DB2® Universal Database for z/OS

Version 8

XML Extender
Administration and Programming

SC18-7431-00

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IBM

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Administration and Programming

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Note

Before using this information and the product it supports, please read the general information under “Notices” on page 321.

First Edition (March 2004)

This edition applies to Version 8 of IBM DB2 Universal Database for z/OS (DB2 UDB for z/OS), 5625-DB2, and to any subsequent releases until otherwise indicated in new editions. Make sure you are using the correct edition for the level of the product.

Specific changes are indicated by a vertical bar to the left of a change. A vertical bar to the left of a figure caption indicates that the figure has changed. Editorial changes that have no technical significance are not noted.

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Contents

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About this guide

This section contains the following information:

- "Who should use this guide"
- "How to use this guide"
- "Highlighting conventions" on page x

Who should use this guide

This guide is intended for the following people:

- Those who work with XML data in DB2® applications and who are familiar with XML concepts. Readers of this document should have a general understanding of XML and DB2 UDB for z/OS™. To learn more about XML, see the following Web site:

  http://www.w3.org/XML

  To learn more about DB2, see the following Web site:

  http://www.ibm.com/software/data/db2/library
- DB2 database administrators who are familiar with DB2 UDB administration concepts, tools, and techniques.
- DB2 application programmers who are familiar with SQL and with one or more programming languages that can be used for DB2 UDB applications.

How to get a current version of this guide

You can get the latest version of this book at the XML Extender Web site:

http://www.ibm.com/software/data/db2/extenders/xmlext/library.html

How to use this guide

This guide is structured as follows:

Part 1. Introduction
This part provides an overview of the XML Extender and how you can use it in your business applications. It contains a getting-started scenario that helps you get up and running.

Part 2. Administration
This part describes how to prepare and maintain a DB2 UDB database for XML data. Read this part if you need to administer a DB2 UDB database that contains XML data.

Part 3. Programming
This part describes how to manage your XML data. Read this part if you need to access and manipulate XML data in a DB2 UDB application program.

Part 4. Reference
This part describes how to use the XML Extender administration commands, user-defined types, user-defined functions, and stored procedures. It also lists the messages and codes that the XML Extender issues. Read this part if you are familiar with the XML Extender concepts

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and tasks, but you need information about a user-defined type (UDT), user-defined function (UDF), command, message, metadata tables, control tables, or code.

Part 5. Appendixes
The appendixes describe the DTD for the document access definition, samples for the examples and getting started scenario, and other IBM® XML products.

Highlighting conventions

This books uses the following conventions:

Bold text indicates:
- Commands
- Field names
- Menu names
- Push buttons

Italic text indicates
- Variable parameters that are to be replaced with a value
- Emphasized words
- First use of a glossary term

Uppercase letters indicate:
- Data types
- Column names
- Table names

Example text indicates:
- System messages
- Values that you type
- Coding examples
- Directory names
- File names

How to read syntax diagrams

Throughout this book, the syntax of commands and SQL statements is described using syntax diagrams.

Read the syntax diagrams as follows:
- Read the syntax diagrams from left to right, from top to bottom, following the path of the line.

  The ►►—— symbol indicates the beginning of a statement.

  The ——► symbol indicates that the statement syntax is continued on the next line.

  The ►—— symbol indicates that a statement is continued from the previous line.

  The ——►◄ symbol indicates the end of a statement.

  Diagrams of syntactical units other than complete statements start with the ►—— symbol and end with the ——► symbol.
- Required items appear on the horizontal line (the main path).

```
►►──required_item─────────────────────────────────────────────────►◄
```

- Optional items appear below the main path.

```
►►──required_item──┬───────────────┬──────────────────────────────►◄
                   └─optional_item─┘
```

If an optional item appears above the main path, that item has no effect on the execution of the statement and is used only for readability.

```
                   ┌─optional_item─┐
►►──required_item──┴───────────────┴──────────────────────────────►◄
```

- If you can choose from two or more items, they appear vertically, in a stack.

  If you *must* choose one of the items, one item of the stack appears on the main path.

```
►►──required_item──┬─required_choice1─┬───────────────────────────►◄
                   └─required_choice2─┘
```

If choosing one of the items is optional, the entire stack appears below the main path.

```
►►──required_item──┬──────────────────┬───────────────────────────►◄
                   ├─optional_choice1─┤
                   └─optional_choice2─┘
```

If one of the items is the default, it appears above the main path and the remaining choices are shown below.

```
                   ┌─default_choice──┐
►►──required_item──┼─────────────────┼────────────────────────────►◄
                   ├─optional_choice─┤
                   └─optional_choice─┘
```

- An arrow returning to the left, above the main line, indicates that an item that can be repeated.

```
                   ┌─────────────────┐
                   ▼                 │
►►──required_item────repeatable_item─┴────────────────────────────►◄
```

- If the repeat arrow contains punctuation, you must separate repeated items with the specified punctuation.

```
                   ┌─,───────────────┐
                   ▼                 │
►►──required_item────repeatable_item─┴────────────────────────────►◄
```

- A repeat arrow above a stack indicates that you can repeat the items in the stack.

– Keywords appear in uppercase (for example, `FROM`). In the XML Extender, keywords can be used in any case. Terms that are not keywords appear in lowercase letters (for example, *column-name*). They represent user-supplied names or values.
– If punctuation marks, parentheses, arithmetic operators, or other such symbols are shown, you must enter them as part of the syntax.

Accessibility

Accessibility features help a user who has a physical disability, such as restricted mobility or limited vision, to use software products. The major accessibility features in z/OS products, including DB2 UDB for z/OS, enable users to:

- Use assistive technologies such as screen reader and screen magnifier software
- Operate specific or equivalent features by using only a keyboard
- Customize display attributes such as color, contrast, and font size

Assistive technology products, such as screen readers, function with the DB2 UDB for z/OS user interfaces. Consult the documentation for the assistive technology products for specific information when you use assistive technology to access these interfaces.

Online documentation for Version 8 of DB2 UDB for z/OS is available in the DB2 Information Center, which is an accessible format when used with assistive technologies such as screen reader or screen magnifier software. The DB2 Information Center for z/OS solutions is available at the following Web site: http://publib.boulder.ibm.com/infocenter/db2zhelp.

Part 1. Introduction

This part provides an overview of the XML Extender and how you can use it in your business applications.

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Chapter 1. Introduction

Introduction to XML Extender

DB2's XML Extender provides the ability to store and access XML documents, to generate XML documents from existing relational data, and to insert rows into relational tables from XML documents. XML Extender provides new data types, functions, and stored procedures to manage your XML data in DB2 UDB).

The XML Extender is available for the following operating systems:

- Windows® NT
- Windows 2000
- AIX®
- Solaris Operating Environment
- Linux
- OS/390 and z/OS
- iSeries

Related concepts:

- "XML Documents" on page 3
- "Features of XML Extender" on page 5
- "Lesson: Storing an XML document in an XML column" on page 8
- "Lesson: Composing an XML document" on page 20
- "XML Extender tutorial lessons" on page 7

XML Documents

Because companies tend to share data between different applications, companies are continually faced with the problem of replicating, transforming, exporting, or saving their data in formats that can be imported into other applications. Many of these transforming processes tend to drop some of the data, or they at least require that users go through the tedious process of ensuring that the data remains consistent. This manual checking consumes both time and money.

One of the ways to address this problem is for application developers to write *Open Database Connectivity (ODBC)* applications, a standard application programming interface (API) for accessing data in both relational and non-relational database management systems. These applications save the data in a database management system. From there, the data can be manipulated and presented in the form in which it is needed for another application. Database applications must be written to convert the data into a form that an application requires. Applications change quickly and quickly become obsolete. Applications that convert data to HTML provide presentation solutions, but the data presented cannot be practically used for other purposes. A method that separates the data from its presentation is needed to provide a practical form of interchange between applications.

XML—*eXtensible Markup Language*—addresses this problem. XML is extensible because the language is a meta-language that allows you to create your own language based on the needs of your enterprise. You use XML to capture not only the data for your particular application, but also the data structure. Although it is not the only data interchange format, XML has emerged as the accepted standard. By adhering to this standard, applications can share data without first transforming it using proprietary formats.

Because XML is now the accepted standard for data interchange, many applications are emerging that will be able to take advantage of it.

Suppose that you are using a particular project management application and you want to share some of its data with your calendar application. Your project management application could export tasks in XML, which could then be imported as-is into your calendar application. In today's interconnected world, application providers have strong incentives to make an XML interchange format a basic feature of their applications.

How XML data is handled in DB2

Although XML solves many problems by providing a standard format for data interchange, some challenges remain. When building an enterprise data application, you must answer questions such as:

- How often do I want to replicate the data?
- What kind of information must be shared between applications?
- How can I quickly search for the information I need?
- How can I make a particular action, such as a new entry being added, trigger an automatic data interchange between all of my applications?

These kinds of issues can be addressed only by a database management system. By incorporating the XML information and meta-information directly in the database, you can more efficiently obtain the XML results that your other applications need. With the XML Extender, you can take advantage of the power of DB2® in many XML applications.

With the content of your structured XML documents in a DB2 UDB database, you can combine structured XML information with traditional relational data. Based on the application, you can choose whether to store entire XML documents in DB2 in user-defined types provided for XML data (XML data types), or you can map the XML content as base data types in relational tables. For XML data types, XML Extender adds the power to search rich data types of XML element or attribute values, in addition to the structural text search that the OS/390® Text Extender provides.

XML Extender provides two methods of storing and access for XML data in DB2:

XML column method

Stores entire XML documents as column data or externally as a file, and extracts the required XML element or attribute value and stores it in *side tables*, indexed subtables for high-speed searching. By storing the documents as column data, you can:

- Perform fast search on XML elements or attributes that have been extracted and stored in side tables as SQL basic data types and indexed.
- Update the content of an XML element or the value of an XML attribute.
- Extract XML elements or attributes dynamically using SQL queries.
- Validate XML documents when they are inserted and updated.
- Perform structural-text search with the Text Extender.

XML collection method
: Composes and decomposes contents of XML documents with one or more relational tables.

Features of XML Extender

XML Extender provides the following features to help you manage and exploit XML data with DB2:

- Administration tools to help you manage the integration of XML data in relational tables
- Storage and access methods for XML data within the database
- A data type definition (DTD) repository for you to store DTDs used to validate XML data
- A mapping file called the Document Access Definition (DAD), which is used to map XML documents to relational data
- Location paths to specify the location of an element or attribute within an XML document.

