be searched for exactly as typed. This form of search is case-sensitive; that is, the use of upper- and lowercase letters is significant. For example, if you search for mice, you do not find "Mouse".

This parameter requires that the index configuration parameter Respect case is set to yes. This configuration setting cannot be changed after the index has been built.

### **STEMMED FORM OF**

A keyword that causes the word (or each word in the phrase) following STEMMED FORM OF to be reduced to its word stem before the search is carried out. This form of search is not case-sensitive. For example, if you search for mouse, you find "Mouse".

The way in which words are reduced to their stem form is language-dependent. Currently, only English stemming is supported and the word must follow regular inflection endings.

### **FUZZY FORM OF**

A keyword for making a "fuzzy" search, which is a search for terms that have a similar spelling to the search term. This is particularly useful when searching in documents that were created by an Optical Character Recognition (OCR) program. Such documents often include misspelled words. For example, the word economy could be recognized by an OCR program as economy. Note that successful matches are only returned for words in a document where the first three characters match. In the above example, economy is not a match. Fuzzy search cannot be used if a word in the search atom contains a masking character.

### **match level**

An integer between 1 and 100 specifying the degree of similarity, where 100 is more similar than 1. 100 specifies an "exact match", and 60 is already considered a very "fuzzy value". The fuzzier the match level is, the longer the elapsed search time, since more documents qualify for the search. The default match level is 70.



**WEIGHT number**

Associates a text-literal with a weight value to change the default score. The allowed weight values are integers between 0 (the lowest score weighting) and 1000 (the highest); the default value is 100.

**word-or-phrase**

A word or phrase to be searched for. The characters that can be used within a word are language-dependent. It is also language-dependent whether words need to be separated by separator characters. For English and most other languages, each word in a phrase must be separated by a blank character.

To search for a character string that contains double quotation marks, type the double quotation marks twice. For example, to search for the text "wildcard" character, use:

```
""wildcard"" character"
```

Note that in the example, it is only possible to search for one set of quotation marks. You cannot search for two quotation marks in a sequence. There is also a maximum length of 128 bytes for each word or phrase.

**Masking characters**

A word can contain the following masking characters:

**\_ (underscore)**

Represents any single character.

**% (percent)**

Represents any number of arbitrary characters. If a word consists of a single %, then it represents an optional word of any length. A word cannot be composed exclusively of masking characters, except when a single % is used to represent an optional word. If you use a masking character, you cannot use the THESAURUS keyword. Masking characters cannot follow a non-alphanumeric character. Masking characters cannot be used inside a fuzzy search. masking always expands into a single word only.

**ESCAPE escape-character**

A character that identifies the next character as one to be searched for and not as one to be used as a masking character. For example, if an escape-character is \$, then \$%, \$\_, and \$\$ represent %, \_, and \$ respectively. Any % and \_ characters not preceded by \$ represent masking characters.

During search, you are only allowed to use single-byte escape characters. No double-byte characters are allowed.

**THESAURUS *thesaurus-name***

A keyword used to specify the name of the thesaurus to be used to expand a text-literal. The thesaurus name is the file name (without its extension) of a thesaurus that has been compiled using the thesaurus compiler. It must be located in <os-dependent>/sqllib/db2ext/thes. Alternatively, the full path can be specified preceding the file name.

**EXPAND *relation***

Specifies which relation is used to expand the text-literal using the thesaurus. The thesaurus has predefined relations described in the DB2EXTTH command. These are referred to using the following keywords:

- SYNONYM, a symmetrical relationship expressing equivalence.
- RELATED, a symmetrical relationship expressing association.

- BROADER, a directed hierarchical relationship that can be followed by specified depth levels.
- NARROWER, a directed hierarchical relationship that can be followed by specified depth levels.

For user-defined relations, use RELATION(number), that corresponds to the relation definition in DB2TEXTTH.

**TERM OF** *text-literal*

The text-literal, to which other search terms are to be added from the thesaurus.

*count* **LEVELS**

A keyword used to specify the number of levels (the depth) of terms in the thesaurus that are to be used to expand the search term for the given relation. If you do not specify this keyword, a count of 1 is assumed. The value of depth must be a positive integer value.

**ATTRIBUTE** *Attribute-name*

Searches for documents that have attributes matching the specified condition. The attribute-name refers to the name of an attribute expression in the CREATE INDEX command, or to an attribute definition in the document model file.

The attribute-factor is allowed for attributes of type double only. The precision of the value is guaranteed for 15 digits. Numbers that consist of 16 digits and above are rounded. Usage of masking characters is not allowed in attribute-name, valueFrom and, valueTo. For an explanation, see the following:

**BETWEEN valueFrom AND valueTo**

A BETWEEN attribute factor evaluates to true if the value of the attribute is greater than (not equal to) valueFrom and smaller than (not equal to) valueTo.

*>valueFrom*

A ">" attribute factor evaluates to true if the value of the attribute is greater than (not equal to) valueFrom.

*<valueTo*

A "<" attribute factor evaluates to true if the value of the attribute is lower than (not equal to) valueTo.

If the attribute name in the CREATE INDEX command is specified with quotes, or is defined in a model file, the specified attribute name must match exactly. Whereas, if no quotes are specified in the CREATE INDEX command, the attribute name must be in uppercase.

**IS ABOUT language word-or-phrase**

An option that lets you specify a free-text search argument. Using IS ABOUT, you can search for any (but not necessarily all) of the words that you specify in word-or-phrase in any order in a document. The closer together the terms used in word-or-phrase are and the more terms that are included in a document, the higher the returned score for the document.

The parameter language is optional and must be set only for Thai (TH\_TH) where it is required for tokenization purposes. It has no affect on any other language.

Note that IS ABOUT is useful only if document score values are requested and the search results are ordered by score values.

---

## SQL scalar search function and the SQL table-valued function

Net Search Extender provides SQL scalar search functions and an SQL table-valued function for searching text documents stored in DB2.

This section describes the following SQL search functions.

Search function	Purpose
"CONTAINS scalar function"	Searches for text in a particular document.
"NUMBEROFMATCHES scalar function"	Searches and returns the number of matches found.
"SCORE scalar function" on page 156	Searches and returns the score value of a found text document.
"DB2EXT.TEXTSEARCH command" on page 156	The SQL table-valued function returns a table of found primary keys, a number of matches, and/or score values.
"DB2EXT.HIGHLIGHT" on page 159	To get information about why a document qualified as a search result.

### CONTAINS scalar function

#### Purpose

The CONTAINS scalar function searches for text in a text document indexed by Net Search Extender. It returns the INTEGER value 1 if the document contains the text, or any relation specified in the search argument. Otherwise, it returns 0.

#### Function syntax

►► CONTAINS (—*column-name*—, —*search-argument*—) ◀◀

#### Function parameters

##### column name

The name of a table column. The column must have an associated text index. You can create text indexes by using the administration command DB2TEXT CREATE INDEX.

##### search-argument

A string of type VARCHAR containing the terms to be searched.

<b>Note:</b> You cannot use the CONTAINS query on a text index created on a view.
---

### NUMBEROFMATCHES scalar function

#### Purpose

The NUMBEROFMATCHES scalar function searches in text documents and returns an INTEGER value indicating how many matches resulted per document.

## Function syntax

►►—NUMBEROFMATCHES—(—*column-name*—,—*search-argument*—)—►►

## Function parameters

### column name

The name of a table column. The column must have an associated text index. You can create text indexes by using the administration command `DB2TEXT CREATE INDEX`.

### search-argument

A string of type `VARCHAR` containing the terms to be searched.

**Note:** You cannot use the `NUMBEROFMATCHES` query on a text index created on a view.

## SCORE scalar function

### Purpose

The `SCORE` scalar function searches in text documents and returns a score value for each document found, indicating how well the found document is described by the search argument.

`SCORE` returns a `DOUBLE` value. As the search term appears more frequently in the document, the score of the document increases.

## Function syntax

►►—SCORE—(—*column-name*—,—*search-argument*—)—►►

## Function parameters

### column name

The name of a column. The column must have an associated text index. You can create text indexes by using the administration command `DB2TEXT CREATE INDEX`.

### search-argument

A string of type `VARCHAR` containing the terms to be searched.

**Note:** You cannot use the `SCORE` query on a text index created on a view. The values returned by score are only meaningful if they are compared to other values retrieved from the same index.

## DB2EXT.TEXTSEARCH command

### Purpose

In addition to the stored procedure search and the SQL scalar search functions, Net Search Extender provides two SQL table-valued functions which look very similar to the stored procedure.

Both table-valued functions are called `db2ext.textsearch`. The only difference between them is that one supports the `HIGHLIGHT` function and has two additional parameters, `numberOfHits` and `hitInformation`.

Both table-valued functions return the results from the user tables sorted according to the sort criteria defined in the parameter called INITIAL SEARCH RESULT ORDER in the CREATE INDEX command. If the SQL query statement containing the table-valued function has a join at the end of the statement (for example, something like where T.primkey = S.key), the order of the result rows depends on the join method and not on the order defined in the CREATE INDEX command.

Note that you can not use the table-valued function on tables with a compound primary key.

**Note:** The table-valued function may be used in a distributed DB2 environment only if the user table is stored in a single-node tablespace. You must also ensure that you connect to the correct node using the DB2NODE environment variable.

#### 1. db2ext.textsearch without highlight support

```
db2ext.textSearch
(
  query           VARCHAR(4096),
  indexSchema     VARCHAR(128),
  indexName       VARCHAR(128),
  resultFirstRow  INTEGER,
  resultNumberRows  INTEGER,
  primKeyBinding  <supported types>,// same type as primary key
)

return table
(
  primKey         <supported types>,// same type as primary key
  numberOfMatches INTEGER,
  score           DOUBLE,
  totalNbResults  INTEGER
)
```

#### 2. db2ext.textsearch with highlight support

```
db2ext.textSearch
(
  query           VARCHAR(4096),
  indexSchema     VARCHAR(128),
  indexName       VARCHAR(128),
  resultFirstRow  INTEGER,
  resultNumberRows  INTEGER,
  primKeyBinding  <supported types>,// same type as primary key
  numberOfHits   INTEGER
)

return table
(
  primKey         <supported types>,// same type as primary key
  numberOfMatches INTEGER,
  score           DOUBLE,
  totalNbResults  INTEGER
  hitInformation BLOB(20K)
)
```

## Function parameters

The following are input parameters.

**query** See “Syntax of search arguments” on page 147 for additional information.

**indexSchema, indexName**

Identifies the index to search.

**resultFirstRow**

The result list of the query is returned in parts. This parameter describes which row of the query result list is the first one to be entered into the result table of the table-valued function. The value must be  $\geq 0$ .

Note that the number 0 identifies the first row in the query result list.

**resultNumberRows**

This parameter describes how many rows of the query result list are entered into the result table of the table-valued function, and where 0 means that all the results need to be returned.

Note that this is different from the result limit query parameter that determines the maximum size of the query result list.

**primaryKeyBinding**

The type of this parameter determines the type of the primaryKey Output parameter. If the text index has been created for a base table with a primary key of type <type1>, then primaryKeyBinding must also be of type <type1>.

Additionally, the parameter determines the scope of the text search. If primaryKeyBinding is set to NULL ("CAST(NULL as <type1>)", the scope of the search will be all the documents stored in the index. Alternatively, you can restrict the search to documents primaryKeyBinding is bound to.

For example, if primaryKeyBinding is set to CAST(5 as BIGINT), you restrict the search to the single document with the BIGINT primary key value of "5".

Note that only single column primary keys of the following types are supported: SMALLINT, INTEGER, BIGINT, REAL, DOUBLE, VARCHAR FOR BIT DATA, DATE, TIME, and TIMESTAMP.

**numberOfhits**

This option specifies the number of terms that are highlighted using the highlighting function called db2ext.highlight. If 0 is specified, all of the hits are highlighted up to a maximum of 1100 hits. This process may be time-consuming.

## Function parameters

The following return values are stored in a temporary table which needs to be joined to your user table if further results are requested. Note that the NUMBEROFMATCHES, SCORE, TOTALNUMBEROFRESULTS, and HITINFORMATION are only calculated if they are requested in your select statement.

**primKey**

The primary key of the found document.

**numberofmatches**

NUMBEROFMATCHES is an INTEGER value indicating how many matches resulted for each document.

**score** Score returns a DOUBLE value. As the search term increases in frequency in the document, the document score increases.

### **totalNumberOfResults**

The query result list denotes how many results were found. Note that each row has the same value.

Also note that when you use the STOP SEARCH AFTER, or the RESULT LIMIT together with the SCORE syntax in a query, this number is no longer reliable.

### **hitInformation**

The hit information returned by `db2ext.textsearch` is necessary for highlight processing. Currently, hit information for approximately 1100 hits can be contained in this output parameter. If the number of hits exceeds this threshold, hit information for these further hits is ignored.

Note that this value is only returned if you specify `numberOfHits`.

## **Usage**

With the SQL table-valued function you are able to search on views in the same way you do with the stored procedure search. Only with the SQL table-valued function no shared memory is needed, so the index does not need to have a cache that must be activated.

This function is primarily for those users who have used an SQL query within the stored procedure search. However, the restriction is that only a single column primary key on base tables is supported.

The following example shows how you can work on a multi-column primary key table:

```
select s.id from
db2ext.sample s, table (db2ext.textSearch(
    "characteristics",
    'DB2EXT',
    'COMMANDS',
    1,
    20,
    cast(NULL as INTEGER))) t
where s.id = t.primkey
```

In this example, you must first create a view on this table with a single unique key and then create the index on this view.

For an example of using the SQL table-valued function with the `db2ext.highlight` function, see "DB2EXT.HIGHLIGHT."

## **DB2EXT.HIGHLIGHT**

### **Purpose**

Use the `db2ext.highlight` function to get information that can be used to display why a particular document qualifies as a search result. More specifically, it can be used to:

- get hits
- get hits and surrounding text
- get the document with user-defined highlight tags surrounding the hits.

Note that the `db2ext.highlight` function can only be used with the `db2ext.textsearch` table-valued function. The table-valued function searches the index providing the results for the HIGHLIGHT function to use.

## Function syntax

►—db2ext.highlight—————►  
►—(—document-content—,—hit-information—,—hit-processing-information—)—►

## Function parameters

The following are input parameters:

### document content CLOB(100K)

Only UTF8 documents of TEXT or serialized XML format are supported. For highlighting natively stored XML documents, the XML data must be serialized to CLOB by using the XMLSERIALIZE SQL/XML function.

To increase the CLOB value, use the “DB2EXTTH (utility) command” on page 140.

### hit information BLOB(20K)

A string containing hit information. This is returned by the db2ext.textsearch function, if the numberOfHits parameter is specified.

### hit processing information VARCHAR(1024)

This parameter is a list of option value pairs separated by a comma ‘,’ character with each string character surrounded by “ ” characters. It specifies how highlighting should be processed for the specified document. If none of the options is specified, the original document content is returned unmodified.

#### TAGS = (“STRING”, “STRING”)

This option enables the user to specify the tags to be inserted before and after a hit in the document. If this option is omitted, no tags are added before and after a hit in the document.

#### WINDOW\_NUMBER = INTEGER

This option specifies how many parts (or windows) of the document should be returned by the highlight function. Each window contains one or more hits and the first hit in each window determines the part of the document returned to the user. These hits may or may not have text surrounding the hit.

If this option is omitted, 0 is taken as the default and the entire document containing start and end tags (if specified) is returned. In this case, the WINDOW\_SIZE option is ignored.

#### WINDOW\_SIZE = INTEGER

This option specifies the recommended size of the window in bytes. This actual size may vary, depending on the number of hits, length of hits and the start and end tag sizes. If the option is omitted, 0 is the default and only hits without surrounding text will be returned.

#### WINDOW\_SEPARATOR = “STRING”

This option specifies the tag used to separate one window from the next window. If the option is omitted, “...” is the default value.

#### FORMAT = “STRING”

This option specifies the format of the document. Valid values are



XML or TEXT. If this option is omitted, then TEXT is taken as the default value. Ensure that the format value is the same as that specified during indexing.

**MODEL\_NAME = "STRING"**

This option specifies the model name related to the specified XML document. Note that if the FORMAT is TEXT, this option results in an error condition.

**SECTIONS = ("section-name1", ..., "section-nameN")**

For XML documents, highlighting can be restricted to relevant sections. For example, they can be defined in the model file. To specify these sections, separate the one or more section names with a comma. If this option is omitted, highlighting is performed on the whole XML document. Note that if the FORMAT is TEXT, this option is ignored.

Section specification ("section-name1",..., "section-nameN") used in DB2EXT.HIGHLIGHT must be the same as is for the DB2EXT.TEXTSEARCH function.

## Function parameters

The following are return parameters.

**CLOB(200K)**

The HIGHLIGHT function returns a CLOB value containing the document parts modified by the HIGHLIGHT function.