Administration tools: The XML Extender administration tools help you enable your database and table columns for XML, and map XML data to DB2® relational structures.

XML Extender provides a command line tool, an administration wizard, and programming interfaces for administration tasks.

- The **dxxadm** command can be run from UNIX® System Services (USS).
- JCL based on samples provided in the SDXXJCL data set
- The XML Extender administration stored procedures allow you to invoke administration commands from a program.

Storage and access methods: XML Extender provides two storage and access methods for integrating XML documents with DB2 data structures: XML column and XML collection. These methods have very different uses, but can be used in the same application.

XML column method
: This method helps you store intact XML documents in DB2. The XML column method works well for archiving documents. The documents are inserted into columns enabled for XML and can be updated, retrieved, and searched. Element and attribute data can be mapped to DB2 UDB tables (side tables), which can be indexed for fast search.

XML collection method
: This method helps you map XML document structures to DB2 UDB tables so that you can either compose XML documents from existing DB2 UDB data, or decompose XML documents, storing the untagged data in DB2 UDB tables. This method is good for data interchange applications, particularly when the contents of XML documents are frequently updated.

DTDs: The XML Extender also allows you to store DTDs, the set of declarations for XML elements and attributes. When a database server is *enabled* for XML, a DTD repository table (DTD_REF) is created. Each row of this table represents a DTD with additional metadata information. Users can access this table to insert their own DTDs. The DTDs are used for validating the structure of XML documents.

DAD files: You specify how structured XML documents are to be processed by XML Extender using a *document access definition (DAD)* file. The DAD file is an XML document that maps the XML document structure to a DB2 UDB table. You use a DAD file when storing XML documents in a column, or when composing or decomposing XML data. The DAD file specifies whether you are storing documents using the XML column method, or defining an XML collection for composition or decomposition.

Location paths: A *location path* specifies the location of an element or attribute within an XML document. The XML Extender uses the location path to navigate the structure of the XML document and locate elements and attributes.

For example, a location path of `/Order/Part/Shipment/ShipDate` points to the shipDate element, that is a child of the Shipment, Part, and Order elements, as shown in the following example:

```
<Order>
  <Part>
    <Shipment>
      <ShipDate>
+...
```

Figure 1 shows an example of a location path and its relationship to the structure of the XML document.

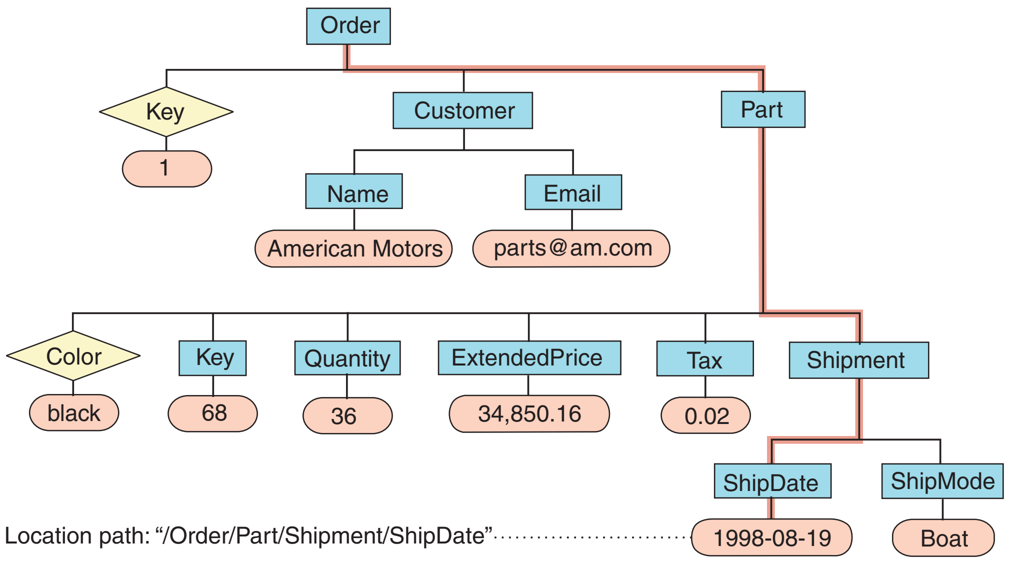


Figure 1. Storing documents as structured XML documents in a DB2 UDB table column

The location path is used in the following situations:

XML columns

- Used to identify the elements and attributes to be extracted or updated when using the XML Extender user-defined functions.
- Also used to map the content of an XML element or attribute to a side table.

XML collections

Used to override values in the DAD file from a stored procedure.

To specify the location path, XML Extender uses a subset of the *XML Path Language (XPath)*, the language for addressing parts of an XML document.

For more information about Xpath, see the following Web page:

http://www.w3.org/TR/xpath

Related concepts:

- "How XML data is handled in DB2" on page 4
- "Lesson: Storing an XML document in an XML column" on page 8
- "Lesson: Composing an XML document" on page 20
- "XML Extender tutorial lessons" on page 7

XML Extender tutorial lessons

This tutorial shows you how to get started using XML Extender to access and modify XML data for your applications. Three lessons are provided:

- Storing an XML document in an XML column
- Composing an XML document
- Cleaning up the database

By following the tutorial lessons, you can set up a database using provided sample data, map SQL data to an XML document, store XML documents in the database, and then search and extract data from the XML documents.

In the administration lessons, you use the **odb2** command for *UNIX® System Services (USS)* with XML Extender administration commands. In XML data management lessons, you use XML Extender UDFs and stored procedures. Most of the examples in the rest of the book draw on the sample data that is used in this chapter.

Prerequisites

To complete the lessons in this tutorial, you must have the following prerequisites installed:

- DB2 for z/OS™ Version 8
- XML Toolkit for z/OS Version 1.4
- USS set up
- odb2 command line or the DXXGPREP JCL job

In addition, the DB2 UDB database server must have been enabled by the DB2 UDB administrator.

Scenario for the lessons

In these lessons, you work for ACME Auto Direct, a company that distributes cars and trucks to automotive dealerships. You have two tasks. First you will set up a system in which orders can be archived in the SALES_DB database for querying by the sales department. Next, you extract information in an existing purchase order database, SALES_DB.

Methods to run the lessons:

Two methods for running the scripts and commands are provided.

- Use the odb2 command line to run SQL statements.

  From USS prompt type:

  ```
  odb2
  ```

  A command prompt is displayed, from which you can enter SQL commands.
- You can submit batch jobs that will issue equivalent steps.

Related concepts:
- "Administration tools for XML Extender" on page 37
- "XML Extender administration planning" on page 38
- "Lesson: Storing an XML document in an XML column" on page 8
- "Lesson: Composing an XML document" on page 20

Lesson: Storing an XML document in an XML column

The XML Extender provides a method of storing and accessing whole XML documents in the database. The XML column method enables you to store the document using the XML file types, index the column in side tables, and then query or search the XML document. This storage method is particularly useful for archival applications in which documents are not frequently updated.

This lesson shows you how to use the XML column storage and access method.

The scenario:

You have the task of archiving the sales data for the service department. The sales data that you need to work with is stored in XML documents that use the same DTD.

The service department provided a recommended structure for the XML documents and specified which element data will be queried most frequently. The service department wants the XML documents stored in the SALES_TAB table in the SALES_DB database and wants to be able to search them quickly. The SALES_TAB table will contain two columns with data about each sale, and a third column will contain the XML document. This column is called ORDER.

To store this XML document in the SALES_TAB table, you will:
1. Determine the XML Extender user-defined types (UDTs) in which to store the XML document, as well as which XML elements and attributes will be frequently queried.
2. Set up the SALES_DB database for XML.
3. Create the SALES_TAB table, and enable the ORDER column so that you can store the intact document in DB2.
4. Insert a DTD for the XML document for validation.
5. Store the document as an XMLVARCHAR data type.

When you enable the column, you will define side tables to be indexed for the structural search of the document in a document access definition (DAD) file, an XML document that specifies the structure of the side tables.

The SALES_TAB table is described in Table 1 on page 9. The XML column to be enabled for XML, ORDER, is shown in italics.

Table 1. SALES_TAB table

Column name	Data type
INVOICE_NUM	CHAR(6) NOT NULL PRIMARY KEY
SALES_PERSON	VARCHAR(20)
ORDER	XMLVARCHAR

The scripts and samples:

For this tutorial, you use a set of scripts and JCL samples to set up your environment and perform the steps in the lessons. These scripts are in the *dxx_install*/samples/db2xml/cmd directory (where *dxx_install* is the directory where you installed the XML Extender files). The JCL is in library SDXXJCL.

These scripts are:

getstart_db.cmd
Creates the database and populates four tables.

getstart_prep.cmd
Binds the database server with the XML Extender stored procedures and the DB2® CLI and enables the database server for XML Extender.

getstart_insertDTD.cmd
Inserts the DTD used to validate the XML document in the XML column.

getstart_createTabCol.cmd
Creates an application table that will have an XML-enabled column.

getstart_alterTabCol.cmd
Alters the application table by adding the column that will be enabled for XML.

getstart_enableCol.cmd
Enables the XML column.

getstart_createIndex.cmd
Creates indexes on the side tables for the XML column.

getstart_insertXML.cmd
Inserts the XML document into the XML column.

getstart_queryCol.cmd
Runs a select statement on the application table and returns the XML document.

getstart_stp.cmd
Runs the stored procedure to compose the XML collection.

getstart_exportXML.cmd
Exports the XML document from the database for use in an application.

getstart_clean.cmd
Cleans up the tutorial environment.

Table 2 on page 10 lists the USS and JCL samples that are provided to complete the tasks in the lesson, as well as the suggested role in the organization that might have the correct authority to run the samples. Each task is completed either by an administrator or application developer.

Table 2. Scripts provided for the XML column lessons

Role	USS command files	Description	JCL member name
administrator	getstart_db.cmd	Creates and populates the database and tables used for the lesson	dxxgdb
administrator	getstart_prep.cmd	Binds and enables the database server	dxxgprep
application developer	getstart_insertDTD.cmd	Inserts the dtd getstart.dtd into the dtd_ref table	dxxgidtd
administrator	getstart_createTabCol.cmd	Creates SALES_TAB for XML column	dxxgctco
administrator	getstart_alterTabCol.cmd	Adds the ORDER column to SALES_TAB	dxxgatco
administrator	getstart_enableCol.cmd	Enables the ORDER column as an XML column	dxxgecol
administrator	getstart_createIndex.cmd	Create indexes on side tables	dxxgcrin
application developer	getstart_insertXML.cmd	Inserts an XML document into the SALES_TAB XML column	dxxgixml
application developer	getstart_queryCol.cmd	Queries the XML document held in the sales_tab XML column through the side tables	dxxgcqol
application developer	getstart_stp.cmd	Runs the stored procedure to compose the XML collection	dxxgstp
application developer	getstart_exportXML.cmd	Exports the XML document from the database for use in an application	dxxexml
administrator	getstart_clean.cmd	Cleans up the environment	dxxgclen

These samples are provided for your use in your applications.