## Usage

The following example shows how you can use the HIGHLIGHT function:

```
select p.id,
       p.title,
       db2ext.highlight(p.content,
                       t.hitinformation,
                       'TAGS = ("<bf>", "</bf>"),
                       WINDOW_NUMBER = 5,
                       WINDOW_SIZE = 200,
                       WINDOW_SEPARATOR = "...",
                       FORMAT = "XML",
                       SECTIONS = ("section1-name", "section2-name"))
FROM patent p, table (db2ext.textsearch(
                     '"relational database systems"',
                     'DB2EXT',
                     'TI_FOR_CONTENT',
                     0,
                     20,
                     CAST(NULL as BIGINT),
                     15)) t
WHERE p.id = t.primkey
```

Using documents larger than 100 KB will cause the SQL query to terminate and produce an SQL error (SQL 1476N and sql error -433). To avoid this, use the db2exthl command to increase the permitted document content size.

<b>Note:</b> Special characters, such as "newline" will be returned as is.
--

Highlighting natively stored XML documents requires a serialization of these XML documents to CLOB before they can be passed to the HIGHLIGHT table-valued function. The following example shows you how you can use the HIGHLIGHT function on natively stored XML documents using the XMLSERIALIZE SQL/XML function. The patent content of the sample below is stored as native XML. Notice that FORMAT="XML" is also specified:

```
select p.id,
       p.title,
       db2ext.highlight(XMLSERIALIZE(p.content AS CLOB(100K)),
                       t.hitinformation,
                       'TAGS = ("<bf>","</bf>"),
                       FORMAT = "XML",
                       SECTIONS = ("section1-name", "section2-name"))
FROM patent p, table (db2ext.textsearch(
  'xml database systems',
  'DB2EXT', 'TI_FOR_XML',
  0,
  20,
  CAST(NULL as BIGINT),
  15)) t

WHERE p.id = t.primkey
```

## Restrictions

- Only XML and flat text documents are supported.
- Only UTF8 databases are supported. For binary documents, you need to ensure that the documents are encode in UTF8.
- Thai documents are not supported.
- If there is a mismatch between the document format used during indexing and query time the HIGHLIGHT function will return unpredictable results.
- Only hits found in the text parts of a document will be highlighted.
- The highlight function can only be used with the db2ext.textsearch function.
- String values cannot contain the " character.

---

## Stored procedure search function

Net Search Extender provides a stored procedure search for returning predefined result tables. The result table is specified in the cache table section during create index. Use the stored procedure search when you need to return a small number of results in a specific order.

An example would be a Web application where the first 20 rows with the best score are returned, but the rest of the results can also be returned in increments of 20 rows.

**Note:** The stored procedure function may be used in a distributed DB2 environment only if the user table is stored in a single-node tablespace.

You must also ensure that you connect to the correct node using the DB2NODE environment variable.

## DB2EXT.TEXTSEARCH for stored procedure search

### Function syntax

```
db2ext.TextSearch(  
  
    IN      query                VARCHAR(4096),  
    IN      indexSchema          VARCHAR(128),  
    IN      indexName            VARCHAR(128),  
    IN      resultFirstRow       INTEGER,  
    IN      resultNumberRows     INTEGER,  
    IN      scoringFlag          INTEGER,  
    IN      searchTermCountsFlag INTEGER,  
    OUT     searchTermCounts     VARCHAR(4096),  
    OUT     totalNumberOfResults INTEGER )
```

### Function parameters

The following are input parameters.

**Query** See "Syntax of search arguments" on page 147 for further information.

#### **indexSchema, indexName**

To identify the index to search.

#### **resultFirstrow**

The query result list is returned in parts. The parameter describes which row of the query result list is the first one to be put into the result set of the stored procedure. The first row in the query result list is identified by the number 0.

#### **resultNumberRows**

This parameter describes how many rows of the query result list are put into the result set of the stored procedure.

This is not to be confused with the "result limit" expression in the query, which determines the maximum size of the query result list.

The value should be  $\geq 0$ . Where 0 means that all the results need to be returned.

**Note:** If a larger result set is requested, ensure that a temporary user table space is available. If there is none available, then create a table space. The following example creates a table space on a UNIX platform:

```
db2 "create user temporary tablespace tempts managed by system  
    using ('/work/tempts.ts')"
```

#### **scoringFlag**

0 means that there is no scoring and 1 means that there is scoring. If scoring is requested, an additional column with the score values is returned with the highest value first.

#### **searchTermCountsFlag**

This controls the searchTermCounts processing. If searchTermCountsFlag is 0, searchTermCounts is not calculated.

### Function parameters

The following are output parameters.

**searchTermCounts**

The number of occurrences of each search term query in the index. These counts are returned as a blank separated list in the order of search terms in the query.

See the **searchTermCountsFlag** for information.

**totalNumberOfResults**

The total number of results found in the query result list.

Also note that when you use the STOP SEARCH AFTER, or the RESULT LIMIT together with the scoringFlag syntax in a query, this number is no longer reliable.

**Usage**

The columns in the result set returned by the stored procedure are given by the CACHE TABLE option of the DB2TEXT CREATE INDEX command. If scoringFlag=1, then a column of type double is added. This column contains the SCORE value.

Use the following options to increase the performance of a second query with the same string as the first query. Note that this must be in a different cursor window with no totalNumberOfResults required:

- If you do not require scoring, add the following syntax: STOP SEARCH AFTER x DOCUMENTS, where x is the resultFirstRow + resultNumberRows.
- If you require scoring, add the following syntax: STOP SEARCH AFTER y DOCUMENTS, where y is equal to the totalNumberOfResults in the first query.

To ensure that you connect to the correct node for searching, it may be necessary to set the DB2NODE environment variable.

For UNIX, use the following command:

```
export DB2NODE=<no>
```

Note that it is important that all physical nodes have a synchronized time.

For Windows, use:

```
set DB2NODE= <no>
```

**Note:** A fenced user ID that is different from the instance owner ID does not work with partitioned databases.

---

## Net Search Extender messages

Net Search Extender provides the following message types:

- Information and warning messages
- Error messages

Note that the SQL states returned from the search function are 38600 plus the CTE error number.

### Information and warning messages

**CTE0001**

Operation completed successfully.

- CTE0002**  
The update and locking services are up and running.
- CTE0003**  
Index update started.
- CTE0004**  
Index update ended.
- CTE0005**  
Index update commit: "%1", "%2", "%3" documents inserted, updated, and/or deleted successfully.
- CTE0006**  
Problem accessing text index. Check db2diag.log for details.
- CTE0007**  
The section "%1" does not occur in any of the documents or is not a valid document model section name.
- CTE0008**  
Index reorganization started.
- CTE0009**  
Index reorganization ended.
- CTE0010**  
The attribute "%1" is not valid.
- CTE0011**  
Cache activation started.
- CTE0012**  
Cache activation ended.
- CTE0013**  
Persistent cache was removed.
- CTE0014**  
Cache deactivated.

## **Error messages CTE0100 - CTE0199**

This section contains error messages for Net Search Extender

- "CTE0100: A DB2 operation failed. DB2 information: "%2" "%4". " on page 168
- "CTE0101: A search engine operation failed. Reason code: "%2", "%3", "%4", "%5", "%6". " on page 168
- "CTE0102: A general system function failed. Error: "%2". " on page 168
- "CTE0103: An internal error occurred. Location: "%1", "%2". " on page 168
- "CTE0104: Memory allocation error (search engine). " on page 169
- "CTE0105: Memory allocation error. " on page 169
- "CTE0106: Table "%1"."%2" has no primary key. " on page 169
- "CTE0107: Directory "%1" does not exist. " on page 169
- "CTE0108: The internal size "%4" of the key columns on object "%1"."%2" is larger than maximum allowed size of "%3". " on page 169
- "CTE0109: The number of key columns "%3" on object "%1"."%2" is larger than the allowed maximum of "%4". " on page 170
- "CTE0110: The primary key on object "%1"."%2" is larger than allowed." on page 170

- "CTE0111: The file "%1" is not readable. " on page 170
- "CTE0112: The file "%1" cannot be opened. " on page 170
- "CTE0113: Error converting model file "%1" to UTF8 encoding. " on page 170
- "CTE0114: Unable to register document model "%1" in file "%2". " on page 171
- "CTE0115: A locking problem occurred. Lock Manager information: "%1" "%2"." on page 171
- "CTE0116: Operation conflicts with existing lock." on page 171
- "CTE0117: All available lock space for databases is used. Change the configuration." on page 171
- "CTE0118: All available lock space for indexes on a databases is used. Change the configuration." on page 171
- "CTE0119: All available space for locks on an index is used." on page 172
- "CTE0120: Update and locking services configuration file error." on page 172
- "CTE0121: The update and locking services configuration file cannot be opened." on page 172
- "CTE0122: A syntax error was found in the update and locking services configuration file." on page 172
- "CTE0126: The update and locking service input file "%1" is corrupted." on page 172
- "CTE0127: An update and locking service error has occurred. Reason code: "%1"." on page 173
- "CTE0129: NULL values are not allowed to be passed as parameters." on page 173
- "CTE0130: The specified search argument exceeds the maximum length. The current search argument length is "%1" and the maximum supported length is "%2"." on page 173
- "CTE0131: The user-defined function "%1". "%2" does not exist." on page 173
- "CTE0132: The text index "%1". "%2" does not exist." on page 174
- "CTE0133: The text index "%1". "%2" already exists." on page 174
- "CTE0135: The object "%1". "%2" does not exist." on page 174
- "CTE0136: The column "%1" does not exist in "%2"."%3"." on page 174
- "CTE0137: The table space "%1" does not exist." on page 174
- "CTE0138: The table space "%1" is not regular." on page 174
- "CTE0139: The environment variable "%1" is not set." on page 175
- "CTE0140: The database "%1" is already enabled for text." on page 175
- "CTE0141: The database "%1" is not enabled for text." on page 175
- "CTE0142: The command requires control authority on "%1". "%2" granted to user "%3"." on page 175
- "CTE0143: The command requires database administration authority for user "%1"." on page 175
- "CTE0144: There is at least one text index active in database "%1". " on page 176
- "CTE0145: The CCSID "%1" is not supported." on page 176
- "CTE0146: The language "%1" is not supported." on page 176
- "CTE0147: The format "%1" is not supported." on page 176
- "CTE0148: The specified format "%1" does not accept a model file." on page 176
- "CTE0149: Too many terms (beginning with "%1") are specified for the index update frequency." on page 176

- "CTE0150: Unexpected end of command. Check the command syntax." on page 177
- "CTE0151: Token "%1" is unexpected. Check the command syntax." on page 177
- "CTE0152: Token "%1" is too long." on page 177
- "CTE0153 : Token "%1" occurs twice in the update frequency." on page 177
- "CTE0154: The value "%1" for "%2" is out of range. The valid range is "%3" - "%4"." on page 177
- "CTE0155: The search string is empty." on page 178
- "CTE0157: Syntax error near "%1"." on page 178
- "CTE0158 : The freetext search string is missing." on page 178
- "CTE0159 : Search string exceeds the allowed length of "%1"." on page 178
- "CTE0160 : No section name has been specified in the search string." on page 178
- "CTE0162: The escape command could not be processed." on page 178
- "CTE0163: No thesaurus name specified in thesaurus clause." on page 179
- "CTE0164 : Syntax error in thesaurus relation "%1"." on page 179
- "CTE0166: Freetext must be the last statement in search query." on page 179
- "CTE0167 : Syntax error in free text query "%1"." on page 179
- "CTE0168 : A left parenthesis in a section statement is missing." on page 179
- "CTE0169: A comma or right parenthesis is missing in a section statement." on page 179
- "CTE0170: A closing double quote is missing." on page 180
- "CTE0171: An open double quote for a section name is missing." on page 180
- "CTE0172: The closing double quote for the section name is missing." on page 180
- "CTE0173: One escape character must be defined in an escape clause." on page 180
- "CTE0174: A blank character is not allowed as an escape character." on page 180
- "CTE0175: An escape clause is defined but no mask character is found in the search phrase." on page 181
- "CTE0176 : The succeeding character of an escape character in the phrase is neither the same character nor a mask character. " on page 181
- "CTE0177: The number value "%1" is invalid." on page 181
- "CTE0178: Mask characters in fuzzy phrase must be preceded by an escape character." on page 181
- "CTE0179: Thesaurus name "%1" exceeds allowed length of "%2". " on page 181
- "CTE0180: Thesaurus "%1" can not be found." on page 181
- "CTE0181: Library "%1" cannot be loaded." on page 182
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**CTE0100: A DB2 operation failed. DB2 information: “%2” “%4”.  
Explanation**

A DB2 error occurred that does not allow further processing.

**What to do**

For more detailed information on this DB2 error, use db2 ? SQLxxx.

**CTE0101: A search engine operation failed. Reason code: “%2”, “%3”, “%4”, “%5”, “%6” .**

**Explanation**

A Search Engine error occurred that does not allow further processing.

**What to do**

For more detailed information, see the Search Engine reason code descriptions.

**CTE0102: A general system function failed. Error: “%2”.  
Explanation**

A system error occurred that does not allow further processing.

**What to do**

Additional information can be found on UNIX in the errno.h header file.

**CTE0103: An internal error occurred. Location: “%1”, “%2”.  
Explanation**

An internal processing error that does not allow further processing. Try to start and stop the update and locking services, as well as DB2.

**What to do**

If the error persists, start a trace and also check the db2diag.log.



**CTE0104: Memory allocation error (search engine).****Explanation**

The system has run out of memory.

**What to do**

Increase the available memory size for the instance owner, or stop other processes running parallel.

**CTE0105: Memory allocation error.****Explanation**

The system has run out of memory.

**What to do**

Increase the available memory size for the user, or stop other processes running parallel.

**CTE0106: Table "%1"."%2" has no primary key.****Explanation**

You tried to create an index on a table that does not have a primary key.

**What to do**

Call the db2 alter table to ensure the existence of a primary key. Then try to create the index again.

**CTE0107: Directory "%1" does not exist.****Explanation**

You specified a directory which does not exist.

**What to do**

Create the directory, ensure accessibility to the instance owner. Then try to specify the directory again. Note that in a distributed DB2 environment, this directory has to exist on every physical node.

**CTE0108: The internal size "%4" of the key columns on object "%1"."%2" is larger than maximum allowed size of "%3".****Explanation**

The internal representation of the key columns exceeds the maximum size.

**What to do**

Change the layout of the table before creating the index again. Use smaller key columns, which also benefit performance.

**CTE0109: The number of key columns "%3" on object "%1"."%2" is larger than the allowed maximum of "%4".**

**Explanation**

A maximum number of 14 key columns is supported.

**What to do**

Change the layout of the table before creating the index again.

**CTE0110: The primary key on object "%1"."%2" is larger than allowed.**

**Explanation**

The primary key length exceeds the maximum size. The primary key length limit is based on the page size of the tablespace used by the table:

Max Key Length	Page size
1007	4K
2031	8K
4079	16K
4094	32K

Note that if the primary key consists of more than one column, the mentioned limits must be reduced by 2 bytes for each additional column.

**What to do**

Change the layout of the table before creating the index again. Use smaller key columns, which also benefit performance.

**CTE0111: The file "%1" is not readable.**

**Explanation**

The file specified cannot be read.

**What to do**

Check the access rights for the file. Take into account that the Stored Procedure runs as a fenced user ID, which may also require rights to work on this file.

**CTE0112: The file "%1" cannot be opened.**

**Explanation**

The file specified could not be opened.

**What to do**

Verify that the file is correctly specified.

**CTE0113: Error converting model file "%1" to UTF8 encoding.**

**Explanation**

The specified CCSID or the default database CCSID does not match the model file CCSID.

### **What to do**

Ensure correct specification of the model file CCSID.

### **CTE0114: Unable to register document model "%1" in file "%2".**

#### **Explanation**

The model file could not be used.

### **What to do**

Check that the model file syntax is correctly specified.

### **CTE0115: A locking problem occurred. Lock Manager information: "%1" "%2".**

#### **Explanation**

An internal locking problem occurred.

### **What to do**

Check the current locks using the `db2text control` command. Using the same command, clean up the pending locks. If this does not help, stop and restart the locking and update services.

### **CTE0116: Operation conflicts with existing lock.**

#### **Explanation**

You have tried to use a command that is currently not allowed when other commands are running on the index.

### **What to do**

Check the locks held on this index to see which commands are currently running. Wait until the other commands have finished. If the operation is no longer running but the lock is still active, clean up the locks for the index and try again.

### **CTE0117: All available lock space for databases is used. Change the configuration.**

#### **Explanation**

You tried to work on more databases than are configured in your lock file.

### **What to do**

Change the number of databases you want to work in parallel with in your lock configuration `db2ext1m.cfg`. Restart the update and locking services using the `db2text stop` and `db2text start` commands.

### **CTE0118: All available lock space for indexes on a databases is used. Change the configuration.**

#### **Explanation**

You tried to work on more indexes for one database than are configured in your lock file.