Planning how to store the document:

Before you use the XML Extender to store your documents, you need to:

- Understand the XML document structure.
- Determine the XML user-defined type in which you will store the XML document.
- Determine the XML elements and attributes that the service department will frequently search, so that the content of these can be stored in side tables and indexed to improve performance.

The following sections will explain how to make these decisions.

The XML document structure:

The XML document structure for this lesson takes information for a specific order that is structured by the order key as the top level, then customer, part, and shipping information on the next level.

This lesson provides the sample DTD for you to understand and validate the XML document structure.

Determining the XML data type for the XML column:

The XML Extender provides XML user defined types that you can use to define a column to hold XML documents. These data types are:

XMLVARCHAR
: Used for documents smaller than 3 kilobytes stored in DB2. The maximum size of XMLVARCHAR documents can be redefined to as large as 32672 kilobytes.

XMLCLOB
: Used for documents larger than 3 kilobytes stored in DB2. The maximum document size is 2 gigabytes.

XMLFILE
: Used for documents stored outside DB2.

In this lesson, you will store a small document in DB2, so you will use the XMLVARCHAR data type.

Determining elements and attributes to be searched:

When you understand the XML document structure and the needs of the application, you can determine which elements and attributes will be searched or extracted most frequently, or those that will be the most expensive to query. The service department will frequently query the order key, customer name, price, and shipping date of an order, and they will need quick performance for these searches. This information is contained in elements and attributes of the XML document structure. Table 3 describes the location paths of each element and attribute.

Table 3. Elements and attributes to be searched

Data	Location Path
order key	/Order/@key
customer name	/Order/Customer/Name
price	/Order/Part/ExtendedPrice
shipping date	/Order/Part/Shipment/ShipDate

Mapping the XML document to the side tables:

To map your XML documents to a side table, you must create a DAD file for the XML column. The DAD file is used to store the XML document in DB2. It also maps the XML element and attribute contents to DB2 UDB side tables used for indexing, which improves search performance.

After identifying the elements and attributes to be searched, you determine how they should be organized in the side tables, how many tables to use, and which columns are in what table. Organize the side tables by putting similar information in the same table. The document structure is also determined by whether the location path of any elements can be repeated more than once in the document. For example, in the document, the part element can be repeated multiple times, and therefore, the price and date elements can occur multiple times. Elements that can occur multiple times must each be in their own side tables.

You must also determine what DB2 UDB base types the element or attribute values should use, which is determined by the format of the data.

- If the data is text, use VARCHAR.
- If the data is an integer, use INTEGER.
- If the data is a date, and you want to do range searches, use DATE.

In this tutorial, the elements and attributes are mapped to either ORDER_SIDE_TAB, PART_SIDE_TAB or, SHIP_SIDE_TAB. The tables below show which table each element or attribute is mapped to.

ORDER_SIDE_TAB

Column name	Data type	Location path	Multiple occurring?
ORDER_KEY	INTEGER	/Order/@key	No
CUSTOMER	VARCHAR(16)	/Order/Customer/Name	No

PART_SIDE_TAB

Column name	Data type	Location path	Multiple occurring?
PRICE	DECIMAL(10,2)	/Order/Part/ExtendedPrice	Yes

SHIP_SIDE_TAB

Column name	Data type	Location path	Multiple occurring?
DATE	DATE	/Order/Part/Shipment/ShipDate	Yes

Creating the SALES_DB database:

In this task, you create a sample database and enable the database for XML.

To create the database:

1. Ensure that the database server was enabled by the DB2 UDB administrator.
2. Change to the `dxx_install/samples/db2xml/cmd directory, where dxx_install is the directory where you installed the XML Extender files.` The sample files contain references to files that use absolute path names. Check the sample files and change these values for your directory paths.
3. Run the **getstart_db** command:

   From the **odb2 command line:** Enter the following command:

   ```
   getstart_db.cmd
   ```

   TSO: Submit the `dxxgdb` JCL job.

Enabling the server:

To store XML information in the database, you need to enable it for the XML Extender. When you enable a database for XML, XML Extender:

- Creates user-defined types (UDTs), user-defined functions (UDFs), and stored procedures
- Creates and populates control tables with the necessary metadata that the XML Extender requires
- Creates the DB2XML schema and assigns the necessary privileges

To enable the database for XML:

Use one of the following methods to enable the database.

Run the following script:

```
getstart_prep.cmd
```

This script runs the **dxxadm** command option that enables the database:

```
dxxadm enable_server -a subsystem-name wlm environment wlm-name
```

Enabling the XML column and storing the document:

In this lesson, you will enable a column for XML Extender and store an XML document in the column. For these tasks, you will:

1. Store the DTD in the DTD repository
2. Create a DAD file for the XML column
3. Create the SALES_TAB table
4. Add the column of XML type
5. Enable the XML column
6. View the column and side tables
7. Index the side tables for structural search.
8. Store the XML document

Storing the DTD in the DTD repository:

You can use a DTD to validate XML data in an XML column. The XML Extender creates a table in the XML-enabled database, called DTD_REF. The table is known as the DTD repository and is available for you to store DTDs. When you validate XML documents, you must store the DTD in this repository. The DTD for this lesson is in

```
dxx_install/samples/db2xml/dtd/getstart.dtd
```

where *dxx_install* is the directory where you installed DB2 XML Extender.

Command line:

- Enter the following SQL INSERT command, all on the same DB2 command line:

  ```
  INSERT into DB2XML.DTD_REF values
  ('dxx_install/samples/db2xml/dtd/getstart.dtd,
   DB2XML.XMLClobFromFile
  ('dxx_install/samples/db2xml/dtd/getstart.dtd),
   0, 'user1',   'user1', 'user1')
  ```

- Run the following command file to insert the DTD:

  ```
  getstart_insertDTD.cmd
  ```

TSO: Submit the `dxxgidtd` JCL job.

Creating a DAD file for the XML column:

This section explains how you create a DAD file for the XML column. In the DAD file, you specify that the access and storage method you are using is XML column. In the DAD file you define the tables and columns for indexing.

In the following steps, elements in the DAD are referred to as *tags* and the elements of your XML document structure are referred to as *elements*. A sample of a DAD file similar to the one you will create is in `dxx_install/samples/db2xml/dad/getstart_xcolumn.dad` . It has some minor differences from the file generated in the following steps. If you use it for the lesson, the file paths might be different than for your environment; the <validation> value is set to NO, rather than YES.

To create a DAD file for use with XML column:

1. Open a text editor and name the file `getstart_xcolumn.dad`

   All the tags used in the DAD file are case sensitive.
2. Create the DAD header, with the XML and the DOCTYPE declarations.

   ```
   <?xml version="1.0"?>
   <!DOCTYPE DAD SYSTEM "/dxx_install/samples/DB2XML/dtd/dad.dtd ">
   ```

   The DAD file is an XML document and requires XML declarations.
3. Insert start and end (<DAD> and</DAD>) tags for the document. All other tags are located inside these tags.
4. Insert start and end (<DTDID> and</DTDID>) tags with a DTD ID to specify a DTD if the document will be validated:

   ```
   <dtdid>dxx_install/samples/db2xml/dtd/getstart.dtd</dtdid>
   ```

   Verify that this string matches the value used as the first parameter value when you insert the DTD in the DTD repository table. For example, the path that you use for the DTDID might be different from the string mentioned you inserted in the DTD reference table if you are working on a different machine drive.
5. Insert start and end (<validation> and </validation>) tags and a keyword YES or NO to indicate whether you want XML Extender to validate the XML document structure using the DTD that you inserted into the DTD reference table. For example:

   ```
   <validation>YES</validation>
   ```

   The value of <validation> can be in mixed case.
6. Insert start and end (<Xcolumn> and</Xcolumn>) tags to specify that the storage method is XML column.
7. Create side tables. For each side table that you want to create:
   a. Insert start and end (<table> and </table>) tags for each side table that is to be generated, and specify the name of the side table in double quotation marks using the ″name=″ attribute as shown here:

      ```
      <Xcolumn>
      <table name="order_side_tab">
      </table>
      <table name="part_side_tab">
      </table>
      <table name="ship_side_tab">
      </table>
      </Xcolumn>
      ```

b. Inside the table tags, insert a `<column>` tag for each column that you want the side table to contain. Each column has four attributes: name, type, path, and multi_occurrence.

Example:

```
<table name="person_names">
<column name ="fname"
        type="varchar(50)"
        path="/person/firstName"
        multi_occurrence="NO"/>
<column name ="lname"
        type="varchar(50)"
        path="/person/lastName"
        multi_occurrence="NO"/>
</table>
```

Where:

name Specifies the name of the column that is created in the side table.

type Indicates the data type in the side table for each indexed element or attribute.

path Specifies the location path in the XML document for each element or attribute to be indexed.

multi_occurrence
Indicates whether the element or attribute referred to by the path attribute can occur more than once in the XML document. The possible values for *multi_occurrence* are *YES* or *NO.* If the value is *NO*, then you can mention more than one column tag in the side table. If the value is *YES*, you can mention only one column in the side table.

```
<Xcolumn>
<table name="order_side_tab">
  <column name="order_key"
          type="integer"
          path="/Order/@key"
          multi_occurrence="NO"/>
  <column name="customer"
          type="varchar(50)"
          path="/Order/Customer/Name"
          multi_occurrence="NO"/>
</table>
<table name="part_side_tab">
  <column name="price"
          type="decimal(10,2)"
          path="/Order/Part/ExtendedPrice"
          multi_occurrence="YES"/>
</table>
<table name="ship_side_tab">
  <column name="date"
          type="DATE"
          path="/Order/Part/Shipment/ShipDate"
          multi_occurrence="YES"/>
</table>
</Xcolumn>
```

8. Ensure that you have the necessary end tags:
   - A closing </Xcolumn> tag after the last </table> tag
   - A closing </DAD> tag after the </Xcolumn> tag
9. Save the file with the following name:
   ```
   getstart_xcolumn.dad
   ```

You can compare the file that you just created with the sample file, `dxx_install/samples/db2xml/dad/getstart_xcolumn.dad` . This file is a working copy of the DAD file required to enable the XML column and create the side tables. The sample files contain references to files that use absolute path names. Check the sample files and change these values for your directory paths.