### **What to do**

Change the number of indexes you want to work in parallel with in your lock configuration file `db2ext1m.cfg`. Restart the update and locking services using the `db2text stop` and `db2text start` commands.

### **CTE0119: All available space for locks on an index is used.**

#### **Explanation**

The operations you are running require more locks for one index than are configured in your lock configuration file.

### **What to do**

Change the number of locks you want to work in parallel with in your lock configuration `db2ext1m.cfg`. Restart the update and locking services using the `db2text stop` and `db2text start` commands.

### **CTE0120: Update and locking services configuration file error.**

#### **Explanation**

The configuration file `db2ext1m.cfg` is in error.

### **What to do**

Check the `db2ext1m.cfg` file and correct the error. Restart the update and locking services using the command `db2text start`.

### **CTE0121: The update and locking services configuration file cannot be opened.**

#### **Explanation**

The file `db2ext1m.cfg` could not be opened.

### **What to do**

Check if the file exists and that it can be accessed. If the file cannot be accessed, try to update your db2 instance using `db2iupdt`.

### **CTE0122: A syntax error was found in the update and locking services configuration file.**

#### **Explanation**

A syntax error was found in the update and locking services configuration file.

### **What to do**

Check the update and locking services configuration file for errors.

### **CTE0126: The update and locking service input file "%1" is corrupted.**

#### **Explanation**

A required file for update and locking services is corrupted.

### **What to do**

Check if the file exists and if it can be accessed. If you can access the file, rename the file and restart the update and locking services. The file should be created again. However, this action removes all of the specified frequency updates for create index.

**CTE0127: An update and locking service error has occurred.  
Reason code: "%1".**

#### **Explanation**

An internal error has occurred in the update and locking service area.

### **What to do**

Stop DB2 and Net Search Extender and then clean up your shared resources. Try to start both again. If this does not work, report the problem to your IBM® representative.

**CTE0129: NULL values are not allowed to be passed as parameters.**

#### **Explanation**

DB2 has passed a NULL value to an internal user-defined function.

### **What to do**

First make sure the specified base table has a primary key. Change your select statement to avoid this problem. Switch on the trace function and pass the returned information on to IBM Services.

**CTE0130: The specified search argument exceeds the maximum length. The current search argument length is "%1" and the maximum supported length is "%2".**

#### **Explanation**

The length of the specified search argument is "%1". The maximum length must not exceed "%2".

### **What to do**

Reduce the length of your search argument to "%2".

**CTE0131: The user-defined function "%1". "%2" does not exist.**

#### **Explanation**

The specified user-defined function does not exist in this database.

### **What to do**

Check the name specified for this user-defined function, or register the user-defined function in the database you are using.

**CTE0132: The text index "%1". "%2" does not exist.  
Explanation**

The specified text index does not exist in this database.

**What to do**

Check the name specified and the database you are using. Use the `db2ext.textcolumns` view to see the existing text indexes.

**CTE0133: The text index "%1". "%2" already exists.  
Explanation**

The text index that you specified already exists in this database.

**What to do**

Check the name specified and the database you are using. Use the `db2ext.textcolumns` view to see the existing text indexes.

**CTE0135: The object "%1". "%2" does not exist.  
Explanation**

The specified object name does not exist in this database.

**What to do**

Check the object name specified and the database you are using.

**CTE0136: The column "%1" does not exist in "%2"."%3".  
Explanation**

The specified column does not exist.

**What to do**

Check the column name that you specified. Check the table, view, or database you are using.

**CTE0137: The table space "%1" does not exist.  
Explanation**

The specified tablespace does not exist in this database.

**What to do**

Check the name specified and the database you are using.

**CTE0138: The table space "%1" is not regular.  
Explanation**

The specified table space is not regular. The event table can only be created in a regular table space.

**What to do**

Use this command again with a regular table space.

**CTE0139: The environment variable "%1" is not set.****Explanation**

A required environment variable is not set.

**What to do**

Check your environment, specify the required variable, and use the command again.

**CTE0140: The database "%1" is already enabled for text.****Explanation**

The database you specified is already enabled for text.

**What to do**

Check the name that you specified. Also check the DB2DBDFT variable that implies an implicit connection.

**CTE0141: The database "%1" is not enabled for text.****Explanation**

The database you specified is not enabled for text.

**What to do**

Check the database name you specified and the DB2DBDFT variable. If the database name is correct, use the command `db2text enable database` for text.

**CTE0142: The command requires control authority on "%1". "%2" granted to user "%3".****Explanation**

You do not have the authority to use this command.

**What to do**

Only the owner of this table can use this command or provide you with the required authorization.

**CTE0143: The command requires database administration authority for user "%1".****Explanation**

You do not have the required authority to use this command.

**What to do**

Only the owner of the database can use this command or provide you with the required authorization.

**CTE0144: There is at least one text index active in database "%1".**

**Explanation**

You cannot disable your database until all text indexes are dropped.

**What to do**

See the `db2ext.textcolumns` view for the existing indexes. Drop the existing indexes using the `DROP INDEX` command or specify the `FORCE` option with the `DISABLE DATABASE` command.

**CTE0145: The CCSID "%1" is not supported.**

**Explanation**

The CCSID that you specified is not supported.

**What to do**

Specify a valid CCSID.

**CTE0146: The language "%1" is not supported.**

**Explanation**

The specified language is not supported.

**What to do**

Specify a valid language.

**CTE0147: The format "%1" is not supported.**

**Explanation**

The specified format is not supported.

**What to do**

Specify a valid format.

**CTE0148: The specified format "%1" does not accept a model file.**

**Explanation**

The format "%1" does not support model files.

**What to do**

Use a format that accepts a model file, or remove the model file from your command.

**CTE0149: Too many terms (beginning with "%1") are specified for the index update frequency.**

**Explanation**

The syntax for the update frequency is not correct.



**What to do**

Ensure that the DAY, HOUR, and MINUTE parameters are only specified once.

**CTE0150: Unexpected end of command. Check the command syntax.****Explanation**

The command syntax is not correct.

**What to do**

Check the command syntax. Verify that you specified the required parameters.

**CTE0151: Token "%1" is unexpected. Check the command syntax.****Explanation**

The syntax of the command is not correct.

**What to do**

Check the command syntax and verify that the token you are using is allowed in the specific command.

**CTE0152: Token "%1" is too long.****Explanation**

The token is too long.

**What to do**

Check the command syntax and verify that the token is reduced to the maximum size allowed.

**CTE0153 : Token "%1" occurs twice in the update frequency.****Explanation**

You specified an incorrect syntax for the update frequency.

**What to do**

Ensure that the DAY, HOUR, and MINUTE parameters are only specified once.

**CTE0154: The value "%1" for "%2" is out of range. The valid range is "%3" - "%4".****Explanation**

You specified an incorrect value. The value should be in the allowed range.

**What to do**

Update your command. Change the value to match those in the allowed range.

**CTE0155: The search string is empty.**

**Explanation**

You specified an empty search string.

**What to do**

Check that the search string includes valid alphanumeric characters.

**CTE0157: Syntax error near "%1".**

**Explanation**

You specified an incorrect search syntax.

**What to do**

Check the syntax near %1. Correct and try again.

**CTE0158 : The freetext search string is missing.**

**Explanation**

Specify a freetext string.

**What to do**

Check that the search string after "is about" includes valid alphanumeric characters.

**CTE0159 : Search string exceeds the allowed length of "%1".**

**Explanation**

The search string is too long.

**What to do**

Reduce the size of the search string and try again.

**CTE0160 : No section name has been specified in the search string.**

**Explanation**

You need to specify a valid section name.

**What to do**

Add a valid section name and try again.

**CTE0162: The escape command could not be processed.**

**Explanation**

Your search string includes too many special characters that can be used as masking characters.

### **What to do**

Reduce the number of special characters in your search term, or avoid the escape command. The following special characters can be used: ! \* + , \_ . : ; { } ~ | ? [ ] ` = \

### **CTE0163: No thesaurus name specified in thesaurus clause.**

#### **Explanation**

A thesaurus search is requested without a thesaurus name.

### **What to do**

Specify a thesaurus name in your search argument.

### **CTE0164 : Syntax error in thesaurus relation "%1".**

#### **Explanation**

The specified syntax for the thesaurus relation is not correct.

### **What to do**

Update the thesaurus relation according to the syntax specification.

### **CTE0166: Freetext must be the last statement in search query.**

#### **Explanation**

It is not allowed to have further operators after the "is about" token.

### **What to do**

Rewrite the query string. The last operator must be "is about".

### **CTE0167 : Syntax error in free text query "%1".**

#### **Explanation**

The syntax for the free text string is not correct.

### **What to do**

Update the free text string according to the syntax specification.

### **CTE0168 : A left parenthesis in a section statement is missing.**

#### **Explanation**

The syntax for the section statement is not correct.

### **What to do**

Update the section statement according to the syntax specification.

### **CTE0169: A comma or right parenthesis is missing in a section statement.**

#### **Explanation**

The syntax for the section statement is not correct.

**What to do**

Update the section statement according to the syntax specification.

**CTE0170: A closing double quote is missing.****Explanation**

The specified syntax for the search term is not correct.

**What to do**

Update the search term according to the syntax specification.

**CTE0171: An open double quote for a section name is missing.****Explanation**

The syntax for the section statement is not correct.

**What to do**

Update the section statement according to the syntax specification.

**CTE0172: The closing double quote for the section name is missing.****Explanation**

The syntax for the section statement is not correct.

**What to do**

Update the section statement according to the syntax specification.

**CTE0173: One escape character must be defined in an escape clause.****Explanation**

There can be no more than one character in an escape clause.

**What to do**

Remove the additional characters in the escape clause.

**CTE0174: A blank character is not allowed as an escape character.****Explanation**

It is not allowed to have a blank character in an escape clause.

**What to do**

Change the escape clause to a clause with a valid character.

**CTE0175: An escape clause is defined but no mask character is found in the search phrase.**

**Explanation**

An escape clause is specified without using a mask character.

**What to do**

Remove the escape clause.

**CTE0176 : The succeeding character of an escape character in the phrase is neither the same character nor a mask character.**

**Explanation**

The character after the escape character must be either a masking character or the escape character itself.

**What to do**

Change the search string to correctly use the escape character.

**CTE0177: The number value "%1" is invalid.**

**Explanation**

The specified number in the search argument is not valid.

**What to do**

Check the documentation about the valid range. Update the value in the search argument.

**CTE0178: Mask characters in fuzzy phrase must be preceded by an escape character.**

**Explanation**

Masking together with fuzzy search is not allowed.

**What to do**

Update the search string with an escape character.

**CTE0179: Thesaurus name "%1" exceeds allowed length of "%2".**

**Explanation**

Primary keys longer than 60 bytes are not supported.

**What to do**

Change the layout of the table before creating the index again.

**CTE0180: Thesaurus "%1" can not be found.**

**Explanation**

The thesaurus specified cannot be found.

### **What to do**

Check that the thesaurus files are located in the thesaurus directory or fully qualified.

### **CTE0181: Library "%1" cannot be loaded.**

#### **Explanation**

A library cannot be found.

### **What to do**

Check that the library is located in the library path and available. Start and stop DB2 to ensure that the current settings are used.

### **CTE0182: Function "%1" cannot be loaded from library "%2".**

#### **Explanation**

A library entry point cannot be loaded.

### **What to do**

The library accessed seems to be invalid. Check that the library is specified only once.

### **CTE0183: Error occurred using shared system resources.**

#### **Explanation**

A request to shared system resources like shared memory or semaphores cannot be fulfilled.

### **What to do**

Check the current system status and configuration. On UNIX use the `ipcs` command to check the resources. Stop all applications, such as DB2 and Net Search Extender. If further resources are listed, clean them up using `ipcrm`.

### **CTE0184: No db2text start command was issued.**

#### **Explanation**

A command was called which requires the locking and update services.

### **What to do**

Start the update and locking services with `db2text start`.

### **CTE0185: The update and locking services are already active.**

#### **Explanation**

A `db2text start` is issued but the update and locking services are already running.

### **What to do**

No further action.

**CTE0186: Update and locking service error occurred, check db2diag.log for details.**

**Explanation**

An update and locking service error occurred.

**What to do**

Check the db2diag.log for further information, or clean up your shared resources. See also CTE0183.

**CTE0187: Update and locking services are still active, use FORCE option to stop the services.**

**Explanation**

The db2text stop command has not stopped the locking services, there are still processes running.

**What to do**

Check with db2text control which processes are running and wait for those to finish. If you need to stop them, use the FORCE option.

**CTE0188: There is a temporary problem using update and locking services. Please try again.**

**Explanation**

The db2text stop command has not stopped the locking services. Programs are still running or an inconsistent situation is found.

**What to do**

Check with db2text control which processes are running and wait for those to finish. To stop them, use the FORCE option.

**CTE0189: The executable program "%1" cannot be found.**

**Explanation**

The program file cannot be located or accessed.

**What to do**

Check if the program file is located in the bin or adm directory of the DB2 server. The installation is corrupt if the file cannot be found.

**CTE0190: The executable program "%1" cannot be started.**

**Explanation**

The program cannot be started.

**What to do**

Check if the program is located in the bin or adm directory of the DB2 server and that the appropriated libraries are installed. For further information, call the program manually on the server.

**CTE0191 : The drop index operation is incomplete. Check db2diag.log for details.**

**Explanation**

The drop index operation is incomplete, possibly caused by the FORCE option.

**What to do**

Using the FORCE option drops everything regardless of any errors. Check the index directory for pending files and remove these manually.

**CTE0192: Errors occurred in an update index operation. Check event table "%1". "%2" and db2diag.log for details.**

**Explanation**

During the index update process, any document errors are written to the event table.

**What to do**

Check the event table for more information about the document errors. Clean up the event log after the problems have been fixed.

**CTE0194: The type "%1" of column "%2" is not supported.**

**Explanation**

You used a column that is not in the list of the supported ones.

**What to do**

Check create index for a list of valid columns for Keys and Indexing. Make the appropriate changes to the command and try again.

**CTE0195: "%1" is not an absolute path.**

**Explanation**

An absolute path on the server is required.

**What to do**

Check the path and write an absolute path in the command.

**CTE0198: No corresponding text index.**

**Explanation**

There is no text index on the column.

**What to do**

Check if the text index still exists.

**CTE0199: There is no text index corresponding to column "%1" of table "%2".**

**Explanation**

You tried to search on a column without a text index.



## What to do

Check the column you are searching on, or create a text index on the column.

## Error messages CTE0200 - CTE0360

This section contains error messages for Net Search Extender

- "CTE0200: At least one command option must be specified." on page 188
- "CTE0201: There is a conflict with an existing text index on the same column." on page 188
- "CTE0202: The object "%1"."%2" must be a view when key columns are specified." on page 188
- "CTE0203 : The text index "%1"."%2" was not created with the CACHE TABLE option. This is required for command execution." on page 189
- "CTE0204: An attribute name is missing. Add "AS <attribute name>" to the attribute expression. " on page 189
- "CTE0205: CACHE TABLE expressions are not valid." on page 189
- "CTE0206: ATTRIBUTE expressions are not valid." on page 189
- "CTE0207: KEY COLUMNS FOR INDEX ON VIEW not specified for index on view "%1"."%2"." on page 189
- "CTE0208: INITIAL SEARCH RESULT ORDER columns are not valid." on page 190
- "CTE0209: The type "%1" of attribute column "%2" is not supported, type DOUBLE is required." on page 190
- "CTE0210: The value "%1" for index configuration parameter "%2" is not valid. A valid value is "%3"." on page 190
- "CTE0211: "%1" is not a valid index configuration parameter. " on page 190
- "CTE0212: Internal index configuration file "%1" could not be saved." on page 191
- "CTE0213: Internal index configuration file template "%1" could not be loaded." on page 191
- "CTE0214: Internal error when setting new entry "[%1],%2=%3" for index configuration file. " on page 191
- "CTE0215: Index creation on alias "%1"."%2" is not supported. Use base table "%3"."%4" instead." on page 191
- "CTE0217: The schedule service is already active." on page 191
- "CTE0218: Function "%1" failed with error code "%2"." on page 192
- "CTE0219: The service "%1" could not be opened. Error code "%2". " on page 192
- "CTE0220: The DB2 instance profile path could not be found." on page 192
- "CTE0221: UpdateFrequency "%1" is incorrectly specified." on page 192
- "CTE0222: The schedule service input file "%1" is corrupted." on page 192
- "CTE0223: File "%1" could not be closed." on page 193
- "CTE0224 : File "%1" could not be copied to "%2"." on page 193
- "CTE0225: File "%1" could not be removed." on page 193
- "CTE0227: A write operation on file "%1" failed." on page 193
- "CTE0228: The user has insufficient access rights at the operating system level." on page 193

- “CTE0231: “%1” is not defined in same nodegroup (“%4”) as the table space of “%2”.”%3”.” on page 193
- “CTE0232: The specified or default table space “%1” is not single-noded. This is necessary for an index on a view, or when the CACHE TABLE option is specified.” on page 194
- “CTE0233: There is a conflicting administration command running. Please retry this command later.” on page 194
- “CTE0234: There is a conflicting administration command running on a text index. Please retry this command later, or specify the FORCE option of a DISABLE DATABASE command.” on page 194
- “CTE0235: No valid license found for Net Search Extender.” on page 194
- “CTE0236: Only Node0 is supported on MPP instances.” on page 195
- “CTE0237: Internal error: log table “%1”.”%2” contains an invalid operation “%3”.” on page 195
- “CTE0238: Internal error: table “%1”.”%2” contains an incorrect syntax expression in column “%3”.” on page 195
- “CTE0239: Internal error: total length of index properties “%1” exceeds maximum “%2”.” on page 195
- “CTE0240: Internal error: setting environment variable “%1” failed.” on page 195
- “CTE0242: Value “%1” for parameter “%2” is invalid.” on page 196
- “CTE0243: The cache for text index “%1”.”%2” has not been activated.” on page 196
- “CTE0244: Internal error: call to “%1” returns rc=“%2”, SQLCODE=“%3”.” on page 196
- “CTE0245: The requested cache size exceeds the available cache size. Increase the maximum cache size to a value > “%1” or decrease the pctfree value.” on page 196
- “CTE0246: File “%1” is empty.” on page 197
- “CTE0247: A Net Search Extender stored procedure could not be created.” on page 197
- “CTE0248: The generated search string is too long. Reduce the complexity of search query.” on page 197
- “CTE0249: Executable program “%1” terminated abnormally.” on page 197
- “CTE0250 : The return type “%1” of column type transformation function “%2”.”%3” is not supported.” on page 197
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**CTE0200: At least one command option must be specified.**

**Explanation**

The ALTER INDEX command changes the characteristics of an index, such as the update and storage options. None of the characteristics to be changed was specified.

**What to do**

Specify at least one command option. Refer to the command syntax for all possible options.

**CTE0201: There is a conflict with an existing text index on the same column.**

**Explanation**

A text index defined on the same column was created with different parameters from this create index command.

**What to do**

Correct the parameter values in the create index command. Make sure that following parameters have the same value for the existing index and the index to be created: ccsid, language, format, document model, index configuration, column function, and attributes.

**CTE0202: The object “%1”.”%2” must be a view when key columns are specified.**

**Explanation**

The specified object is not a view. The KEY COLUMNS FOR INDEX ON VIEW clause is only allowed when indexing a column of a view.

**What to do**

Remove the KEY COLUMNS FOR INDEX ON VIEW(SQL-columnname-list) clause.

**CTE0203 : The text index "%1"."%2" was not created with the CACHE TABLE option. This is required for command execution.**  
**Explanation**

This command can only be executed if the specified index was created with the CACHE TABLE option.

**What to do**

Create an index with CACHE TABLE option. Refer to the documentation for the command syntax.

**CTE0204: An attribute name is missing. Add "AS <attribute name>" to the attribute expression.**

**Explanation**

Whenever a column expression is used in the attribute expression, an attribute name must be supplied. For example: (C1+C2 AS myname).

**What to do**

Add "AS <attribute name>" to the attribute expression.

**CTE0205: CACHE TABLE expressions are not valid.**

**Explanation**

The column list in the cache table expression is not valid.

**What to do**

Correct the cache table column list in the create index command. Make sure the columns exist in the specified table. If a function is applied on a column, verify that it is used correctly.

**CTE0206: ATTRIBUTE expressions are not valid.**

**Explanation**

The column list in the attribute expression is not valid.

**What to do**

Correct the attribute column list in the create index command. Make sure the columns exist in the specified table. If a function is applied on a column, verify that it is used correctly.

**CTE0207: KEY COLUMNS FOR INDEX ON VIEW not specified for index on view "%1"."%2".**

**Explanation**

If indexes on views are created, the KEY COLUMNS FOR INDEX ON VIEW(SQL-columnname-list) clause must be specified. The list of column names specifies the columns that UNIQUELY identify a row in the view.

### **What to do**

Include the KEY COLUMNS FOR INDEX ON VIEW(SQL-columnname-list) clause in the create index command.

### **CTE0208: INITIAL SEARCH RESULT ORDER columns are not valid.**

#### **Explanation**

The column list in the INITIAL SEARCH RESULT ORDER(SQL-order-by list) expression is not valid.

### **What to do**

Correct the order by column list in the create index command. Check if the syntax is correct and the columns exist in the specified table. If a function is applied on a column, verify that it is used correctly.

### **CTE0209: The type "%1" of attribute column "%2" is not supported, type DOUBLE is required.**

#### **Explanation**

For attribute columns, the only supported data type is DOUBLE.

### **What to do**

Make sure the attribute columns of the table with the text column to be indexed are of type DOUBLE. It may be possible to use cast operators in attribute column expressions. Refer to the SQL Reference for data types which can be casted to double.

### **CTE0210: The value "%1" for index configuration parameter "%2" is not valid. A valid value is "%3".**

#### **Explanation**

The specified value for the configuration parameter is incorrect. For valid values of the parameters refer to the command syntax.

### **What to do**

Correct the index configuration parameter value in the create index command.

### **CTE0211: "%1" is not a valid index configuration parameter.**

#### **Explanation**

The index configuration option is not known.

### **What to do**

Check the create index command syntax. Valid index configuration options are TreatNumbersAsWords and IndexStopWords. These have to be comma separated: index configuration(treatnumberaswords 1, indexstopwords 1).

**CTE0212: Internal index configuration file "%1" could not be saved.**

**Explanation**

The internal configuration file for the index could not be saved.

**What to do**

Make sure the instance owner has write permissions to the directory the file should be saved in. If a file with the same name already exists, make sure that it is writable for the instance owner.

**CTE0213: Internal index configuration file template "%1" could not be loaded.**

**Explanation**

The internal index configuration file template could not be read.

**What to do**

Make sure the file exists in the correct location and is readable.

**CTE0214: Internal error when setting new entry "[%1],%2=%3" for index configuration file.**

**Explanation**

Internal error while writing an internal configuration file for the index.

**What to do**

If the file exists, check if it is readable and writable for the instance owner. Check that there is enough space on the device where the file is located.

**CTE0215: Index creation on alias "%1"."%2" is not supported. Use base table "%3"."%4" instead.**

**Explanation**

The index cannot be created on the alias.

**What to do**

Type in the create index command with the base table.

**CTE0217: The schedule service is already active.**

**Explanation**

The service is already active, you do not need to start it.

**What to do**

No action required.

**CTE0218: Function "%1" failed with error code "%2".****Explanation**

A Windows function failed with the specified error code which does not allow further processing.

**What to do**

Use the specified Windows system error code to get detailed error information.

**CTE0219: The service "%1" could not be opened. Error code "%2".****Explanation**

The specified service cannot be found on the Windows system.

**What to do**

Check if the specified service is installed on the Windows system. Use the specified Windows system error code to get detailed error information.

**CTE0220: The DB2 instance profile path could not be found.****Explanation**

Internal DB2 function to obtain the DB2 instance profile path failed.

**What to do**

Create a DB2 instance without specifying the instance profile path information and retry the command.

**CTE0221: UpdateFrequency "%1" is incorrectly specified.****Explanation**

The syntax for the update frequency statement is not correct.

**What to do**

Correct the update frequency statement according to the syntax specification.

**CTE0222: The schedule service input file "%1" is corrupted.****Explanation**

The scheduler file containing index update information is corrupted.

**What to do**

Use your system editor and try to correct the problem. Maybe an entry has been truncated, or the ending line character has been deleted. If this does not restore the file content, try the following:

- Call command `db2text stop` to stop the scheduler.
- Delete the scheduler service file.
- Call command `db2text start` to start the scheduler.
- Use command `db2text alter index ...` to recreate the update frequency entries for all concerned indexes.



**CTE0223: File "%1" could not be closed.**

**Explanation**

The file specified cannot be closed.

**What to do**

Verify that the file is correctly specified.

**CTE0224 : File "%1" could not be copied to "%2".**

**Explanation**

The first file cannot be copied to the second file.

**What to do**

Verify that the files are correctly specified. Check if the second file already exists and is read only. Also check if there is enough free space on the system.

**CTE0225: File "%1" could not be removed.**

**Explanation**

The file specified cannot be removed from the system.

**What to do**

Verify that the file is specified correctly and check the file access rights.

**CTE0227: A write operation on file "%1" failed.**

**Explanation**

The file specified is not writable.

**What to do**

Verify that the file is correctly specified and check the file access rights. Also check if there is enough free space on the system.

**CTE0228: The user has insufficient access rights at the operating system level.**

**Explanation**

The command requires administrator rights at the operating system level.

**What to do**

Ensure that you have operating system administrator rights. Check if you are a member of the administrator group.

**CTE0231: "%1" is not defined in same nodegroup ("%4") as the table space of "%2"."%3".**

**Explanation**

The table space of the administration tables is required to be distributed over different nodes in exactly the same way as the table containing the text column to

be indexed. To enforce this, it is checked whether the specified tablespace is defined in the same nodegroup.

#### **What to do**

Specify a table space that is defined in the same nodegroup as the table containing the text column to be indexed.

**CTE0232: The specified or default table space "%1" is not single-noded. This is necessary for an index on a view, or when the CACHE TABLE option is specified.**

#### **Explanation**

An index on a view or with the CACHE TABLE option enabled is only supported for tables on a single node.

#### **What to do**

Put the table in a single-noded table space if the default table space caused this error. Alternatively, specify another single-noded table space, if you specified a multi-noded table space.

**CTE0233: There is a conflicting administration command running. Please retry this command later.**

#### **Explanation**

Another administration command is still running or terminated abnormally without releasing the command lock.

#### **What to do**

Check with CONTROL LIST which locks are still active. If there is an active lock but no command running, clear the lock manually using the CONTROL CLEAR command. Be aware that someone else may be running the administration command holding the lock.

**CTE0234: There is a conflicting administration command running on a text index. Please retry this command later, or specify the FORCE option of a DISABLE DATABASE command.**

#### **Explanation**

Another administration command is still running or terminated abnormally without releasing the command lock.

#### **What to do**

Check with CONTROL LIST which locks are still active. If there is an active lock but no command running, clear the lock manually using the CONTROL CLEAR command. Be aware that someone else may be running the administration command holding the lock. For a DISABLE DATABASE command you may specify the FORCE option which stops all other commands on that database.

**CTE0235: No valid license found for Net Search Extender.**

#### **Explanation**

There was no valid license found for Net Search Extender.

### What to do

Check whether the license was correctly installed with `db2lic`. Make sure existing instances are updated after the product install.

### **CTE0236: Only Node0 is supported on MPP instances.** Explanation

Text Indexes can only be created on MPP instances, if the table with the text column to be indexed resides on Node0.

### What to do

Check the node group of the tablespace in which the table is defined.

### **CTE0237: Internal error: log table "%1"."%2" contains an invalid operation "%3".** Explanation

The log table keeps track of operations executed on the table containing the indexed text column. This table might be corrupted, as it contains an entry not written by Net Search Extender.

### What to do

Check the log table and delete the corrupted entry.

### **CTE0238: Internal error: table "%1"."%2" contains an incorrect syntax expression in column "%3".** Explanation

There is an error in the expression list in the specified text column.

### What to do

Check the delimiter Begin and End pairs.

### **CTE0239: Internal error: total length of index properties "%1" exceeds maximum "%2".** Explanation

The maximum size of the index properties (1016 bytes) is exceeded. The properties contain the instance, index, and work directory as well as other information.

### What to do

Make sure these path names are not too long.

### **CTE0240: Internal error: setting environment variable "%1" failed.** Explanation

Setting the specified environment variable failed. There may be a problem with the environment setup.

### What to do

Check your OS specific guidelines.

### **CTE0242: Value "%1" for parameter "%2" is invalid.**

#### **Explanation**

The search stored procedure or the table valued function DB2EXT.TEXTSEARCH was called with invalid parameters.

### What to do

Correct the parameter values of the search stored procedure or table valued function. For valid parameters refer to the documentation.

### **CTE0243: The cache for text index "%1"."%2" has not been activated.**

#### **Explanation**

A Net Search Extender operation requires an activated cache. The cache is currently not activated. These are the possible reasons:

- The cache has never been activated after the last DB2TEXT START command.
- The cache has been explicitly deactivated with the DB2TEXT DEACTIVATE CACHE command.

### What to do

Perform a DB2TEXT ACTIVATE CACHE command for the index and rerun the Net Search Extender operation.

### **CTE0244: Internal error: call to "%1" returns rc="%2", SQLCODE="%3".**

#### **Explanation**

An internal processing error occurred when calling an internal function.

### What to do

If the error persists, start a trace and check the db2diag.log. Report the error.

### **CTE0245: The requested cache size exceeds the available cache size. Increase the maximum cache size to a value > "%1" or decrease the pctfree value.**

#### **Explanation**

The cache size necessary to load all data exceeds the MAXIMUM CACHE SIZE value for an index. This can be detected during activation of the cache (the DB2TEXT ACTIVATE command), or by an index update operation while the cache is activated.

### What to do

If the error was reported in a DB2TEXT ACTIVATE command, recalculate the maximum cache size using the DB2EXT.MAXIMUM\_CACHE\_SIZE function and alter the MAXIMUM CACHE SIZE setting for the index. Eventually decrease the PCTFREE value. If the maximum number of documents is exceeded during

incremental update, rebuild the cache with the commands db2 deactivate cache and db2text activate cache recreate.

**CTE0246: File "%1" is empty.  
Explanation**

A DB2TEXT CREATE INDEX command failed because the document model file specified in the command is empty.

**What to do**

Specify a valid document model file in the command.

**CTE0247: A Net Search Extender stored procedure could not be created.  
Explanation**

A DB2TEXT ENABLE DATABASE command failed to create the internal stored procedure DB2EXT.CTESRVSP.

**What to do**

Check the additional DB2 error message associated with a CREATE PROCEDURE statement for details. If the error cannot be corrected by removing an existing stored procedure with an identical name, start a trace and report the error.

**CTE0248: The generated search string is too long. Reduce the complexity of search query.  
Explanation**

A Net Search Extender query is too long or too complex to be processed by the base search engine. The complexity is affected by thesaurus expansions, FUZZY FORM OF expressions, and masking characters.

**What to do**

Reduce complexity or length of the query.

**CTE0249: Executable program "%1" terminated abnormally.  
Explanation**

When executing a Net Search Extender command, the executable "%1" was called, but terminated abnormally.

**What to do**

Verify, that the executable was not terminated explicitly by user interaction, for example, a signal. If not, start a trace, rerun the command, and report the error.

**CTE0250 : The return type "%1" of column type transformation function "%2"."%3" is not supported.  
Explanation**

In a DB2TEXT CREATE INDEX command a column type transformation was specified that returns an unsupported datatype. Supported datatypes are: CHARACTER, VARCHAR, LONG VARCHAR, CLOB, GRAPHIC, VARGRAPHIC,

LONG VARCHAR, DBCLOB, BLOB, and XML.

**What to do**

Choose a different column type transformation function.

**CTE0251: Internal error: the column type "%1" is not supported.**

**Explanation**

A column type is used that is not in the list of supported types.

**What to do**

Check create index for a list of valid columns for Keys and Indexing. Make the appropriate changes to the command and try again. If the error persists, start a trace and also check the db2diag.log. Report the error to IBM Services.

**CTE0252: The parameter "%1" is missing.**

**Explanation**

Internal error - when executing a Net Search Extender command, an administration executable program was called with a missing parameter "%1".

**What to do**

Try to change Net Search Extender parameter commands to avoid the problem. If the error persists, switch on the trace function and report the error to IBM Services.

**CTE0253: The document listed in the log view was not found.**

**Explanation**

The contents of a text document that is listed in the log view has changed and could not be accessed.

**What to do**

Check that the document exists and the read/access permissions of the text documents to be included in the index.

**CTE0254: The cache for index "%1" is already activated.**

**Explanation**

The index has already been activated with the ACTIVATE CACHE command.

**What to do**

Check the specified index name and the database that you are using.

**CTE0255 : A column name for a cache result column expression is missing. Add "AS <cache column name>" to the expression.**

**Explanation**

A cache result column expression must be named. For example: 'C1+C2 AS myresult'.

### **What to do**

Add "AS <cache column name>" to the expression.

### **CTE0256: The query necessary to select data for indexing failed. Reduce the complexity of the attribute, cache table, or the initial search result order expressions.**

#### **Explanation**

Net Search Extender creates a query from the expressions in your command to select data for indexing from the database. The query failed because it was too complex.

### **What to do**

Reduce the complexity of attribute, cache table, or initial search result order expressions.

### **CTE0257: Error creating shared memory.**

#### **Explanation**

The shared memory resource could not be created due to a previous error or permission problem.

### **What to do**

Check db2diag.log for further information, or clean up your shared resources. See also error CTE0183.