Creating the SALES_TAB table:

In this section you create the SALES_TAB table. Initially, it has two columns with the sale information for the order.

To create the table:

Enter the following CREATE TABLE statement using one of the following methods:

Command line:

- Enter the following DB2 UDB commands:

  ```
  DB2 CREATE TABLE SALES_TAB(INVOICE_NUM CHAR(6)
           NOT NULL PRIMARY KEY,
           SALES_PERSON VARCHAR(20))
  ```
- Run the following command file to create the table:

  ```
  getstart_createTabCol.cmd
  ```

TSO: Submit the `dxxgctco` JCL job.

Adding the column of XML type:

Add a new column to the SALES_TAB table. This column will contain the intact XML document that you generated earlier and must be of an XML UDT. The XML Extender provides multiple data types. In this lesson, you will store the document as XMLVARCHAR.

To add the column of XML type:

Run the SQL ALTER TABLE statement using one of the following three methods:

Command line:

- Enter the following SQL statement:

  ```
  DB2 ALTER TABLE SALES_TAB ADD \ORDER\ DB2XML.XMLVARCHAR
  ```
- Run the following command file to alter the table:

  ```
  getstart_alterTabCol.cmd
  ```

TSO: Submit the `dxxgatco` JCL job.

Enabling the XML column:

After you create the column of XML type, you enable it for XML Extender. When you enable the column, XML Extender reads the DAD file and creates the side tables. Before enabling the column, you must:

- Determine whether you want to create a default view of the XML column, which contains the XML document joined with the side-table columns. You can specify the default view when querying the XML document. In this lesson, you will specify a view with the `-v` parameter.

- Determine whether you want to specify a primary key as the *ROOT ID*, the column name of the primary key in the application table and a unique identifier that associates all side tables with the application table. If you do not specify a primary key, XML Extender adds the DXXROOT_ID column to the application table, and to the side tables.

  The ROOT_ID column is used as key to tie the application and side tables together, which allows the XML Extender to automatically update the side tables if the XML document is updated. In this lesson, you will specify the name of the primary key in the command (INVOICE_NUM) with the `-r` parameter. The XML Extender will then use the specified column as the ROOT_ID and add the column to the side tables.
- Determine whether you want to specify a table space or use the default table space. In this lesson, you will use the default table space.

To enable the column for XML:

Run the **dxxadm enable_column** command, using one of the following three methods:

Command line:
- Enter the following command:
  ```
  dxxadm enable_column -a V81A SALES_TAB ORDER getstart_xcolumn.dad
          -v SALES_ORDER_VIEW -r INVOICE_NUM
  ```
- Run the following command file to enable the column:
  ```
  getstartenableCol.cmd
  ```

TSO: Submit the `dxxgecol` JCL job.

The XML Extender creates the side tables with the INVOICE_NUM column and creates the default view.

Important: Do not modify the side tables in any way. Updates to the side tables should only be made through updates to the XML document itself. The XML Extender will automatically update the side tables when you update the XML document in the XML column.

Viewing the column and side tables:

When you enabled the XML column, you created a view of the XML column and side tables. You can use this view when working with the XML column.

To view the XML column and side-table columns:

Enter the following SQL SELECT statement from the command line:
```
odb2 SELECT * FROM SALES_ORDER_VIEW
```

The view shows the columns in the side tables, as specified in the `getstart_xcolumn.dad` file.

Indexing side tables for structural search:

Creating indexes on side tables allows you to do fast structural searches of the XML document. In this section, you create indexes on key columns in the side tables that were created when you enabled the XML column, ORDER. The service department has specified which columns their employees are likely to query most often. Table 4 describes these columns that you will index.

Table 4. Side-table columns to be indexed

Column	Side table
ORDER_KEY	ORDER_SIDE_TAB
CUSTOMER	ORDER_SIDE_TAB
PRICE	PART_SIDE_TAB
DATE	SHIP_SIDE_TAB

To index the side tables:

Run the following CREATE INDEX SQL commands using one of the following three methods:

Command line:

- Enter the following commands:
  ```
  DB2 CREATE INDEX KEY_IDX
        ON ORDER_SIDE_TAB(ORDER_KEY)

  DB2 CREATE INDEX CUSTOMER_IDX
        ON ORDER_SIDE_TAB(CUSTOMER)

  DB2 CREATE INDEX PRICE_IDX
        ON PART_SIDE_TAB(PRICE)

  DB2 CREATE INDEX DATE_IDX
        ON SHIP_SIDE_TAB(DATE)
  ```
- Run the following command file to create the indexes:
  ```
  getstart_createIndex.cmd
  ```

TSO: Submit the `dxxgcrin` JCL job.

Storing the XML document:

Now that you enabled a column that can contain the XML document and indexed the side tables, you can store the document using the functions that the XML Extender provides. When storing data in an XML column, you either use default casting functions or XML Extender UDFs. Because you will be storing an object of the base type VARCHAR in a column of the XML UDT XMLVARCHAR, you will use the default casting function.

To store the XML document:

1. Open the XML document `dxx_install/samples/db2xml/xml/getstart.xml` Ensure that the file path in the DOCTYPE matches the DTD ID specified in the DAD and when inserting the DTD in the DTD repository. You can verify they match by querying the DB2XML.DTD_REF table and by checking the DTDID element in the DAD file. If you are using a different drive and directory structure than the default, you need to change the path in the DOCTYPE declaration to match your directory structure.
2. Run the SQL INSERT command, using one of the following methods:

   Command line:

   - Enter the following SQL INSERT command:

```
DB2 INSERT INTO SALES_TAB (INVOICE_NUM, SALES_PERSON, ORDER) VALUES
('123456', 'Sriram Srinivasan', DB2XML.XMLVarcharFromFile
('dxx_install/samples/db2xml/
/xml/getstart.xml '))
```

- Run the following command file to store the document:

  ```
  getstart_insertXML.cmd
  ```

TSO: Submit the `dxxgixml` JCL job.

Verify that the tables have been updated. Run the following SELECT statements for the tables from the command line.

```
SELECT * FROM SALES_TAB
SELECT * FROM PART_SIDE_TAB
SELECT * FROM ORDER_SIDE_TAB
SELECT * FROM SHIP_SIDE_TAB
```

Querying the XML document:

You can search the XML document with a direct query against the side tables. In this step, you will search for all orders that have a price over 2500.00.

To query the side tables:

Run the SQL SELECT statement, using one of the following methods:

- Run **QueryCol.sql**

Command line: Either:

- Enter the following SQL SELECT statement:

  ```
  DB2 "SELECT DISTINCT SALES_PERSON FROM SALES_TAB S,
     PART_SIDE_TAB P  WHERE PRICE > 2500.00
      AND S.INVOICE_NUM=P.INVOICE_NUM"
  ```

- Run the following command file to search the document:

  ```
  getstart_queryCol.cmd
  ```

- **TSO:** Submit the `dxxgcqol` JCL job.

The result set should show the names of the salespeople who sold an item that had a price greater than 2500.00.

You have completed the getting started tutorial for storing XML documents in DB2 UDB tables. For Example:

```
SALES_PERSON

--------------------

Sriram Srinivasan
```

Related concepts:

- "Introduction to XML Extender" on page 3
- "Lesson: Composing an XML document" on page 20
- "XML Extender tutorial lessons" on page 7

Lesson: Composing an XML document

This lesson teaches you how to compose an XML document from existing DB2® data.

The scenario:

You have the task of taking information in an existing purchase order database, SALES_DB, and extracting requested information from it to be stored in XML documents. The service department will then use these XML documents when working with customer requests and complaints. The service department has requested specific data to be included and has provided a recommended structure for the XML documents.

Using existing data, you will compose an XML document, `getstart.xml`, from data in these tables.

To compose an XML document, you will plan and create a DAD file that maps columns from the related tables to an XML document structure that provides a purchase order record. Because this document is composed from multiple tables, you will create an XML collection and associate these tables with an XML structure and a DTD. You use this DTD to define the structure of the XML document. You can also use it to validate the composed XML document in your applications.

The existing database data for the XML document is described in the following tables. The column names with an asterisk are columns that the service department has requested in the XML document structure.

ORDER_TAB

Column name	Data type
ORDER_KEY *	INTEGER
CUSTOMER	VARCHAR(16)
CUSTOMER_NAME *	VARCHAR(16)
CUSTOMER_EMAIL *	VARCHAR(16)

PART_TAB

Column name	Data type
PART_KEY *	INTEGER
COLOR *	CHAR(6)
QUANTITY *	INTEGER
PRICE *	DECIMAL(10,2)
TAX *	REAL
ORDER_KEY	INTEGER

SHIP_TAB

Column name	Data type
DATE *	DATE
MODE *	CHAR(6)