### **CTE0258: Shared memory version error.**

#### **Explanation**

The shared memory resource could not be accessed because it is corrupted or there is a version conflict.

### **What to do**

Check db2diag.log for further information. Disable and re-enable the database and then try again.

### **CTE0259: Cannot insert entry in global shared memory. Entry already exists.**

#### **Explanation**

An entry to be inserted in global shared memory already exists because of a previous error.

### **What to do**

Check db2diag.log for further information. Restart the update and locking services using the commands db2text stop and db2text start.

**CTE0260: Cannot access entry in global shared memory. Entry not found.**

**Explanation**

An entry to be removed from global shared memory does not exist because of a previous error.

**What to do**

Check db2diag.log for further information. Try to restart the update and locking services using the commands db2text stop and db2text start.

**CTE0261: There is at least one cache activated for a text index in this instance. Deactivate the cache for any activated index using the DEACTIVATE CACHE command, or use the FORCE option to stop.**

**Explanation**

The db2text stop command can only be used if you run a DEACTIVATE CACHE command for all text indexes that have been activated with the ACTIVATE CACHE command.

**What to do**

Deactivate the cache for any activated index using the DEACTIVATE CACHE command or use the FORCE option to stop.

**CTE0262: The value for parameter "%1" is too long.**

**Explanation**

The value exceeds the maximum allowable size.

**What to do**

Check the maximum size.

**CTE0263: The text index "%1"."%2" was created with the RECREATE INDEX ON UPDATE option. In this context, the UPDATE MINIMUM or COMMITCOUNT FOR UPDATE may not be specified.**

**Explanation**

Update minimum and commitcount for update are only effective if the index is updated incrementally.

**What to do**

If you want to recreate the index each time an update is performed, remove the UPDATE MINIMUM and COMMITCOUNT FOR UPDATE settings. If you want to use UPDATE MINIMUM and COMMITCOUNT FOR UPDATE, do not specify RECREATE INDEX ON UPDATE.



**CTE0264: Errors occurred in an activate index operation. Check event view "%1"."%2" and the db2diag.log for details.**

**Explanation**

During the index activate process, errors are written to the event table and the db2diag.log file.

**What to do**

Check the event table for more information about the document errors. Clean up the event log after the problems have been fixed.

**CTE0265: The table space of a user table or administration table space ("%1") is not only defined on node 0.**

**Explanation**

If text indexes are created on MPP instances, the table space of the user table must only reside on Node0.

**What to do**

Use a table where the table space resides on Node0.

**CTE0266: ValueFrom "%1" must be smaller than ValueTo "%2".**

**Explanation**

The values specified in the attribute search are not valid. If the search syntax is 'BETWEEN ValueFrom AND ValueTo', the lower boundary (ValueFrom) must be smaller than upper boundary(ValueTo).

**What to do**

Change the boundaries in the 'BETWEEN ValueFrom AND ValueTo' clause.

**CTE0267: The Net Search Extender database objects in the database "%1" are in an inconsistent state.**

**Explanation**

At least one Net Search Extender object is missing or corrupted. Either the database has not been migrated after installation of a new Net Search Extender product version, or a database user has changed or dropped Net Search Extender internal object(s). In this case, all text indexes are lost and the database has to be disabled for text.

**What to do**

For a database migration to the current version please follow the migration description found in the Net Search Extender documentation. Alternatively, issue a DB2TEXT DISABLE DATABASE command using the FORCE option. You can then enable the database for text again by using the DB2TEXT ENABLE DATABASE command.

**CTE0270: Logtable "%1"."%2" could not be modified after incremental update. Entries are to be processed during the next UPDATE.**

**Explanation**

When starting an incremental index update, a timestamp is created. This serves as a threshold for change records to be processed. Changes occurring concurrently to the incremental update are then processed later, during the next update. In certain situations, there can be changes in transactions that are uncommitted at the time the update starts, but are committed while the index update is being performed. This may potentially lead to inconsistencies.

To avoid such an inconsistent situation, the change records prior to the threshold timestamp are not deleted from the logtable, although they have been partially processed. On the next incremental update the changes will be re-applied to the index.

**What to do**

On the next index update the changes are re-applied to the index. In case of delete operations, this can lead to the following error: CTE0101:  
ItlEnReasonCode\_Docmap\_ docid\_not\_found.

Note that this error can be ignored, as the document was already deleted. If CTE0270 errors frequently occur, consider dropping and re-creating the index with a modified timestamp threshold for incremental index update. For example:  
db2text "CREATE INDEX ... INDEX CONFIGURATION(UPDATEDELAY 30)"

This means that processing during an incremental update run only changes records older than 30 seconds and avoids interference with concurrent change transactions of less than 30 seconds.

**CTE0271: Cache not usable, DEACTIVATE and ACTIVATE RECREATE required.**

**Explanation**

The cache is in an inconsistent state because the maximum cache size has been reached.

**What to do**

Check that the maximum cache size is still sufficient. Then call the following db2text commands: DEACTIVATE CACHE and ACTIVATE CACHE RECREATE.

**CTE0272: Insufficient cache size. Increase the PCTFREE value or use DEACTIVATE and ACTIVATE [RECREATE] to recreate the cache.**

**Explanation**

All reserved memory for the cache has been used.

**What to do**

Rebuild the cache by using the following sequence of db2text commands: DEACTIVATE CACHE, ALTER INDEX MAXIMUM CACHE SIZE, and ACTIVATE CACHE RECREATE.

**CTE0273: The cache for index "%1", "%2" is already activated.  
Explanation**

The index has already been activated with the ACTIVATE CACHE command.

**What to do**

Check the specified index name and the database that you are using.

**CTE0274: The target database system "%1" for the connection is not supported.  
Explanation**

You tried to execute a DB2TEXT command with a connection to a database system that is not supported by Net Search Extender.

**CTE0275: The type and version information for server "%1" could not be found.  
Explanation**

The type and version information for the server could not be found in the DB2 catalog view 'SERVERS'.

**What to do**

Make sure that the DB2 federated environment is set up correctly.

**CTE0277: A cache memory segment could not be attached.  
Explanation**

The system cannot allocate enough memory to load a large cache segment, or the cache segment cannot be opened because it has been previously deleted.

**What to do**

Check your system settings and increase the amount of paging space and free memory. For large cache sizes you may need to prepare your system. Refer to the Net Search Extender documentation. Use the DEACTIVATE and ACTIVATE [RECREATE] commands to recreate the cache. If the problem persists, check db2diag.log for additional information.

**CTE0278: On an AIX 32-bit system, change the MAXDATA setting before activating a large cache.  
Explanation**

When you use the search stored procedure on an AIX 32-bit system, you may need to change the MAXDATA setting for the db2fmp executable.

**What to do**

Refer to the Net Search Extender documentation for details about changing the MAXDATA setting.

**CTE0279: The size of the cached data has reached a system limit.**

**Explanation**

By decreasing the PCTFREE value, you can increase the maximum data size during cache activation. This enables the system to reserve less freespace in the cache.

**What to do**

Use a lower PCTFREE value or reduce your amount of text data to be cached. Use the DEACTIVATE and ACTIVATE [RECREATE] commands to recreate the cache.

**CTE0280: There is not enough disk space to write persistent cache files.**

**Explanation**

The system can not write a large enough file for persistent cache in the cache directory.

**What to do**

Change the persistent cache directory to an empty file system by using the ALTER INDEX command. Alternatively, reduce the cache size by decreasing the PCTFREE or MAXIMUM CACHE SIZE values or by using a temporary cache.

**CTE0281: Deletion of persistent cache file "%1" has failed.**

**Explanation**

The file does not exist or cannot be accessed.

**What to do**

Check if this file still exists and delete it manually.

**CTE0282: The number of documents in the cache has reached a system limit.**

**Explanation**

By decreasing the PCTFREE value, you can increase the maximum number of document entries to be cached during cache activation. This enables the system to reserve less freespace in the cache.

**What to do**

Use a lower PCTFREE value or reduce the amount of document entries in the cache. Use the DEACTIVATE and ACTIVATE [RECREATE] commands to recreate the cache.

**CTE0283: A cache memory segment could not be created.**

**Explanation**

The system cannot allocate enough memory for loading a large cache segment into memory. By decreasing the PCTFREE value, you achieve a smaller cache segment size.

### What to do

Check your system settings and increase the amount of paging space and free memory. You can also decrease the cache size by using a lower PCTREE value. For large cache sizes, you may need to prepare your system. Refer to the Net Search Extender documentation. Use the DEACTIVATE and ACTIVATE [RECREATE] commands to recreate the cache. If the problem persists, check db2diag.log for additional information.

### **CTE0284: The text index is located on node "%1", but the search function was called on node "%2".**

#### **Explanation**

The search stored procedure or table valued function DB2EXT.TEXTSEARCH was not called on the node where the index is located. The search function will not automatically be distributed to the correct node.

### What to do

Set the DB2NODE environment variable to the node where the index is connected before connecting to the database.

### **CTE0285: Search function is not allowed for a text index which is distributed to multiple nodes.**

#### **Explanation**

The table valued function DB2EXT.TEXTSEARCH must not be called with indexes that are distributed to multiple nodes, since it will not be automatically distributed to the correct nodes, but executed on the coordinator node.

### What to do

Use the CONTAINS, SCORE or NUMBEROFMATCHES function in a multiple node environment.

### **CTE0286: No row found in "%1"."IBMSNAP\_REGISTER" for source table "%2"."%3" and capture change table "%4"."%5".**

#### **Explanation**

No valid entry was found in the IBMSNAP\_REGISTER table for the replication capture table characteristics specified in the DB2TEXT CREATE INDEX command. A valid entry must contain the specified source table for the index in columns SOURCE\_OWNER and SOURCE\_NAME, with SOURCE\_VIEW\_QUAL=0 and the specified replication capture table in columns PHYS\_CHANGE\_OWNER and PHYS\_CHANGE\_TABLE.

Possible causes: The specified source table was not registered as a replication source for the replication capture table.

### What to do

Register the source table correctly for DB2 Replication, or specify a correct replication capture table for the source table.

**CTE0287: Invalid value "%1" for "%2" in "%3".IBMSNAP\_REGISTER" for source table "%4"."%5" and capture change table "%6"."%7".**

**Explanation**

A replication setting found in the IBMSNAP\_REGISTER table is not allowed. Possible causes: 1.The column CHG\_UPD\_TO\_DEL\_INS does not contain the value 'Y'. 2.The column CCD\_CONDENSED contains the value 'Y'.

**What to do**

When registering the source table for DB2 Replication, ensure that update operations are transformed into pairs of delete and insert operations. In addition, ensure that no condensed replication capture tables are used.

**CTE0288: Source table "%1"."%2" and capture change table "%3"."%4" are on different servers ("%5" and "%6").**

**Explanation**

The specified source table and replication capture table must reside on the same server.

**CTE0289: The wrapper "%1" is not supported.**

**Explanation**

The wrapper is not supported. Refer to the Net Search Extender documentation for a list of supported wrappers.

**CTE0290: The alias "%1"."%2" is not allowed in the replication clause.**

**Explanation**

You are not allowed to specify an alias for a nickname in a replication clause.

**What to do**

Specify the nickname instead of the alias, or create a new nickname for the remote table.

**CTE0291: The specified format is not allowed for a column of type XML.**

**Explanation**

For columns of type XML only the 'XML' format is allowed.

**What to do**

Specify format 'XML' or none.

**CTE0292: Windows Exception "%1" was caught, address="%2", flags="%3".**

**Explanation**

A windows exception occurred. Exception name, address and flags are provided.

**CTE0293: Windows Exception "%1" was caught.**

**Explanation**

A windows exception occurred.

**CTE0294: Search argument processing problem.**

**Explanation**

A search argument processing error occurred due to an incorrect environment setup.

**What to do**

Check that the locale charmap value matches the DB2 code page and is available on the system.

**CTE0295: Invalid CCSID "%1" specified for non-binary text column.**

**Explanation**

For non-binary text column data types, DB2 always stores the data in the database CCSID. Only the database CCSID is valid for non-binary text columns.

**What to do**

Omit the CCSID-clause or specify a valid CCSID.

**CTE0296: The library "%1" cannot be found on "%2". Please check the Net Search Extender installation.**

**Explanation**

You tried to execute a Net Search Extender command by using the DB2 Control Center. Net Search Extender is not installed correctly on the target system.

**What to do**

Check if Net Search Extender is installed correctly on the target system.

**CTE0297: The database "%1" is associated with DB2 Text Search**

**Explanation**

You are not allowed to associate a database with more than one text search component.

**What to do**

If you want to continue using DB2 Text Search with the database, then no action is required. If you would rather use DB2 Net Search Extender, disable the database from DB2 Text Search and try this command again.

**CTE0298: The database "%1" is already associated with DB2 Text Search. This command cannot be executed.**

**Explanation**

You are not allowed to associate a database with more than one text search component.

## What to do

If you do not want to use DB2 Net Search Extender, disable the database using the DB2TEXT DISABLE DATABASE command. If you would rather use DB2 Net Search Extender, try this command again after disabling the database with DB2 Text Search.

## CTE0360: A specific error message displays Explanation

This message number is reserved for specific Net Search Extender errors.

## What to do

Respond to the specific error message.

## Error messages CTE0451 - CTE0866

This section contains error messages for Net Search Extender

- "CTE0451: The specified document format "%1" is not supported by the highlighting UDF." on page 209
- "CTE0452: Syntax error near option "%1" in the highlighting UDF." on page 209
- "CTE0453: The return size of the highlighting UDF is too small." on page 209
- "CTE0454: Error converting the parameters of the highlighting UDF from codepage "%1" to codepage UTF8. " on page 209
- "CTE0455: The database codepage "%1" is not supported in the highlighting UDF." on page 210
- "CTE0456: The highlighting UDF only supports documents in codepage UTF8." on page 210
- "CTE0457: The value "%1" for parameter "%2" is not valid in the highlighting UDF." on page 210
- "CTE0458: Usage: db2exthl <new size in kilo bytes>." on page 210
- "CTE0841: Missing command option "%1"." on page 210
- "CTE0842: No value is specified for the command option "%1"." on page 210
- "CTE0843: No numeric value is specified for the command option "%1"." on page 210
- "CTE0844: The definition file path "%1" is too long." on page 211
- "CTE0845: No definition file is specified." on page 211
- "CTE0846: The definition file name "%1" is too long." on page 211
- "CTE0847: The definition file "%1" does not exist." on page 211
- "CTE0849: The dictionary file "%1" could not be locked." on page 211
- "CTE0850: Output file "%1" already exists." on page 211
- "CTE0851: The integrity of the dictionary file "%1" is lost." on page 212
- "CTE0852: Dictionary file "%1" version error." on page 212
- "CTE0853: The existing dictionary "%1" cannot be overwritten." on page 212
- "CTE0855: A thesaurus term is incorrectly specified." on page 212
- "CTE0856: The definition file "%1" is empty." on page 212
- "CTE0857: No block starting line found in file "%1" at line "%2"." on page 213
- "CTE0858: An invalid relationship is specified in file "%1" at line "%2"." on page 213



- “CTE0859: The relationship number is out of range in file “%1” at line “%2”.” on page 213
- “CTE0860: No terms are defined in file “%1” at line “%2”.” on page 213
- “CTE0861: The thesaurus term in file “%1” at line “%2” is too long.” on page 213
- “CTE0862: Strength is incorrectly specified in file “%1” at line “%2”.” on page 214
- “CTE0863: Strength is out of range in file “%1” at line “%2”.” on page 214
- “CTE0864: Internal error: Thesaurus compiler failed with reason code “%1”.” on page 214
- “CTE0865: The directory “%1” could not be created.” on page 214
- “CTE0866: The directory “%1” could not be removed.” on page 214

**CTE0451: The specified document format “%1” is not supported by the highlighting UDF.**

**Explanation**

The document format “%1” does not support highlighting.

**What to do**

Use a document format that is supported by the highlighting UDF.

**CTE0452: Syntax error near option “%1” in the highlighting UDF.**

**Explanation**

You specified an incorrect syntax near the specified option.

**What to do**

Check the syntax near option %1. Correct and try again.

**CTE0453: The return size of the highlighting UDF is too small.**

**Explanation**

The requested parts of the highlighted document does not fit into the return parameter of the highlighting UDF.

**What to do**

Decrease the window number, the window size and/or the number of sections from which hits should be displayed. This will reduce the document parts returned to the user.

**CTE0454: Error converting the parameters of the highlighting UDF from codepage “%1” to codepage UTF8.**

**Explanation**

The parameters of the highlighting UDF in the specified CCSID (which may be the default database CCSID), cannot be converted to UTF8.

**What to do**

Ensure correct specification of the CCSID.

**CTE0455: The database codepage "%1" is not supported in the highlighting UDF.**

**Explanation**

The database has a codepage which is not supported by the highlighting UDF.

**CTE0456: The highlighting UDF only supports documents in codepage UTF8.**

**Explanation**

Only documents in codepage UTF8 support the highlighting UDF.