Column name	Data type
COMMENT	VARCHAR(128)
PART_KEY	INTEGER

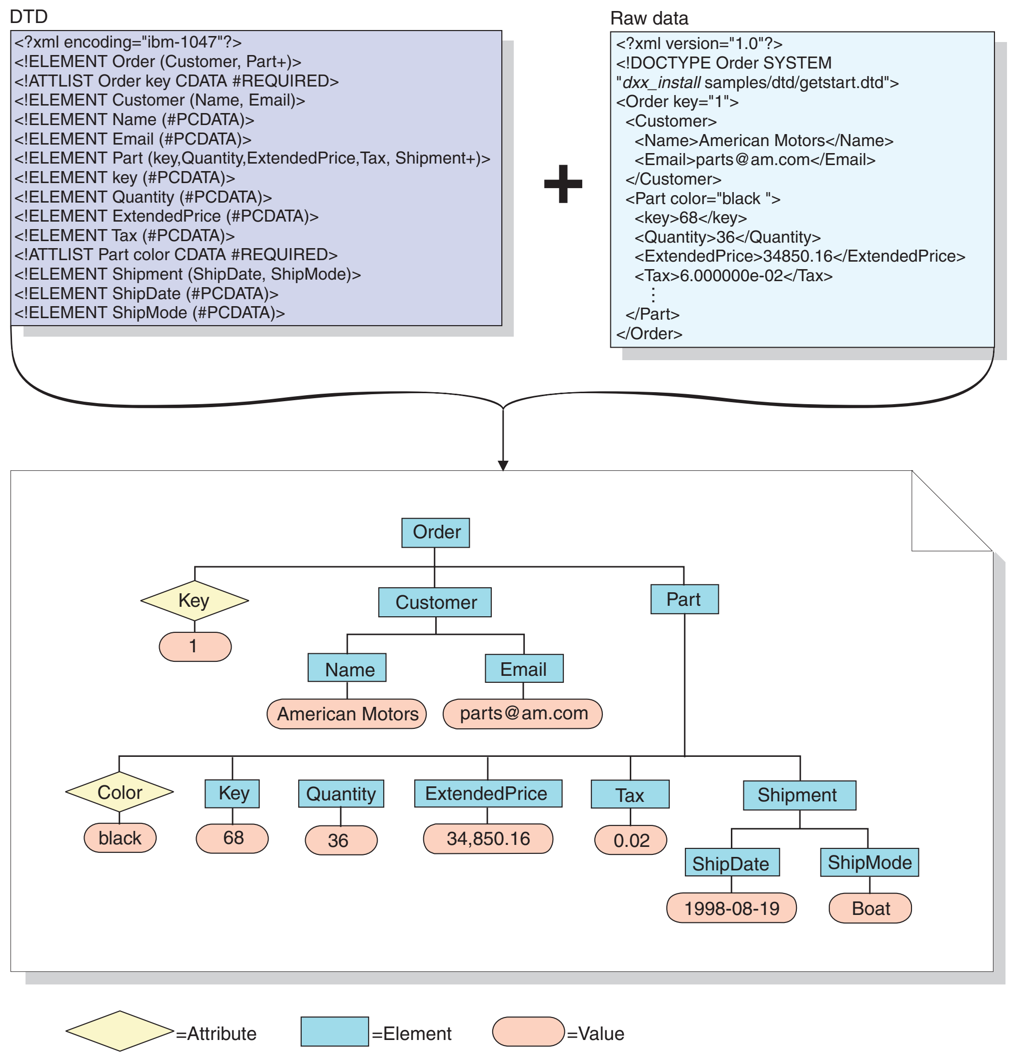
Planning:

Before you use the XML Extender to compose your documents, you need to determine the structure of the XML document and how it corresponds to the structure of your database data. This section provides an overview of the XML document structure that the service department requested, and the DTD that you will use to define the structure of the XML document. This section also shows how this document maps to the columns that contain the data used to populate the documents.

Determining the document structure:

The XML document structure takes information for a specific order from multiple tables and creates an XML document for the order. These tables each contain related information about the order and can be joined on their key columns. The service department wants a document that is structured by the order number as the top level, and then customer, part, and shipping information. The service department wants the document structure to be intuitive and flexible, with elements that describe the data rather than the structure of the document. (For example, the customer's name should be in an element called "customer," rather than a paragraph.)

After you design the document structure, you create a DTD to describe the structure of the XML document. This lesson provides an XML document and a DTD for you. Using the rules of the DTD, and the hierarchical structure of the XML document, you can create a hierarchical map of your data, as shown in Figure 2 on page 22.



DTD

```
<?xml encoding="ibm-1047"?>
<!ELEMENT Order (Customer, Part+)>
<!ATTLIST Order key CDATA #REQUIRED>
<!ELEMENT Customer (Name, Email)>
<!ELEMENT Name (#PCDATA)>
<!ELEMENT Email (#PCDATA)>
<!ELEMENT Part (key,Quantity,ExtendedPrice,Tax, Shipment+)>
<!ELEMENT key (#PCDATA)>
<!ELEMENT Quantity (#PCDATA)>
<!ELEMENT ExtendedPrice (#PCDATA)>
<!ELEMENT Tax (#PCDATA)>
<!ATTLIST Part color CDATA #REQUIRED>
<!ELEMENT Shipment (ShipDate, ShipMode)>
<!ELEMENT ShipDate (#PCDATA)>
<!ELEMENT ShipMode (#PCDATA)>
```

Raw data

```
<?xml version="1.0"?>
<!DOCTYPE Order SYSTEM
"dxx_install samples/dtd/getstart.dtd">
<Order key="1">
  <Customer>
    <Name>American Motors</Name>
    <Email>parts@am.com</Email>
  </Customer>
  <Part color="black ">
    <key>68</key>
    <Quantity>36</Quantity>
    <ExtendedPrice>34850.16</ExtendedPrice>
    <Tax>6.000000e-02</Tax>
      ⋮
  </Part>
</Order>
```

Figure 2. The hierarchical structure of the DTD and XML document

Mapping the XML document and database relationship:

After you design the structure and create the DTD, you need to show how the structure of the document relates to the DB2 UDB tables that you will use to populate the elements and attributes. You can map the hierarchical structure to specific columns in the relational tables, as shown in Figure 3 on page 23.

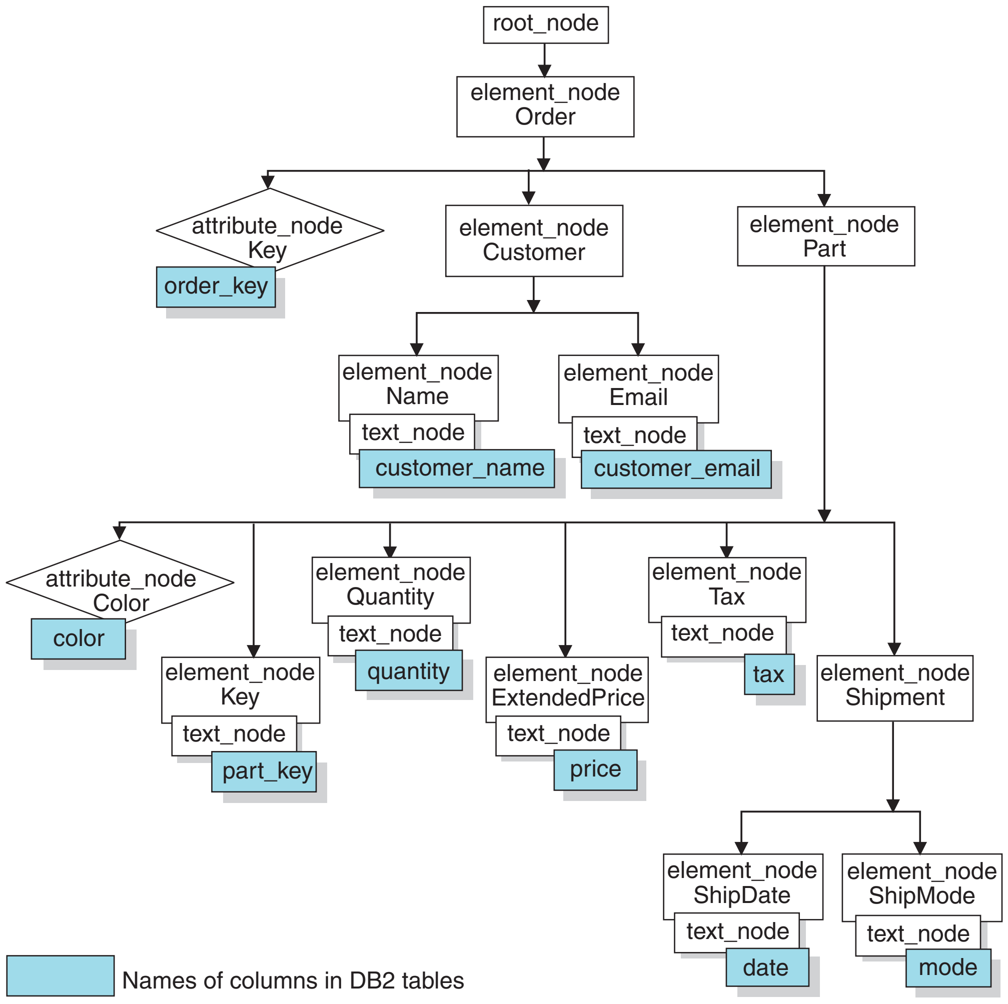


Figure 3. XML document mapped to relational table columns

This figure uses nodes to show elements, attributes, and text within the XML document structure. These nodes are used in the DAD file and are explained more fully in later steps.

Use this relationship description to create DAD files that define the relationship between the relational data and the XML document structure.

To create the XML collection DAD file, you need to understand how the XML document corresponds to the database structure, as described in Figure 3, so that you can describe from what tables and columns the XML document structure derives data for elements and attributes. You will use this information to create the DAD file for the XML collection.

The scripts and samples:

This lesson provides a set of scripts for you to use to set up your environment. `These scripts are in the dxx_install/samples/db2xml/xml directory (where dxx_install is the directory in USS where the sample DTD, DAD, and XML files are located).`

The scripts are:

Table 5 lists the USS and JCL samples that are provided to complete the getting started tasks.

Table 5. List of the XML collection lesson samples

Role	Description	USS command files	JCL file
administrator	Creates and populates the tables used for the lesson	Getstart_db.cmd	dxxgdb
administrator	Binds and enables the database	Getstart_prep.cmd	dxxgprep
administrator	Run a stored procedure to compose an XML document	Getstart_stp.cmd	dxxgstp
administrator	Exports a generated XML document from DB2	Getstart_export.cmd	dxxgexml
administrator	Cleanup the environment	Getstart_clean.cmd	dxxgclen

Important: If you completed the XML column lesson and did not clean up your environment, you might be able to skip this step. Check to see if you have a SALES_DB database.

To create the database:
1. Ensure that the database server was enabled by the DB2 administrator.
2. Change to the *dxx_install*/`samples/db2xml/xml directory, where` *`dxx_install`* `is the directory in USS where the sample DTD, DAD, and XML files are located`. The sample files contain references to files that use absolute path names. Check the sample files and change these values for your directory paths.
3. Run the create database command file, using one of the following methods:

   odb2 command line: Enter the following command:

   ```
   getstart_db.cmd
   ```

   TSO: Submit the `dxxgdb` JCL job.

To store XML information in the database, you need to enable it for the XML Extender. When you enable a database for XML, the XML Extender:
- Creates the user-defined types (UDTs), user-defined functions (UDFs), and stored procedures.
- Creates and populates control tables with the necessary metadata that the XML Extender requires.

Important: If you completed the XML column lesson and did not clean up your environment, you might be able skip this step.