**CTE0457: The value "%1" for parameter "%2" is not valid in the highlighting UDF.**

**Explanation**

A value for a highlighting parameter is not valid.

**What to do**

Check the parameter value and ensure that the value is allowed in the data range.

**CTE0458: Usage: db2exthl <new size in kilo bytes>.**

**Explanation**

The parameter for the db2exthl utility is not correct.

**What to do**

Provide a value between 1 and 1048576.

**CTE0841: Missing command option "%1".**

**Explanation**

A required command option was not specified.

**What to do**

Check the specified parameters and add the missing parameter.

**CTE0842: No value is specified for the command option "%1".**

**Explanation**

A required value for a command option was not specified.

**What to do**

Check the specified parameters and add the missing option.

**CTE0843: No numeric value is specified for the command option "%1".**

**Explanation**

A string instead of a number has been specified.

**What to do**

Check the specified parameters and change the string to the correct number.

**CTE0844: The definition file path "%1" is too long.****Explanation**

The specified path is too long and could not be processed.

**What to do**

Use a shorter path and try again.

**CTE0845: No definition file is specified.****Explanation**

The definition file needs to be specified.

**What to do**

Add a valid definition file and try the call again.

**CTE0846: The definition file name "%1" is too long.****Explanation**

The specified definition file name is too long.

**What to do**

Reduce the length of the definition file name to the size allowed.

**CTE0847: The definition file "%1" does not exist.****Explanation**

The specified definition file could not be found.

**What to do**

Check that the definition file is in the correct path and can be accessed by the current user.

**CTE0849: The dictionary file "%1" could not be locked.****Explanation**

The process was not able to lock the dictionary file. Either you do not have write access, or another process has opened the file for writing.

**What to do**

Check the running processes to ensure that no process is locking the dictionary file and check your access rights.

**CTE0850: Output file "%1" already exists.****Explanation**

The specified output file could not be overwritten.

**What to do**

Check that you are able to create the thesaurus in the specified directory.

**CTE0851: The integrity of the dictionary file "%1" is lost.****Explanation**

The thesaurus dictionary files are corrupted.

**What to do**

Clean up the directory and compile your definition file again.

**CTE0852: Dictionary file "%1" version error.****Explanation**

Your dictionary file was generated with an older version of the thesaurus compiler.

**What to do**

Compile your definition file again with the current version of the thesaurus compiler.

**CTE0853: The existing dictionary "%1" cannot be overwritten.****Explanation**

An existing dictionary cannot be overwritten.

**What to do**

Check your write access right on the dictionary file, its directory location and subdirectory location.

**CTE0855: A thesaurus term is incorrectly specified.****Explanation**

There is a syntax error in your definition file.

**What to do**

Check your Net Search Extender documentation for information on creating a thesaurus definition file and thesaurus support.

**CTE0856: The definition file "%1" is empty.****Explanation**

An empty definition file is not allowed.

**What to do**

Check your Net Search Extender documentation for information on creating a thesaurus definition file and thesaurus support.

**CTE0857: No block starting line found in file "%1" at line "%2".**  
**Explanation**

There is a syntax error in your definition error.

**What to do**

A block has to start with ':WORDS'. Check your Net Search Extender documentation for information on thesaurus concepts.

**CTE0858: An invalid relationship is specified in file "%1" at line "%2".**

**Explanation**

There is a syntax error in your definition error.

**What to do**

You have to examine your 'associated-term-definition'. Check your Net Search Extender documentation for information on creating a thesaurus definition file.

**CTE0859: The relationship number is out of range in file "%1" at line "%2".**

**Explanation**

The user-defined relations are all based on the associative type. They are identified by unique numbers between 1 and 128.

**What to do**

Verify your relationship numbers.

**CTE0860: No terms are defined in file "%1" at line "%2".**

**Explanation**

Required terms are not specified.

**What to do**

Check your Net Search Extender documentation for information on creating a thesaurus definition file.

**CTE0861: The thesaurus term in file "%1" at line "%2" is too long.**

**Explanation**

The length of the thesaurus term is restricted to 64 bytes.

**What to do**

Alter the size of your thesaurus term and try again.

**CTE0862: Strength is incorrectly specified in file "%1" at line "%2".**

**Explanation**

There is a syntax error in your definition file.

**What to do**

Check your Net Search Extender documentation for information on creating a thesaurus definition file and thesaurus support.

**CTE0863: Strength is out of range in file "%1" at line "%2".**

**Explanation**

The strength value should be specified between 1 and 100.

**What to do**

Change the strength value so that it is a numerical value from 1 to 100.

**CTE0864: Internal error: Thesaurus compiler failed with reason code "%1".**

**Explanation**

An internal processing error occurred that does not allow further processing. Try to start and stop the update and locking services, as well as DB2.

**What to do**

If the error persists, start a trace and also check the db2diag.log.

**CTE0865: The directory "%1" could not be created.**

**Explanation**

The specified directory could not be created.

**What to do**

Check if the directory already exists and the permissions on the directory.

**CTE0866: The directory "%1" could not be removed.**

**Explanation**

The directory could not be removed.

**What to do**

Check that you have write permissions on the specified directory.

---

## Windows system errors

The following is a list of Windows system errors:

**System errors**

- 1 Incorrect function.

- 2 The system cannot find the file specified.
- 3 The system cannot find the path specified.
- 4 The system cannot open the file.
- 5 Access is denied.
- 6 The handle is invalid.
- 8 Not enough storage is available to process this command.
- 14 Not enough storage is available to complete this operation.
- 15 The system cannot find the drive specified.
- 29 The system cannot write to the specified device.
- 30 The system cannot read from the specified device.
- 32 The process cannot access the file because it is being used by another process.
- 36 Too many files opened for sharing.
- 38 Reached the end of the file.
- 39 The disk is full.
- 80 The file exists.
- 82 The directory or file cannot be created.
- 100 Cannot create another system semaphore.
- 101 The exclusive semaphore is owned by another process.
- 102 The semaphore is set and cannot be closed.
- 103 The semaphore cannot be set again.
- 104 Cannot request exclusive semaphores at interrupt time.
- 105 The previous ownership of this semaphore has ended.
- 110 The system cannot open the device or file specified.
- 111 The file name is too long.
- 112 There is not enough space on the disk.
- 121 The semaphore timeout period has expired.
- 126 The specified module could not be found.
- 127 The specified procedure could not be found.
- 147 Not enough resources are available to process this command.
- 155 Cannot create another thread.
- 161 The specified path is invalid.
- 164 No more threads can be created in the system.
- 170 The requested resource is in use.
- 183 Cannot create a file when that file already exists.
- 187 The specified system semaphore name was not found.
- 206 The filename or extension is too long.
- 267 The directory name is invalid.

- 288 Attempt to release mutex not owned by caller.
- 298 Too many posts were made to a semaphore.
- 998 Invalid access to memory location.
- 1051 A stop control has been sent to a service that other running services are dependent on.
- 1052 The requested control is not valid for this service.
- 1053 The service did not respond to the start or control request in a timely fashion.
- 1054 A thread could not be created for the service.
- 1055 The service database is locked.
- 1056 An instance of the service is already running.
- 1057 The account name is invalid or does not exist.
- 1058 The service cannot be started, either because it is disabled or because it has no enabled devices associated with it.
- 1059 Circular service dependency was specified.
- 1060 The specified service does not exist as an installed service.
- 1061 The service cannot accept control messages at this time.
- 1062 The service has not been started.
- 1063 The service process could not connect to the service controller.
- 1064 An exception occurred in the service when handling the control request.
- 1066 The service has returned a service-specific error code.
- 1067 The process terminated unexpectedly.
- 1068 The dependency service or group failed to start.
- 1069 The service did not start due to a logon failure.
- 1070 After starting, the service hung in a start-pending state.
- 1071 The specified service database lock is invalid.
- 1072 The specified service has been marked for deletion.
- 1073 The specified service already exists.
- 1078 The name is already in use as either a service name or a service display name.
- 1079 The account specified for this service is different from the account specified for other services running in the same process.
- 1082 No recovery program has been configured for this service.
- 1154 One of the library files needed to run this application is damaged.
- 1219 The credentials supplied conflict with an existing set of credentials.
- 1242 The service is already registered.
- 1243 The specified service does not exist.
- 1244 The operation being requested was not performed because the user has not been authenticated.



- 1245 The operation being requested was not performed because the user has not logged on to the network. The specified service does not exist.
- 1392 The file or directory is corrupted and unreadable.
- 1455 The paging file is too small for this operation to complete.
- 1793 The user's account has expired.

## Net Search Extender information catalogs

Net Search Extender stores important information about defaults, configurations, text indexes, and formats in catalog tables. To view this information, you can query some views on tables.

The following views and tables reflect the current configuration of your system:

- Database level information views:
  - db2ext.dbdefaults
- Index level information views:
  - db2ext.textindexes
  - db2ext.textindexformats
  - db2ext.indexconfiguration
- Table views for a text index:
  - Event view
  - Log table view

### Views for database-level information

The view db2ext.dbdefaults displays all the default values for the database.

The defaults on the database level cannot be changed and are available as attribute-value pairs in this view:

db2ext.dbdefaults

```
db2 select DEFAULTNAME, DEFAULTVALUE from DB2EXT.DBDEFAULTS
```

*Table 8. db2ext.dbdefaults view*

Attribute	Default Value	Notes
CCSID	CCSID of database	Default CCSID for documents. This is applied if no CCSID is specified in the CREATE INDEX command.
FORMAT	TEXT	Document default format. This is applied if no format is specified in the CREATE INDEX command.
INDEXDIRECTORY	See the path name under <b>Notes</b> <sup>®</sup>	Directory for full-text index files. This is applied if no index directory is specified in the CREATE INDEX command. The path name is: \$DB2EXT_INSTOWNERHOMEDIR/sql1lib/db2ext/indexes
LANGUAGE	EN_US	The document language.
MODELCCSID	CCSID of database	CCSID of document model files.

Table 8. db2ext.dbdefaults view (continued)

Attribute	Default Value	Notes
UPDATECOMMITCOUNT	0	The number of changes processed in one transaction during an update.
CLEARCOMMITCOUNT	0	The number of changes processed in one transaction during an CLEAR INDEX command.
UPDATEFREQUENCY	NONE	When to check for updates in new indexes.
UPDATEMINIMUM	1	The minimum number of changes before update is executed.
WORKDIRECTORY	See the path name under <b>Notes</b>	Directory for index temporary files. The path name is: <os_dependent>/sql11ib/db2ext/indexes
CACHEDIRECTORY	See the path name under <b>Notes</b>	Default directory for PERSISTENT CACHE option of the CREATE INDEX command. The path name is: <os_dependent>/sql11ib/db2ext/memory
PCTFREE	50	The percentage of the cache left free for future inserts.
USERPERSISTENTCACHE	1	Use the persistent cache.
AUTOMATICREORG	1	The REORGANIZE option in the CREATE INDEX command. This means automatic reorganization.
TREATNUMBERSASWORDS	0	Do not interpret sequences of characters and numbers as separate words, even if they are adjacent characters. For example, the 0 default means that tea42at5 is considered as one word.
INDEXSTOPWORDS	1	Index all text including stop words.
VERSION		NSE V9.1 Current <sup>®</sup> version number of Net Search Extender.
UPDATEDELAY	0	Specifies the duration in seconds for incremental update without capture tables. Only entries older than this duration will be taken from the log table. This is to avoid lost updates. For example, document changes that are not reflected in the index in transaction scenarios where user transactions interfere with update commands. Therefore, the UpdateDelay parameter should be set to the maximum duration of a user write transaction on the table the index was created on.

## Views for index-level information

You can query information at an index-level using the following Net Search Extender views:

- db2ext.textindexes
- db2ext.textindexformats

- db2ext.indexconfiguration
- <index eventview name schema>.<index eventview name>

For backward compatibility reasons, DB2 Text Information Extender views db2ext.textcolumns, db2ext.formats, and db2ext.models are still supported, but deprecated.

Note that in the db2ext.textcolumns view the OPERATION, OPERATIONBEGIN, and OPERATIONEND columns are no longer supported.

### db2ext.textindexes view

Each database enabled for Net Search Extender contains a db2ext.textindexes view. This contains information on settings, statistics, and defaults for the created text indexes in this database.

When you create a text index, new entries are created in db2ext.textindexes. When you drop the text indexes, these entries are deleted.

You can query the view to obtain information about the indexes. This is an example using the index schema:

```
db2 "select COLNAME from DB2EXT.TEXTINDEXES where INDSHEMA='myschema'
and INDNAME='myindex'"
```

Note, however, that you cannot modify the view using normal SQL data manipulation commands, or explicitly create or drop the catalog view. Additional contents of the view are found in the following table.

Also note that the replication parameters are not included in this view.

Table 9. db2ext.textindexes view

Attribute	Type	Notes
INDSHEMA	VARCHAR(128)	Schema name of the text index.
INDNAME	VARCHAR(128)	Name of the text index.
TABSHEMA	VARCHAR(128)	The table name of the schema for base tables, nicknames, and views.
TABNAME	VARCHAR(128)	Alias name the index was created on.
COLNAME	VARCHAR(128)	Column the index was created on.
CCSID	INTEGER	Document CCSID for this index.
LANGUAGE	VARCHAR(5)	Document language for this index.
FUNCTIONSCHEMA	VARCHAR(128)	Schema of the column mapping function.
FUNCTIONNAME	VARCHAR(18)	Name of the column mapping function.
INDEXDIRECTORY	VARCHAR(256)	Directory for full-text index files.
WORKDIRECTORY	VARCHAR(256)	Directory for index temporary files.
CACHEDIRECTORY	VARCHAR(256)	Directory for persistent cache (if persistentcache=1).
UPDATEFREQUENCY	VARCHAR(300)	Trigger criterion for applying automatic updates to this index.
UPDATEMINIMUM	INTEGER	Minimum number of documents that must be changed before an update is performed.

Table 9. db2ext.textindexes view (continued)

Attribute	Type	Notes
EVENTVIEWSHEMA	VARCHAR(128)	Schema of the event view created for this index.
EVENTVIEWNAME	VARCHAR(128)	Name of the event view created for this index.
LOGVIEWSHEMA	VARCHAR(128)	Schema of the log view created for an index.
LOGVIEWNAME	VARCHAR(128)	Name of the log view created for an index (important for incremental update on views).
COMMITCOUNT	INTEGER	Default for commitcount update.
NUMBER_DOCS	INTEGER	Total number of documents currently in the index. Note that during an index update, this value is only updated if the commitcount is set.
REORG_SUGGESTED	INTEGER	Indicates if performance can be improved by running UPDATE INDEX REORGANIZE. This parameter is only true (1) if at least one of the nodes has an index reorganization suggested.
REORGAUTOMATIC	INTEGER	1, if the index gets automatically reorganized during the update operation.
RECREATEONUPDATE	INTEGER	1, if the index gets automatically reorganized during the update operation.
CREATIONTIME	TIMESTAMP	Time of index creation.
UPDATETIME	TIMESTAMP	Time of last update. If UPDATE TIME is equal to CREATION TIME, then no update has been processed.
PERSISTENTCACHE	INTEGER	1, if persistent cache is used.
MAXIMUMCACHESIZE	INTEGER	Maximum size of cache.
PCTFREE	INTEGER	Percentage of cache left free for future inserts.
CACHETABLE	VARCHAR(32000)	Column expression list for the CACHE TABLE.
RESULTORDER	VARCHAR(32000)	SQL-order-by for INITIAL RESULT ORDER.
ATTRIBUTES	VARCHAR(32000)	Column expression list for ATTRIBUTES.
VIEWKEYCOLUMNS	VARCHAR(32000)	Key columns for index on view.

### db2ext.indexconfiguration view

Index configuration parameters are available in the db2ext.indexconfiguration view. The view is available through normal SQL query facilities. This is an example using the index name:

```
db2 "select VALUE from DB2EXT.INDEXCONFIGURATION where INDSHEMA='myschema'
and INDNAME='myindex' and PARAMETER ='INDEXSTOPWORDS'"
```

Additional contents of the view are found in the following tables.

*Table 10. db2ext.indexconfiguration view*

Attribute	Type	Notes
INDSCHEMA	VARCHAR(128)	Schema name of the index.
INDNAME	VARCHAR(128)	Name of the index.
PARAMETER	VARCHAR(30)	Type of parameter.
VALUE	VARCHAR(512)	Value of the parameter.

For the PARAMETER and VALUE attributes, there are several values available.

*Table 11. db2ext.indexconfiguration view*

Attribute and values	Attribute and values
PARAMETER	VALUE
- TREATNUMBERASWORDS	- 0 or 1
- INDEXSTOPWORDS	- 0 or 1
- UPDATEDELAY	- seconds >= 0

For further information, see the CONFIGURATION option of the CREATE INDEX command.