To enable the database for XML, use one of the following methods:

Creating the DAD file for the XML collection:

Because the data already exists in multiple tables, you will create an XML collection, which associates the tables with the XML document. You define the collection by creating a DAD file.

In this section, you create the mapping scheme in the DAD file that specifies the relationship between the tables and the structure of the XML document.

In the following steps, elements in the DAD are referred to as *tags* and the elements of your XML document structure are referred to as *elements*. A sample of a DAD file similar to the one you will create is in *dxx_install*/`samples/db2xml/dad/getstart_xcollection.dad`.

It has some minor differences from the file generated in the following steps. If you use it for the lesson, note that the file paths might be different than in your environment and you might need to update the sample file.

To create the DAD file for composing an XML document:

1. From the `dxx_install/samples/db2xml/xml` directory, open a text editor and create a file called `getstart_xcollection.dad`.
2. Create the DAD header, using the following text:
   ```
   <?xml version="1.0"?>
   <!DOCTYPE DAD SYSTEM "dxx_install/samples/db2xml/dtd/dad.dtd">
   ```
   Change `dxx_install` to the directory where DB2 XML Extender was installed.
3. Insert the <DAD></DAD> tags. All other tags are located inside these tags.
4. Specify <validation> </validation> tags to indicate whether the XML Extender validates the XML document structure when you insert a DTD into the DTD repository table. This lesson does not require a DTD and the value is **NO**.
   ```
   <validation>NO</validation>
   ```
   The value of the <validation> tags can be mixed case.
5. Use the <Xcollection></Xcollection> tags to define the access and storage method as XML collection. The access and storage methods define that the XML data is stored in a collection of DB2 UDB tables.
   ```
   <Xcollection>
   </Xcollection>
   ```
6. After the <Xcollection> tag, provide an SQL statement to specify the tables and columns used for the XML collection. This method is called SQL mapping and is one of two ways to map relational data to the XML document structure. Enter the following statement:
   ```
   <Xcollection
   <SQL_stmt>
      SELECT o.order_key, customer_name, customer_email, p.part_key, color,
      quantity, price, tax, ship_id, date, mode from order_tab o, part_tab p,
      table (select substr(char(timestamp(db2xml.generate_unique())),16)
   as ship_id, date, mode, part_key from ship_tab)  s
            WHERE o.order_key = 1 and
                  p.price > 20000 and
                  p.order_key = o.order_key and
                  s.part_key = p.part_key
            ORDER BY order_key, part_key, ship_id
   </SQL_stmt>
   </Xcollection>
   ```
   This SQL statement uses the following guidelines when using SQL mapping. See Figure 3 on page 23 for the document structure.

- Columns are specified in top-down order, by the hierarchy of the XML document structure. For example, the columns for the order and customer elements are first, those for the part element are second, and those for the shipment are third.
- The columns for a repeating section, or nonrepeating section, of the template that requires data from the database are grouped together. Each group has an object ID column: ORDER_KEY, PART_KEY, and SHIP_ID.
- The object ID column is the first column in each group. For example, O.ORDER_KEY precedes the columns related to the key attribute and p.PART_KEY precedes the columns for the Part element.
- The SHIP_TAB table does not have a single key conditional column, and therefore, the generate_unique user-defined function is used to generate the SHIP_ID column.
- The object ID columns are then listed in top-down order in an ORDER BY statement. The columns in ORDER BY are not qualified by any schema and table name, and they match the column names in the SELECT clause.

7. Add the following prolog information to be used in the composed XML document:

   ```
   <prolog>?xml version="1.0"?</prolog>
   ```

   This exact text is required for all DAD files.
8. Add the <doctype></doctype> tags to be used in the XML document you are composing. The <doctype> tag contains the path to the DTD stored on the client.

   ```
   <doctype>!DOCTYPE Order SYSTEM
   "dxx_install/samples/db2xml/dtd/getstart.dtd"</doctype>
   ```
9. Define the root element of the XML document using the <root_node></root_node> tags. Inside the root_node, specify the elements and attributes that make up the XML document.
10. Map the XML document structure to the DB2 UDB relational table structure using the following three types of nodes:

    element_node
    Specifies the element in the XML document. Element_nodes can have child element_nodes.

    attribute_node
    Specifies the attribute of an element in the XML document.

    text_node
    Specifies the text content of the element and the column data in a relational table for bottom-level element_nodes.

    Figure 3 on page 23 shows the hierarchical structure of the XML document and the DB2 UDB table columns, and indicates what kinds of nodes are used. The shaded boxes indicate the DB2 UDB table column names from which the data will be extracted to compose the XML document.

    To add each type of node, one type at a time:

    a. Define an <element_node> tag for each element in the XML document.

    ```
    <root_node>
    <element_node name="Order">
      <element_node name="Customer">
         <element_node name="Name">
         </element_node>
         <element_node name="Email">
         </element_node>
      </element_node>
    ```

```
  <element_node name="Part">
     <element_node name="key">
     </element_node>
     <element_node name="Quantity">
     </element_node>
     <element_node name="ExtendedPrice">
     </element_node>
     <element_node name="Tax">
     </element_node>
     <element_node name="Shipment" multi_occurrence="YES">
        <element_node name="ShipDate">
        </element_node>
        <element_node name="ShipMode">
        </element_node>
     </element_node> <!-- end Shipment -->
  </element_node> <!-- end Part -->
</element_node> <!-- end Order -->
</root_node>
```

The <Shipment> child element has an attribute of multi_occurrence=YES. This attribute is used for elements without an attribute, that are repeated in the document. The <Part> element does not use the multi-occurrence attribute because it has an attribute of color, which makes it unique.

b. Define an <attribute_node> tag for each attribute in your XML document. These attributes are nested in the appropriate element_node. The added attribute_nodes are highlighted in bold:

```
<root_node>
<element_node name="Order">
  <attribute_node name="key">
  </attribute_node>
  <element_node name="Customer">
     <element_node name="Name">
     </element_node>
     <element_node names"Email">
     </element_node>
  </element_node>
  <element_node name="Part">
    <attribute_node name="color">
    </attribute_node>
    <element_node name="key">
    </element_node>
    <element_node name="Quantity">
    </element_node>

...

  </element_node> <!-- end Part -->
</element_node> <!-- end Order -->
</root_node>
```

c. For each bottom-level element_node, define <text_node> tags to indicate that the XML element contains character data to be extracted from DB2 UDB when the document is composed.

```
<root_node>
<element_node name="Order">
  <attribute_node name="key">
  </attribute_node>
  <element_node name="Customer">
    <element_node name="Name">
      <text_node>
      </text_node>
    </element_node>
    <element_node name="Email">
      <text_node>
      </text_node>
    </element_node>
  </element_node>
  <element_node name="Part">
    <attribute_node name="color">
    </attribute_node>
    <element_node name="key">
       <text_node>
       </text_node>
    </element_node>
    <element_node name="Quantity">
      <text_node>
      </text_node>
    </element_node>
    <element_node name="ExtendedPrice">
      <text_node>
      </text_node>
    </element_node>
    <element_node name="Tax">
      <text_node>
      </text_node>
    </element_node>
    <element_node name="Shipment" multi_occurrence="YES">
      <element_node name="ShipDate">
        <text_node>
        </text_node>
      </element_node>
      <element_node name="ShipMode">
        <text_node>
        </text_node>
      </element_node>
    </element_node> <!-- end Shipment -->
  </element_node> <!-- end Part -->
</element_node> <!-- end Order -->
</root_node>
```

d. For each bottom-level element_node, define a <column/> tag. These tags specify from which column to extract data when composing the XML document and are typically inside the <attribute_node> or the <text_node> tags. The columns defined in the <column/> tag must be in the <SQL_stmt> SELECT clause.

```
<root_node>
<element_node name="Order">
  <attribute_node name="key">
    <column name="order_key"/>
  </attribute_node>
  <element_node name="Customer">
    <element_node name="Name">
      <text_node>
        <column name="customer_name"/>
      </text_node>
    </element_node>
    <element_node name="Email">
      <text_node>
        <column name="customer_email"/>
     </text_node>
    </element_node>
  </element_node>
  <element_node name="Part">
    <attribute_node name="color">
       <column name="color"/>
    </attribute_node>
    <element_node name="key">
      <text_node>
        <column name="part_key"/>
      </text_node>
    <element_node name="Quantity">
```

```
            <text_node>
              <column name="quantity"/>
            </text_node>
          </element_node>
          <element_node name="ExtendedPrice">
            <text_node>
              <column name="price"/>
            </text_node>
          </element_node>
          <element_node name="Tax">
            <text_node>
              <column name="tax"/>
            </text_node>
          </element_node>
          <element_node name="Shipment" multi_occurrence="YES">
            <element_node name="ShipDate">
              <text_node>
                <column name="date"/>
              </text_node>
            </element_node>
            <element_node name="ShipMode">
              <text_node>
                <column name="mode"/>
              </text_node>
            </element_node>
          </element_node> <!-- end Shipment -->
        </element_node> <!-- end Part -->
      </element_node> <!-- end Order -->
      </root_node>
```

11. Ensure that you have the necessary end tags:
    - An ending </root_node> tag after the last </element_node> tag
    - An ending </Xcollection> tag after the </root_node> tag
    - An ending </DAD> tag after the </Xcollection> tag
12. Save the file as `getstart_xcollection.dad`.

You can compare the file that you created with the sample file *dxx_install*/`samples/db2xml/dad/getstart_xcollection.dad` . This file is a working copy of the DAD file required to compose the XML document. The sample file contains location paths and file path names that might need to be changed to match your environment to be run successfully.

In your application, if you will use an XML collection frequently to compose documents, you can define a collection name by enabling the collection. Enabling the collection registers it in the XML_USAGE table and helps improve performance when you specify the collection name (rather than the DAD file name) when running stored procedures. In these lessons, you do not enable the collection.

Composing the XML document:

In this step, you use the dxxGenXML() stored procedure to compose the XML document specified by the DAD file. This stored procedure returns the document as an XMLVARCHAR UDT.

To compose the XML document:

1. Use one of the following methods to call the dxxGenXML stored procedure:

   Command line: Enter the following command:

   ```
   getstart_stp.cmd
   ```

   TSO: Submit the `dxxgstp` JCL job.

The stored procedure composes the XML document and stores it in the RESULT_TAB table.

You can see samples of stored procedures that can be used in this step in the following files:

- *dxx_install*/`samples/db2xml/c/tests2x.sqc` shows how to call the stored procedure using embedded SQL and generates the `tests2x` executable file, which is used by the `getstart_stp.cmd`.
- *dxx_install*/`samples/db2xml/cli/sql2xml.c dxxsamples/cli/sql2xml.c`shows how to call the stored procedure using the CLI.

2. Export the XML document from the table to a file using one of the following methods to call the XML Extender retrieval function, Content():

   Command line:

   - Enter the following commands:

   ```
   DB2 SELECT DB2XML.Content(DB2XML.xmlVarchar(doc),
      'dxx_install/samplesdb2xml/cmd/xml/getstart.xml
        ') FROM RESULT_TAB
   ```

   - Run the following command file to export the file:

   ```
   getstart_exportXML.cmd
   ```

   TSO: Submit the `DXXGEXML` JCL job.

Tip: This step teaches you how to generate one or more composed XML documents using DB2 UDB stored procedure's result set feature. Using a result set allows you to fetch multiple rows to generate more than one document. When you generate each document, you can export it to a file. This method is the simplest way to demonstrate using result sets. For more efficient ways of fetching data, see the CLI examples in *dxx_install*/`samples/db2xml/cli`.

Transforming an XML document into an HTML file:

To show the data from the XML document in a browser, you must transform the XML document into an HTML file by using a stylesheet and the XSLTransformToFile function.

Use the following steps to transform to an HTML file:

1. Generate a stylesheet:

   ```
   <?xml version="1.0" encoding="UTF-8"?>
    <xsl:stylesheet version="1.0"
     xmlns:xsl="http://www.w3.org/1999/XSL/Transform">

    <xsl:template match="/">
     <html>
     <head/>
     <body>

     ...

        </body>
      </html>
    </xsl:template>
    </xsl:stylesheet>
   ```

2. For each element, create a tag using the following format:

   ```
   <xsl:for-each select="xxxxxx">
   ```

   This tag will be used for transforming instructions. Create a tag for each element of the hierarchy of the XML document. For example:

```
<?xml version="1.0" encoding="UTF-8"?>
 <xsl:stylesheet version="1.0"
  xmlns:xsl="http://www.w3.org/1999/XSL/Transform">

 <xsl:template match="/">
  <html>
  <head/>
  <body>

     <xsl:for-each select="Order">

    <xsl:for-each select="Customer">
          <xsl:for-each select="Name | Email">
          </xsl:for-each>
       </xsl:for-each>
<xsl:for-each select="Part">
        <xsl:for-each select="key | Quantity | ExtendedPrice | Tax">
      </xsl:for-each>

           <xsl:for-each select="Shipment">
        <xsl:for-each select="ShipDate | ShipMode">
        </xsl:for-each>
            </xsl:for-each>
          </xsl:for-each>
        </xsl:for-each>
    </body>
   </html>
 </xsl:template>
 </xsl:stylesheet>
```

3. To format the HTML file, use a list that shows the hierarchy of the XML elements to make the data more readable. Create some additional text elements to describe the data. For example, your stylesheet file might look like this:

```
<?xml version="1.0" encoding="UTF-8"?>
 <xsl:stylesheet version="1.0"
  xmlns:xsl="http://www.w3.org/1999/XSL/Transform">

 <xsl:template match="/">
  <html>
  <head/>
  <body>

     <ol style="list-style:decimal outside">
      <xsl:for-each select="Order">
       <li> Orderkey : <xsl:value-of-select="@key"/ <br/>

       <xsl:for-each select="Customer">
        <b>Customer</b><br/>
          <xsl:for-each select="Name | Email">
      <xsl:value-of select="name()"/>
      <xsl:text> : </xsl:text>
           <xsl:value-of select="."/>
           <xsl:text>, </xsl:text>
          </xsl:for-each>
       </xsl:for-each>

         <br/><br/>
    <ol type="A">
        <xsl:for-each select="Part">
         <li><b>Parts</b><br/>
      Color : <xsl:value-of select="@color"/>
           <xsl:text>, </xsl:text>

        <xsl:for-each select="key | Quantity | ExtendedPrice | Tax">
  <xsl:value-of select="name()"/>
            <xsl:text> : </xsl:text>
            <xsl:value-of select="."/>
  <xsl:text>, </xsl:text>
      </xsl:for-each>

           <br/><br/>
      <ol type="a">
           <xsl:for-each select="Shipment">
        <li><b>Shipment</b><br/>
        <xsl:for-each select="ShipDate | ShipMode">
    <xsl:value-of select="name()"/>
              <xsl:text> : </xsl:text>
              <xsl:value-of select="."/>
    <xsl:text>, </xsl:text>
        </xsl:for-each>
       </li>
           </xsl:for-each>
          </ol><br/>
          </li>
          </xsl:for-each>
        </ol>
       </li>
        </xsl:for-each>
       </ol>
    </body>
   </html>
 </xsl:template>
 </xsl:stylesheet>
```

4. Use Xpath to edit the <xsl:value-of select=″xxx″> tags with data from the XML document.

   The element tags are <xsl:value-of select″.″>, where the period (″.″) is used to get data from normal elements.

   The attribute tags are <xsl:value-of select=″@attributname″> , where the ampersand (@) that is added by the attribute name will extract the value of the attribute. You can use the <xsl:value-of select=″name()″> to get the name of the XML tag.

```
<?xml version="1.0" encoding="UTF-8"?>
 <xsl:stylesheet version="1.0"
  xmlns:xsl="http://www.w3.org/1999/XSL/Transform">

 <xsl:template match="/">
  <html>
  <head/>
  <body>

     <ol style="list-style:decimal outside">
      <xsl:for-each select="Order">
       <li> Orderkey : <xsl:value-of-select="@key"/ <br/>

       <xsl:for-each select="Customer">
        <b>Customer</b><br/>
          <xsl:for-each select="Name | Email">
      <xsl:value-of select="name()"/>
      <xsl:text> : </xsl:text>
           <xsl:value-of select="."/>
           <xsl:text>, </xsl:text>
          </xsl:for-each>
       </xsl:for-each>

         <br/><br/>
    <ol type="A">
        <xsl:for-each select="Part">
         <li><b>Parts</b><br/>
      Color : <xsl:value-of select="@color"/>
           <xsl:text>, </xsl:text>
        <xsl:for-each select="key | Quantity | ExtendedPrice | Tax">
  <xsl:value-of select="name()"/>
            <xsl:text> : </xsl:text>
            <xsl:value-of select="."/>
  <xsl:text>, </xsl:text>
      </xsl:for-each>

           <br/><br/>
      <ol type="a">
           <xsl:for-each select="Shipment">
        <li><b>Shipment</b><br/>
        <xsl:for-each select="ShipDate | ShipMode">
    <xsl:value-of select="name()"/>
              <xsl:text> : </xsl:text>
              <xsl:value-of select="."/>
    <xsl:text>, </xsl:text>
        </xsl:for-each>
       </li>
           </xsl:for-each>
          </ol><br/>
          </li>
          </xsl:for-each>
        </ol>
       </li>
        </xsl:for-each>
       </ol>
    </body>
   </html>
 </xsl:template>
 </xsl:stylesheet>
```

5. Save the stylesheet.
6. Create the HTML file in one of the following ways:
   - Use the XSLTransformToFile:
     ```
     SELECT XSLTransformToFile( CAST(doc AS CLOB(4k)),
         'dxx_install\samples\xslt\getstart.xsl',
        'dxx_install\samples\html\getstart.html')
      FROM RESULT_TAB
     ```
   - Use the following command:
     ```
     Getstart_xslt.cmd
     ```

The output file can be written only to a file system that is accessible to the DB2 UDB server.

Cleaning up the tutorial environment:

If you want to clean up the lesson environment, you can run one of the provided scripts or enter the commands from the command line to:
- Disable the XML column, ORDER.
- Drop tables created in the lessons.
- Delete the DTD from the DTD repository table.

They do not disable or drop the SALES_DB database; the database is still available for use with XML Extender. You might receive error messages if you have not completed both lessons in this chapter. You can ignore these errors.

To clean up the tutorial environment:

Run the cleanup command file, using one of the following methods:
- **Command line:** Enter the following command:

```
getstart_clean.cmd
```

TSO: Submit the `dxxgclen` JCL job.

- If you want to disable the server, you can run the following XML Extender command from the command line:

  ```
  dxxadm disable_server -a V81A
  ```

  This command drops the administration control tables DTD_REF and XML_USAGE, and removes the user-defined types and functions provided by XML Extender.

Related concepts:

- "Introduction to XML Extender" on page 3
- "Lesson: Storing an XML document in an XML column" on page 8
- "XML Extender tutorial lessons" on page 7

Part 2. Administration

This part describes how to perform administration tasks for the XML Extender.

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Chapter 2. Administration

Administration tools for XML Extender

The XML Extender administration tools help you enable your database and table columns for XML, and map XML data to DB2® relational structures. The XML Extender provides the following command line tool and programming interfaces for administration tasks that you can use.

XML Extender provides a command line tool and programming interfaces for administration tasks.

- The **dxxadm** command can be run from UNIX® System Services (USS) or from the TSO command line.
- JCL based on samples provided in the SDXXJCL data set

XML Extender also provides the following tools to complete administration tasks:

- The XML Extender administration wizard provides a graphical user interface for administration tasks.
- The XML Extender administration stored procedures allow you to invoke administration commands from a program.

Preparing to administer XML Extender

To run XML Extender, you need to install the following software.

Required software: The XML Extender requires DB2® Universal Database for z/OS Version 8.

Optional software:

- For structural text search, the DB2 Universal Database Text Extender Version 8, which is available with DB2 Universal Database Version 8
- For XML Extender administration wizard:
  - DB2 Universal Database Java Database Connectivity (JDBC)
  - JDK 1.1.7 or JRE 1.1.1, which is available with the DB2 UDB Control Center
  - JFC 1.1 with Swing 1.1, which is available with the DB2 UDB Control Center

Before you install XML Extender, you must complete following tasks:

- View the set up instructions.
- Create a database for XML access.

To perform administration tasks using XML Extender, you must have DB2ADM authority.

Migrating XML Extender from Version 7 to Version 8

If you use XML Extender Version 7, you must migrate each serverthat is enabled for XML Extender before you use an existing XML-enabled database with XML Extender Version 8.

The migration program executes various steps depending on the base level of XML Extender that you have. Steps that the migration program might execute are:

- Create XMLDBCLOB user-defined types (UDTs) and user-defined functions (UDFs) for use with Unicode and DBCS databases
- Create new user-defined functions for Schema and DTD validation and XSLT function.
- Create new stored procedures (dxxGenXMLCLOB and dxxRetrieveXMLCLOB) that return CLOBs.
- Drop and re-create the user-defined functions UDFs that allow you to use the parallel capability for the scalar UDFs.