### **db2ext.textindexformats view**

Format and model information for indexes is available in the db2ext.textindexformats view. This is an example using the index name:

```
db2 "select FORMAT from DB2EXT.TEXTINDEXFORMATS where INDSCHEMA='myschema'
and INDNAME='myindex'"
```

Additional contents of the view are found in the following table.

*Table 12. db2ext.textindexformats view*

Attribute	Type	Notes
INDSCHEMA	VARCHAR(128)	Schema name for the index (used as prefix for indexname and schemaname in the log table).
INDNAME	VARCHAR(128)	Index name specified in CREATE INDEX command.
FORMAT	VARCHAR(30)	The model is bound to this format.
MODELNAME	VARCHAR(30)	The name of a document model.
MODELFILE	VARCHAR(256)	File containing the model definition.
MODELCCSID	INTEGER	CCSID of MODELFILE.
DEFAULT	INTEGER	Currently 1, as multiple formats in an index are not currently supported.

## **Table views for a text index**

You can query information at an index level using these DB2 Net Search Extender views:

- Event view

- Log table view

### Event view

This view allows you to get information on indexing status and error events, and when problems occur during indexing, for example, a document not being found. These index update events are then written to the index's event table.

This view allows you to get information on indexing status and error events, and when problems occur during indexing, for example, a document not being found. These index update events are then written to the index's event table.

The schema and name are stored in the `db2ext.textindexes` view. To get the name of the event view, use the following example:

```
db2 "select EVENTVIEWSHEMA, EVENTVIEWNAME from DB2EXT.TEXTINDEXES
     where INDSHEMA = 'myschema' and INDNAME = 'myindex'
```

The event view for an index consists of the following columns.

*Table 13. The event view*

Attribute	Type	Notes
OPERATION	INTEGER	The operation on the user table is reflected in full-text index (insert = 0/ update = 1/ delete = 2).  When using a replication capture table, update operations are split into a delete and an insert operation. In this case, an insert operation in the event table can be either from an insert, or an update operation on the source table the index was created on.
TIME	TIMESTAMP	Timestamp of event entry creation.
REASON	INTEGER	Reason code. For a list of reason codes, see "Text Search Engine reason codes" on page 224.
SEVERITY	INTEGER	The severity of the table entry. For example, 1 is for information purposes, 4 indicates a warning, and 8 means a table entry error.
MESSAGE	VARCHAR(1024)	Additional text information.
KEY1, ... KEY14	Depends on the user table	First primary key column of user table to the last primary key column (a maximum of 14).
PARTITION	INTEGER	The database partition number on which this error occurs. In a non-distributed environment, this is 0.

The events can be cleared by the `DB2TEXT CLEAR EVENTS` command.

**Note:** Informational events, such as starting, committing, and finishing update processing are also available in this view.

In this case, `Key1, ... Key14` and `OPERATION` all have `NULL` values.

In the case of indexes on views, the `PK01, ..., PK14` columns relate to the columns specified in the `KEY COLUMNS` clause of the `CREATE INDEX` command.

## Log tables, views, and nicknames

The purpose of the log table is to store the change operations on the user table or view that require synchronization with the external full-text index.

For indexes created on regular tables or nickname tables, there are triggers created on the user table to feed change information into the log table. However, if replication capture tables are used, no log table is created and the replication capture table is used instead.

For log tables, the update command reads the entries and deletes them after successful synchronization.

However, in the case of indexes on views, triggers cannot fill the log table. As you can update the view, the user is responsible for this task.

Table 14. The log table view

Attribute	Type	Notes
OPERATION	INTEGER	The type of change on the user table that requires index synchronization: (0 = insert, 1 = update, 2 = delete).
TIME	TIMESTAMP	The timestamp for the creation of a row in this table.
PK01 ... PKnm	Same as user table	In case of errors, the column where the problem occurred. They are a copy of the primary key columns of the user table or the equivalent key columns in case of an index on a view.

The user who creates the table is able to select, update, insert, and delete this view.

If you specify a replication capture table in the create index command, no log table is created and the replication capture table is used instead. The replication capture table must contain the following columns:

Table 15. The replication capture table

Attribute	Type	Notes
IBMSNAP_OPERATION	INTEGER	The type of change on the CD or CCD table that requires index synchronization: (I = insert, U= update, D= delete).  When using a replication capture table, update operations are split into a delete and an insert operation. In this case, an insert operation in the event table can be either from an insert, or an update operation on the source table the index was created on.
IBMSNAP_COMMITSEQ	CHAR	Maps to the corresponding column of the CD or CCD table.
IBMSNAP_INTENTSEQ	CHAR	Maps to the corresponding column of the CD or CCD table.
PK01 ... PKnm	Same as user table	In case of errors, the column where the problem occurred. They are the primary key columns of the user table.

The user who defines the table is able to select, update, insert, and delete with the grant option.

---

## Text Search Engine reason codes

- 0 Operation performed successfully - no error occurred.
- 1 An invalid handle was passed to a function.
- 2 Function could not allocate enough memory.
- 3 Function could not perform due to access limitations or security restrictions.
- 4 The operation is not supported for this version of the Text Search Engine run time.
- 5 The operation is currently not enabled.
- 6 The application violated the Text Search Engine protocol by calling Text Search Engine functions in illegal order.
- 7 An unexpected error occurred. Please report this to your service representative.
- 8 An invalid language was specified.
- 9 The specified language is valid but not supported by the Text Search Engine run time.
- 10 An invalid CCSID was specified.
- 11 The specified CCSID is valid but not supported by the Text Search Engine run time.
- 12 An invalid document ID was specified.
- 13 The specified document format is valid but not supported by the Text Search Engine run time.
- 14 An invalid document format was specified.
- 15 The operation could not succeed due to access limitation during file input/output.
- 16 The operation could not succeed due to read errors during file input/output.
- 17 The operation could not succeed due to read errors during file input.
- 18 The operation could not succeed due to write errors during file output.
- 19 The operation could not succeed due to seek errors during file input/output.
- 20 The operation could not succeed due to tell errors during file input/output.
- 21 The operation could not succeed due to close errors during file input/output.
- 22 The operation could not succeed due to errors during rename operations.
- 23 The operation could not succeed due to errors during remove operations.
- 24 The operation could not succeed due to errors during mkdir operations.



- 25 One or more function arguments did have an invalid value (for example, an unexpected null pointer or an invalid enumeration type value).
- 26 The specified directory does not exist.
- 27 An unexpected Text Search Engine error occurred. Please examine the Text Search Engine error code in the error info object for further details.
- 28 An unexpected COS error occurred. Please report this error.
- 29 An attempt was made to update an empty document.
- 30 The specified argument is not supported for this operation.
- 31 The date attribute parser found an invalid value when trying to parse a date attribute.
- 32 The number attribute parser found an invalid value when trying to parse a number attribute.
- 33 Attribute name invalid, probably too long.
- 35 Reserve number for future use.
- 36 The input document contains an attribute (DATE, NUMBER, or STRING) that exceeds the length limit for attributes. The attribute text has been truncated to that limit.
- 38 The warning threshold as set by the user has been exceeded. As a consequence, this error has been generated.
- 39 The input document could not be indexed. It contains too many nested fields.
- 40 The limit of different attributes for one of the attribute types has been exceeded for this index.
- 46 The iterator is not (or no longer) valid, because its list is empty or deleted.
- 47 The function is not supported for the passed kind of handle. This error occurs, for example, when trying to use `itlQueryResultEntryObtainData` on a list iterator that does not represent a query result iterator.
- 48 This warning is issued if a stop word file cannot be found for the specified language and resource path.
- 49 This warning is issued if a stop word file does not contain any stop words.
- 50 This warning is issued if a stop word file does contain invalid data.
- 100 The index could not be opened because it does not exist with the specified name and/or directory.
- 101 The specified index name is not a valid index name.
- 102 The specified index directory is not a valid directory name.
- 103 The operation cannot be performed because the Text Search Engine detected a corruption of the index structure and/or index file sets.
- 104 The specified index cannot be created because it already exists with the given name and directory.
- 109 Before any other operation can be performed on this index, a rollback operation must be performed.
- 110 The index configuration file does not contain the mandatory section as specified in the error context.

- 111 The index configuration file does not contain the mandatory option as specified in the error context.
- 112 The index configuration file contains invalid data in the option as specified in the error context.
- 113 The index configuration file does not match the Text Search Engine version.
- 200 The specified document model name is not a valid model name.
- 201 The specified document model field name is not a valid field name.
- 202 The specified document model is not known.
- 203 The specified document model already exists and cannot be redefined.
- 204 Too many or too large document models have been added to the index.
- 205 The document model contains too many elements.
- 206 The document model element contains a parameter (XML attribute) that is not allowed for this type of element.
- 207 The document model element contains a parameter value that is not allowed for this type of parameter (XML attribute).
- 208 The document model element does not contain a required parameter (XML attribute), like "name".
- 209 The document model does not seem to be XML, or starts with an unexpected XML element.
- 210 The given XPath (locator value) contains an unexpected token.
- 211 The given XPath (locator value) contains an unexpected axis specifier (name followed by two colons).
- 212 The given XPath (locator value) contains an unexpected node test.
- 213 The document model directory file (extension .mdx) is corrupted.
- 214 The document model index file (extension .mox) is corrupted.
- 215 The document contains an XML element which is mapped to a document attribute and which contains another document attribute. The inner attribute is ignored.
- 216 The given parameter value is too long as a GPP or HTML tag.
- 217 The document model contains a duplicate field definition.
- 218 The document model contains a duplicate attribute definition.
- 300 The operation cannot be performed because the Text Search Engine detected a corruption in the index files used for document name mapping.
- 301 The operation cannot be performed because the Text Search Engine detected an invalid document number.
- 302 The operation cannot be performed because the Text Search Engine detected an invalid document identifier.
- 303 The operation cannot be performed because the Text Search Engine found no index entry for the document identifier.
- 304 The operation cannot be performed because the Text Search Engine found no index entry for the document number.

- 305 The operation cannot be performed because the Text Search Engine detected an overflow in used document numbers.
- 306 The document identifier that the application tried to index has appeared already in the list of documents. The Text Search Engine does not support duplicate document identifiers appearing in one indexing sequence, that is, before the update has been committed.
- 340 The term strength is not valid.
- 341 The relation number is not valid, must be in.
- 342 The relation type is invalid, use one of the defines described in API.
- 343 The phrase (term) is too long.
- 344 Unexpected end of file encountered while reading.
- 345 Version conflict detected when reading index/thesaurus files.
- 346 Overflow in thesaurus buffers.
- 347 Invalid name, probably too long a name, for file or directory.
- 348 Lookup did not find term (phrase) in dictionary or entry in definition file does not contain mandatory term.
- 349 Definition file is empty.
- 350 Thesaurus dictionary or definition file as specified via input parameter does not exist.
- 351 Syntax errors in definition file.
- 352 The Relationship was specified incorrectly.
- 352 The Relationship number was out of range.
- 360 An invalid single character masking was used.
- 361 An invalid multiple character masking was used.
- 362 Operator arity is smaller than number of operands given in query.
- 363 Operator value out of range defined by ItlEnOperator enumeration.
- 364 Value for rank formula out of enumeration range.
- 365 Number identifying proximity segment is out of range.
- 366 Query is under construction and cannot be redefined or reset.
- 367 Scope given as previous search result denotes empty result.
- 368 Invalid call requesting to add field names before setting the first one.
- 369 Invalid search flag requesting an invalid comparison with index content is ignored. If, for example, a case-sensitive comparison was requested for an index that was build in a case insensitive manner, this reason code is shown in the error information.
- 370 Masking of strings is not supported for Thai or DBCS languages.
- 371 No valid query input. For example, the search terms is available.
- 372 Invalid comparison operations requested.
- 373 Invalid comparison operations requested.
- 374 Search index handle was requested for an empty index.

- 375 The combination of operator and requested operator mode is not supported.
- 380 Search result is incomplete, search was discontinued due to threshold.
- 381 Index lookup revealed that query contained stopwords.
- 401 The operation cannot be performed because the Text Search Engine detected a corruption in the index files used for field/attribute name mapping.
- 402 The operation cannot be performed because the Text Search Engine detected an invalid field or attribute name.
- 403 The operation cannot be performed because the given field or attribute name is unknown.
- 404 The limit of different attributes for one of the attribute types or of different fields has been exceeded for this index.
- 500 The document/data contains an invalid character sequence (in a UTF8, UTF16, or DBCS source).
- 501 The code page converter was in error.
- 502 The document/data contains an incomplete character sequence (in a UTF8, UTF16, or DBCS source).
- 503 The code page converter has an invalid descriptor.
- 600 The XML document contains an asynchronous entity. For example, an unquoted XML attribute value.
- 602 Invalid character reference, (for example, or).
- 603 Invalid binary entity reference.
- 604 XML Parser Expat could not be created.
- 605 An attribute name in tag must be unique.
- 607 XML Parser found an invalid external entity reference.
- 608 Documents includes an incorrect token, like missing a < or >.
- 609 XML documents must have an enclosing tag, and after this enclosing end tag no text is allowed.
- 610 A processing instruction is not allowed at its position. For example, the first processing instruction is not the prolog <?xml .. ?>.
- 611 An element is a sequence of start tag, content, and end tag. This error occurred, for example, from the sequence "<s> text /s>", because the end tag is not correct.
- 612 Memory allocation failed in XML parser.
- 614 Invalid parameter entity reference.
- 615 A non-complete character, maybe only the first byte of a 2-byte UTF8 character.
- 616 Recursive entity reference.
- 617 XML Syntax error; for example text outside the enclosing start and end tag.
- 618 Every start tag needs a matching end tag.
- 619 Unclosed cdata section.

- 620    Unclosed token; for example text after the last token in a document.
- 621    There is an entity in the document that could not be resolved.
- 622    Unexpected error.
- 631    Could not parse field or attribute information in meta-tag. Tag must have the format `<meta name="abc" content="xyz">`; maybe attributes name or content of the meta-tag not correct.
- 632    The entity could not be transformed to a character.
- 650    Different field definitions begin with the same start tag.
- 651    One start tag contains another, so the tags are ambiguous.
- 652    If a field and an attribute use the same start tag, then they must use the same end tag or both no end tag.
- 653    A field not yet closed if the document ends.
- 654    No document model is specified for the structured format. The document will be parsed as plain text document without field or attribute informations.
- 670    The operation could not be performed, because it requires the "Outside In" (TM) libraries, which could not be found.
- 671    The operation could not be performed, because a required procedure from the "Outside In" (TM) libraries could not be loaded. Probably the libraries are outdated or corrupted.
- 672    An error occurred while the document was processed with "Outside In".



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## Chapter 10. Troubleshooting

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### Tracing faults

If you need to report an error to an IBM representative, you may be asked to switch on tracing so that information can be written to a file that can be used for locating the error.

As system performance is affected when tracing is switched on, only use the trace facility when directed by an IBM Support Center representative, or by your technical support representative.

To turn tracing on, use the DB2 facility:

```
db2trc on
```

See the DB2 documentation for further information.

To receive information specific to Net Search Extender, a mask with component in 96 can be used:

```
db2trc on -m *.*.96.*.*
```

In the case of severe errors, it may also help to look in `db2diag.log`.

---

### Dropping DB2 objects without using the correct Net Search Extender commands

#### Dropping a table

Before you drop a table with one or more text indexes, you must issue the following command for each text index:

```
db2text drop index <index_name> for text
```

If you accidentally drop a table before you drop the indexes, parts of the indexes will still exist, for example, the administration tables and text index files.

To remove these files, drop the indexes using the `db2text drop index` command, even though the table no longer exists.

#### Dropping a database

Before you drop a database with one or more text indexes, issue the following command for each text index:

```
db2text drop index <index_name> for text
```

If you do not use this command, you must delete all of the index files manually in `index_directory` and `index_work_directory`.

Note that if the indexes belonging to the dropped database were created during an automatic update, you will need to edit the scheduler file `ctedem.dat`.

To do this, enter the following:

For UNIX:

```
db2text stop force
cd ~/sql11ib/db2ext
```

or for Windows:

```
db2text stop force
cd <db2_install_path>\sql11ib\<db2_instance_name>\db2ext
```

Open the file ctedem.dat in the directory and remove all entries referring to the dropped database.

---

## Installation return codes on Windows

### setup.exe return codes on Windows

The setup.exe return codes in the setup.log are the following:

- 0 Success
- -1 General error
- -2 Invalid mode
- -3 Required data not found in the setup.iss file
- -4 Not enough memory available
- -5 File does not exist
- -6 cannot write to the response file
- -7 Unable to write to the log file
- -8 Invalid path to the install shield silent response (.iss) file
- -9 Not a valid list type
- -10 Data type invalid
- -11 Unknown error during setup
- -12 Dialog boxes are out of order
- -51 Cannot create the specified folder
- -52 Cannot access the specified file or folder
- -53 Invalid option selected

---

## Hints and tips

### Authorization

When you issue the DB2TEXT START command on Windows, ensure that you are a member of the Administrators group. Otherwise, the DB2TEXT START command fails and returns the following message: CTE0218 Function "OpenSCManager()" failed with error code "5".

### Authorization

On Windows, ensure that the Net Search Extender instance service DB2EXT-<DB2\_instance\_name> runs under a user account rather than the system account. If you run under the system account, you can not enable your database.

### Language

As Net Search Extender event log messages are always displayed in the DB2 server language, event log messages for commands issued from the DB2 Control Center might be displayed in a different language to language set for the DB2 Control Center.



**Modifying the db2cli.ini file**

If you modified the db2cli.ini file and have problems using Net Search Extender, restore the original version of db2cli.ini.

**Client server interoperability**

You must install the same Net Search Extender fix pack level on both the server and client.

Interoperability between client to server, and vice versa, is only possible for the supported platforms.

**Log size**

If the indexing process is not completed because the error and warning messages require more space than the available DB2 log size, DB2 will rollback the whole transaction and not commit the log table entries. This means that you will not be able to see the entries.

Check the DB2 documentation for information on how to increase your transaction log size to avoid this situation.

**DBCS object names**

If you use DBCS object names in db2text administration commands, it is necessary to enclose those names in double quotes to avoid uppercase transformation.

**Incremental index update on nicknames**

If initial updates on two or more indexes are started at the same time, the update command might return a SQL0803N error. In this case, try the update command again.

**Single masking and character normalization**

Words like 'über' are normalized and are stored in the index in their normalized form ('ueber'). Therefore, if you issue a query containing single character masking, for example '\_ber', you will not find 'über'.

**Using duplicate cache column names**

If you use duplicate cache column names, you will not get an error during text index creation or index update, but you will not be able to search. When you try to search, you will get an SQL error message stating that duplicate columns were used.

**Incorrect shared memory size**

If the specified maximum cache size is too small in a db2text activate cache command, the required cache size that is displayed in the resulting error message is incorrect.

Check for the correct cache size by using the DB2EXT.MAXIMUM\_CACHE\_SIZE and DB2EXT.PCTFREE functions. Correct the maximum cache size by using the db2text alter index command and activate the cache again.

**Unicode tables in a non Unicode database**

You are not allowed to create a text index on a Unicode table if your database does not support Unicode.

**Incorrect codepage for LANG variable in a query on Linux**

If you use a 7-bit ASCII codepage for the LANG variable setting in a query, the following error is displayed: SearchString parse: check LANG & locale charmap values..

To avoid this happening, change your LANG variable to a 8-bit LANG value, restart DB2, and try searching again.

**File access problems**

If you cannot access files, for example, a document model, a text index, or a thesaurus, ensure that you used the correct password and have the correct authorization for running the Net Search Extender instance services. This applies especially to shared resources on mapped network drives.

**Cache cannot be used**

During search or activate cache, the following error message might be displayed: CTE0271 Cache not usable, DEACTIVATE and ACTIVATE RECREATE required. To solve this problem, check your system settings and try to increase the amount of paging space and free memory.

**Instance services not dropped after an uninstall**

If the instance services are not dropped after you uninstall Net Search Extender, use the following tool to drop the services manually: ctereg <instancename> unregister. For example, ctereg db2-0 unregister.

**ctepcrx terminates abnormally on UNIX**

Check that the used instance owner does not have a separate fenced user ID. To check this, open the file .fenced in <instance\_home\_dir>/sql1lib/adm and check if the instance owner is also the fenced user.

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## Appendix A. Overview of the DB2 technical information

DB2 technical information is available through the following tools and methods:

- DB2 Information Center
  - Topics (Task, concept and reference topics)
  - Help for DB2 tools
  - Sample programs
  - Tutorials
- DB2 books
  - PDF files (downloadable)
  - PDF files (from the DB2 PDF DVD)
  - printed books
- Command line help
  - Command help
  - Message help

**Note:** The DB2 Information Center topics are updated more frequently than either the PDF or the hard-copy books. To get the most current information, install the documentation updates as they become available, or refer to the DB2 Information Center at [ibm.com](http://ibm.com)<sup>®</sup>.

You can access additional DB2 technical information such as technotes, white papers, and IBM Redbooks<sup>®</sup> publications online at [ibm.com](http://www.ibm.com). Access the DB2 Information Management software library site at <http://www.ibm.com/software/data/sw-library/>.

### Documentation feedback

We value your feedback on the DB2 documentation. If you have suggestions for how to improve the DB2 documentation, send an email to [db2docs@ca.ibm.com](mailto:db2docs@ca.ibm.com). The DB2 documentation team reads all of your feedback, but cannot respond to you directly. Provide specific examples wherever possible so that we can better understand your concerns. If you are providing feedback on a specific topic or help file, include the topic title and URL.

Do not use this email address to contact DB2 Customer Support. If you have a DB2 technical issue that the documentation does not resolve, contact your local IBM service center for assistance.

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## DB2 technical library in hardcopy or PDF format

The following tables describe the DB2 library available from the IBM Publications Center at [www.ibm.com/shop/publications/order](http://www.ibm.com/shop/publications/order). English DB2 Version 9.5 manuals in PDF format and translated versions can be downloaded from [www.ibm.com/support/docview.wss?rs=71&uid=swg2700947](http://www.ibm.com/support/docview.wss?rs=71&uid=swg2700947).

Although the tables identify books available in print, the books might not be available in your country or region.

Table 16. DB2 technical information

Name	Form Number	Available in print
<i>Administrative API Reference</i>	SC23-5842-00	Yes
<i>Administrative Routines and Views</i>	SC23-5843-00	No
<i>Call Level Interface Guide and Reference, Volume 1</i>	SC23-5844-00	Yes
<i>Call Level Interface Guide and Reference, Volume 2</i>	SC23-5845-00	Yes
<i>Command Reference</i>	SC23-5846-00	Yes
<i>Data Movement Utilities Guide and Reference</i>	SC23-5847-00	Yes
<i>Data Recovery and High Availability Guide and Reference</i>	SC23-5848-00	Yes
<i>Data Servers, Databases, and Database Objects Guide</i>	SC23-5849-00	Yes
<i>Database Security Guide</i>	SC23-5850-00	Yes
<i>Developing ADO.NET and OLE DB Applications</i>	SC23-5851-00	Yes
<i>Developing Embedded SQL Applications</i>	SC23-5852-00	Yes
<i>Developing Java Applications</i>	SC23-5853-00	Yes
<i>Developing Perl and PHP Applications</i>	SC23-5854-00	No
<i>Developing User-defined Routines (SQL and External)</i>	SC23-5855-00	Yes
<i>Getting Started with Database Application Development</i>	GC23-5856-00	Yes
<i>Getting Started with DB2 installation and administration on Linux and Windows</i>	GC23-5857-00	Yes
<i>Internationalization Guide</i>	SC23-5858-00	Yes
<i>Message Reference, Volume 1</i>	GI11-7855-00	No
<i>Message Reference, Volume 2</i>	GI11-7856-00	No
<i>Migration Guide</i>	GC23-5859-00	Yes
<i>Net Search Extender Administration and User's Guide</i>	SC23-8509-00	Yes
<b>Note:</b> The content of this document is not included in the DB2 Information Center		
<i>Partitioning and Clustering Guide</i>	SC23-5860-00	Yes
<i>Query Patroller Administration and User's Guide</i>	SC23-8507-00	Yes
<i>Quick Beginnings for IBM Data Server Clients</i>	GC23-5863-00	No
<i>Quick Beginnings for DB2 Servers</i>	GC23-5864-00	Yes

*Table 16. DB2 technical information (continued)*

<b>Name</b>	<b>Form Number</b>	<b>Available in print</b>
<i>Spatial Extender and Geodetic Data Management Feature User's Guide and Reference</i>	SC23-8508-00	Yes
<i>SQL Reference, Volume 1</i>	SC23-5861-00	Yes
<i>SQL Reference, Volume 2</i>	SC23-5862-00	Yes
<i>System Monitor Guide and Reference</i>	SC23-5865-00	Yes
<i>Text Search Guide</i>	SC23-5866-00	Yes
<i>Troubleshooting Guide</i>	GI11-7857-00	No
<i>Tuning Database Performance</i>	SC23-5867-00	Yes
<i>Visual Explain Tutorial</i>	SC23-5868-00	No
<i>What's New</i>	SC23-5869-00	Yes
<i>Workload Manager Guide and Reference</i>	SC23-5870-00	Yes
<i>pureXML Guide</i>	SC23-5871-00	Yes
<i>XQuery Reference</i>	SC23-5872-00	No

*Table 17. DB2 Connect-specific technical information*

<b>Name</b>	<b>Form Number</b>	<b>Available in print</b>
<i>Quick Beginnings for DB2 Connect Personal Edition</i>	GC23-5839-00	Yes
<i>Quick Beginnings for DB2 Connect Servers</i>	GC23-5840-00	Yes
<i>DB2 Connect User's Guide</i>	SC23-5841-00	Yes

*Table 18. Information Integration technical information*

<b>Name</b>	<b>Form Number</b>	<b>Available in print</b>
<i>Information Integration: Administration Guide for Federated Systems</i>	SC19-1020-01	Yes
<i>Information Integration: ASNCLP Program Reference for Replication and Event Publishing</i>	SC19-1018-02	Yes
<i>Information Integration: Configuration Guide for Federated Data Sources</i>	SC19-1034-01	No
<i>Information Integration: SQL Replication Guide and Reference</i>	SC19-1030-01	Yes
<i>Information Integration: Introduction to Replication and Event Publishing</i>	SC19-1028-01	Yes

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## Ordering printed DB2 books

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## Displaying SQL state help from the command line processor

DB2 returns an `SQLSTATE` value for conditions that could be the result of an SQL statement. `SQLSTATE` help explains the meanings of SQL states and SQL state class codes.

To invoke SQL state help, open the command line processor and enter:

```
? sqlstate or ? class code
```

where *sqlstate* represents a valid five-digit SQL state and *class code* represents the first two digits of the SQL state.

For example, `? 08003` displays help for the 08003 SQL state, and `? 08` displays help for the 08 class code.

---

## Accessing different versions of the DB2 Information Center

For DB2 Version 9.5 topics, the DB2 Information Center URL is <http://publib.boulder.ibm.com/infocenter/db2luw/v9r5/>

For DB2 Version 9 topics, the DB2 Information Center URL is <http://publib.boulder.ibm.com/infocenter/db2luw/v9/>

For DB2 Version 8 topics, go to the Version 8 Information Center URL at: <http://publib.boulder.ibm.com/infocenter/db2luw/v8/>

---

## Displaying topics in your preferred language in the DB2 Information Center

The DB2 Information Center attempts to display topics in the language specified in your browser preferences. If a topic has not been translated into your preferred language, the DB2 Information Center displays the topic in English.

- To display topics in your preferred language in the Internet Explorer browser:
    1. In Internet Explorer, click the **Tools** → **Internet Options** → **Languages...** button. The Language Preferences window opens.
    2. Ensure your preferred language is specified as the first entry in the list of languages.
      - To add a new language to the list, click the **Add...** button.

**Note:** Adding a language does not guarantee that the computer has the fonts required to display the topics in the preferred language.

    - To move a language to the top of the list, select the language and click the **Move Up** button until the language is first in the list of languages.  - 3. Clear the browser cache and then refresh the page to display the DB2 Information Center in your preferred language.
- To display topics in your preferred language in a Firefox or Mozilla browser:
  1. Select the button in the **Languages** section of the **Tools** → **Options** → **Advanced** dialog. The Languages panel is displayed in the Preferences window.
  2. Ensure your preferred language is specified as the first entry in the list of languages.
    - To add a new language to the list, click the **Add...** button to select a language from the Add Languages window.
    - To move a language to the top of the list, select the language and click the **Move Up** button until the language is first in the list of languages.
  3. Clear the browser cache and then refresh the page to display the DB2 Information Center in your preferred language.

On some browser and operating system combinations, you might have to also change the regional settings of your operating system to the locale and language of your choice.

---

## Updating the DB2 Information Center installed on your computer or intranet server

If you have installed the DB2 Information Center locally, you can download and install updates that IBM might make available.

Updating your locally-installed DB2 Information Center requires that you:

1. Stop the DB2 Information Center on your computer, and restart the Information Center in stand-alone mode. Running the Information Center in stand-alone mode prevents other users on your network from accessing the Information Center, and allows you to download and apply updates.
2. Use the Update feature to see what updates are available. If there are updates that you would like to install, you can use the Update feature to download and install them

**Note:** If your environment requires installing the DB2 Information Center updates on a machine that is not connected to the internet, you have to mirror the update site to a local file system using a machine that is connected to the internet and has the DB2 Information Center installed. If many users on your network will be installing the documentation updates, you can reduce the time required for individuals to perform the updates by also mirroring the update site locally and creating a proxy for the update site.

If update packages are available, use the Update feature to download the packages. However, the Update feature is only available in stand-alone mode.

3. Stop the stand-alone Information Center, and restart the DB2 Information Center on your computer.

**Note:** On Windows Vista, the commands listed below must be run as an administrator. To launch a command prompt or graphical tool with full administrator privileges, right-click on the shortcut and then select **Run as administrator**.

To update the DB2 Information Center installed on your computer or intranet server:

1. Stop the DB2 Information Center.
  - On Windows, click **Start** → **Control Panel** → **Administrative Tools** → **Services**. Then right-click on **DB2 Information Center** service and select **Stop**.
  - On Linux, enter the following command:  

```
/etc/init.d/db2icdv95 stop
```
2. Start the Information Center in stand-alone mode.
  - On Windows:
    - a. Open a command window.
    - b. Navigate to the path where the Information Center is installed. By default, the DB2 Information Center is installed in the <Program Files>\IBM\DB2 Information Center\Version 9.5 directory, where <Program Files> represents the location of the Program Files directory.
    - c. Navigate from the installation directory to the doc\bin directory.
    - d. Run the help\_start.bat file:  

```
help_start.bat
```
  - On Linux:



- a. Navigate to the path where the Information Center is installed. By default, the DB2 Information Center is installed in the /opt/ibm/db2ic/V9.5 directory.
- b. Navigate from the installation directory to the doc/bin directory.
- c. Run the help\_start script:

```
help_start
```

The systems default Web browser launches to display the stand-alone Information Center.

3. Click the Update button (🔄). On the right hand panel of the Information Center, click Find Updates. A list of updates for existing documentation displays.
4. To initiate the download process, check the selections you want to download, then click Install Updates.
5. After the download and installation process has completed, click Finish.
6. Stop the stand-alone Information Center.

- On Windows, navigate to the installation directory's doc\bin directory, and run the help\_end.bat file:

```
help_end.bat
```

**Note:** The help\_end batch file contains the commands required to safely terminate the processes that were started with the help\_start batch file. Do not use Ctrl-C or any other method to terminate help\_start.bat.

- On Linux, navigate to the installation directory's doc/bin directory, and run the help\_end script:

```
help_end
```

**Note:** The help\_end script contains the commands required to safely terminate the processes that were started with the help\_start script. Do not use any other method to terminate the help\_start script.

7. Restart the DB2 Information Center.
  - On Windows, click **Start** → **Control Panel** → **Administrative Tools** → **Services**. Then right-click on **DB2 Information Center** service and select **Start**.
  - On Linux, enter the following command:

```
/etc/init.d/db2icdv95 start
```

The updated DB2 Information Center displays the new and updated topics.

---

## DB2 tutorials

The DB2 tutorials help you learn about various aspects of DB2 products. Lessons provide step-by-step instructions.

### Before you begin

You can view the XHTML version of the tutorial from the Information Center at <http://publib.boulder.ibm.com/infocenter/db2help/>.

Some lessons use sample data or code. See the tutorial for a description of any prerequisites for its specific tasks.

## DB2 tutorials

To view the tutorial, click on the title.

### **“pureXML™” in *pureXML Guide***

Set up a DB2 database to store XML data and to perform basic operations with the native XML data store.

### **“Visual Explain” in *Visual Explain Tutorial***

Analyze, optimize, and tune SQL statements for better performance using Visual Explain.

---

## DB2 troubleshooting information

A wide variety of troubleshooting and problem determination information is available to assist you in using DB2 products.

### **DB2 documentation**

Troubleshooting information can be found in the DB2 Troubleshooting Guide or the Support and Troubleshooting section of the DB2 Information Center. There you will find information on how to isolate and identify problems using DB2 diagnostic tools and utilities, solutions to some of the most common problems, and other advice on how to solve problems you might encounter with your DB2 products.

### **DB2 Technical Support Web site**

Refer to the DB2 Technical Support Web site if you are experiencing problems and want help finding possible causes and solutions. The Technical Support site has links to the latest DB2 publications, TechNotes, Authorized Program Analysis Reports (APARs or bug fixes), fix packs, and other resources. You can search through this knowledge base to find possible solutions to your problems.

Access the DB2 Technical Support Web site at <http://www.ibm.com/software/data/db2/udb/support.html>

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