When calling stored procedures, use a period (.) instead of an explanation point (!) in the procedure name. For example, use *db2xml.dxxEnableColumn* instead of *db2xml!dxxEnableColumn*.

Procedure:

To migrate an XML enabled server and XML enabled columns:

1. Install DB2 UDB XML Extender Version 8.1.
2. Re-bind the XML Extender packages by running DXXRBIND.
3. Update the UDFs and stored procedures by running DXXMIGRA.

To manually migrate columns enabled for XML extender:

1. Retrieve the DAD file that is used to enable a column from the DB2XML.XML_USAGE table before you disable any columns.

XML Extender administration planning

The XML Extender provides several methods for administration: XML Extender administration command and XML Extender *stored procedures*. You can also use the XML Extender administration wizard, if you have XML Extender installed on a client workstation.

- The administration command, **dxxadm**, provides subcommands for the various administration tasks.
- Administration tasks can be executed by calling stored procedures for administration from a program.
- The XML Extender administration wizard guides you through the administration tasks. You can use it from a client workstation to perform these tasks.

When you plan an application that uses XML documents, you first decide whether you will:

- Compose XML documents from data in the database.
- Store existing XML documents. If you will store XML documents, you must also decide if you want them to be stored as intact XML documents in a column or decomposed into regular DB2® data.

After you make this decision, you can then decide:

- Whether to validate your XML documents
- Whether to index XML column data for fast search and retrieval
- How to map the structure of the XML document to DB2 UDB relational tables

Setting up the administration wizard

The XML Extender administration tasks consist of enabling your database columns for XML and mapping XML data to DB2 UDB relational structures. You can use the XML Extender wizard to complete these administration tasks. This chapter explains how you can set up and invoke the administration wizard. You can invoke the wizard either through the Windows Start menu or from a command line prompt.

Prerequisites:

Before you set up the wizard, you must install and configure the administration wizard as explained in the README file for your operating system. You must include the required class files in your CLASSPATH environment variable.

With the exception of the line breaks, ensure that the CLASSPATH environment variable looks similar to the following example:

```
.;C:\java\db2java.zip;C:\java\runtime.zip;C:\java\sqlj.zip;
C:\dxx_installtools\dxxadmin.jar;C:\dxx_install\bin\dxxadmin.cmd;
C:\dxx_installtools\html\dxxahelp*.htm;C:\java\jdk\lib\classes.zip;
C:\java\swingall.jar
```

Where *dxx_install* is the install directory.

Procedure:

To set up the XML Extender Administration wizard:

1. Invoke the wizard using the JDK. You can use either the Java Development Kit or the Java Runtime Environment (JRE).
   - To use the JRE, enter:
     ```
     jre -classpath classpath com.ibm.dxx.admin.Admin
     ```
   - To use the JDK, enter:
     ```
     java -classpath classpath com.ibm.dxx.admin.Admin
     ```

   Where *classpath* specifies the %CLASSPATH% environment variable that specifies where the administration wizard class files are located. When using this option, your system CLASSPATH variable must point to the `dxx_install/tools` directory, which contains the following files: `dxxadmin.jar`, `xml4j.jar`, and `db2java.zip`. For example:
   ```
   java -classpath %CLASSPATH% com.ibm.dxx.admin.Admin
   ```

   classpath can also specify an override of the %CLASSPATH% environment variable with pointers to files in the `dxx_install/dxxadmin` directory, from which you are running the XML Extender administration wizard. For example:
   ```
   java -classpath dxxadmin.jar;xml4j.jar;db2java.zip com.ibm.dxx.admin.Admin
      url=jdbc:db2:mydb2 userid=db2xml password=db2xml
      driver=COM.ibm.db2.jdbc.app.DB2Driver
   ```
2. From the Logon window, log on to the database that you want to use to work with XML data.
3. In the **Address** field, type the fully-qualified JDBC URL to the data source to which you are connecting. The address has the following syntax:
   ```
   jdbc:db2:database_name
   ```

   Where *database_name* is the database to which you are connecting and storing XML documents.

For example:

```
jdbc:db2:sales_db
```

4. In the **User ID** and **Password** fields, type or verify the DB2 UDB user ID and password for the database to which you are connecting.
5. In the **JDBC Driver** field, verify the JDBC driver name for the specified address using the following values:

   ```
   COM.ibm.db2.jdbc.app.DB2DRIVER
   ```
6. Click **Finish**. Invoke the wizard and advance to the LaunchPad window.

After you complete this procedure you can invoke the wizard in the LaunchPad window. With the wizard, you can perform the following functions:

- Enable a server.
- Add a DTD to the DTD repository.
- Work with XML columns.
- Work with XML collections.

Access and storage methods

The XML Extender provides two access and storage methods to use DB2® as an XML repository: XML column and XML collection. You need to decide which of these methods best matches your application's needs for accessing and manipulating XML data.

XML column
Stores and retrieves entire XML documents as DB2 UDB column data. The XML data is represented by an XML column.

XML collection
Decomposes XML documents into a collection of relational tables or composes XML documents from a collection of relational tables.

The nature of your application determines which access and storage method is most suitable, and how to structure your XML data.

You use the DAD file to associate XML data with DB2 UDB tables through these two access and storage methods. Figure 4 on page 41 shows how the DAD specifies the access and storage methods.

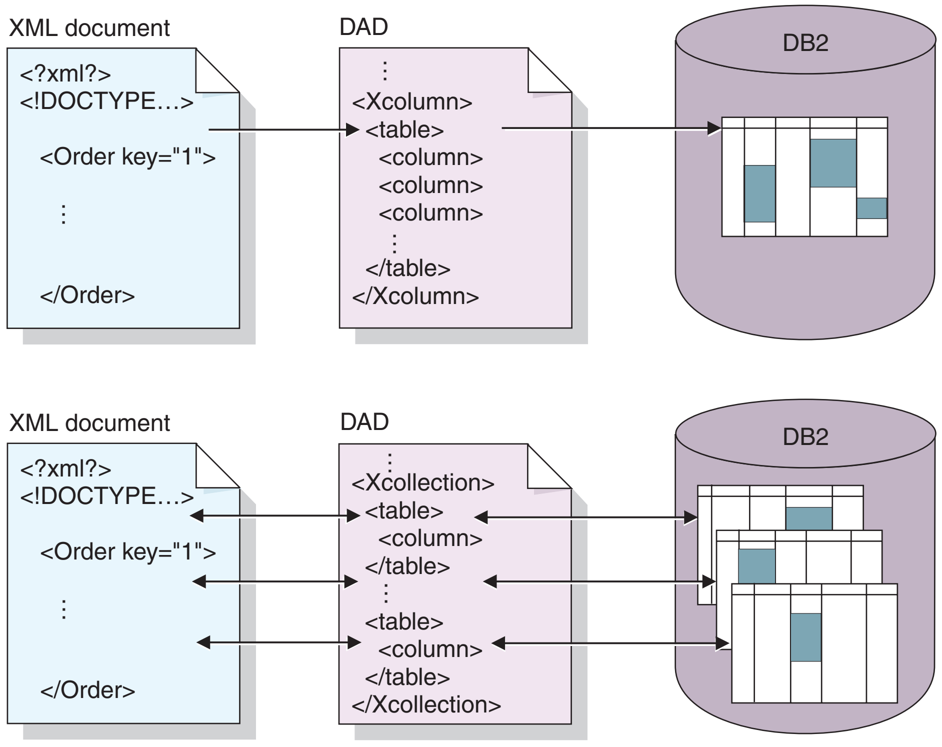

Figure 4. The DAD file maps the XML document structure to a DB2 UDB relational data structure and specifies the access and storage method.

The DAD file defines the location of key files like the DTD, and specifies how the XML document structure relates to your DB2 UDB data. Most important, it defines the access and storage method that you use in your application.

Related concepts:

- “When to use the XML column method” on page 41
- “When to use the XML collection method” on page 42

Related reference:

- “Storage functions in XML Extender overview” on page 138

When to use the XML column method

Use XML columns in any of the following situations:

- The XML documents already exist or come from an external source and you prefer to store the documents in the native XML format. You want to store them in DB2® for integrity, archival, and auditing purposes.
- The XML documents are read frequently, but not updated.
- You want to use file name data types to store the XML documents (external to DB2 UDB) in the local or remote file system and use DB2 UDB for management and search operations.
- You need to perform range searches based on the values of XML elements or attributes, and you know what elements or attributes will frequently be used in the search arguments.
- The documents have elements with large text blocks and you want to use the DB2 UDB Text Extender for structural text search while keeping the entire documents intact.

When to use the XML collection method

Use XML collections in any of the following situations:

- You have data in your existing relational tables and you want to compose XML documents based on a certain DTD.
- You have XML documents that need to be stored with collections of data that map well to relational tables.
- You want to create different views of your relational data using different mapping schemes.
- You have XML documents that come from other data sources. You care about the data but not the tags, and want to store pure data in your database and you want the flexibility to decide whether to store the data in existing tables or in new tables.

Planning for XML columns

Before you begin working with the XML Extender to store your documents, you need to understand the structure of the XML document so that you can determine how to index elements and attributes in the document. When planning how to index the document, you need to determine:

- The XML user-defined type in which you will store the XML document
- The XML elements and attributes that your application will frequently search, so that their content can be stored in side tables and indexed to improve performance
- Whether to validate XML documents in the column with a DTD
- The structure of the side tables and how they will be indexed

XML data types for the XML columns

The XML Extender provides XML user defined types that you use to define a column to hold XML documents. These data types are described in Table 6.

Table 6. The XML Extender UDTs

User-defined type column	Source data type	Usage description
XMLVARCHAR	VARCHAR(*varchar_len*)	Stores an entire XML document as a VARCHAR data type within DB2. Used for small documents that are stored in DB2.
XMLCLOB	CLOB(*clob_len*)	Stores an entire XML document as a CLOB data type within DB2. Used for large documents that are stored in DB2.
XMLFILE	VARCHAR(512)	Stores the file name of an XML document in DB2, and stores the XML document in a file local to the DB2® server. Used for documents that are stored outside DB2.

Elements and attributes to index for XML columns

When you understand the XML document structure and the needs of your application, you can determine which elements and attributes will be searched or extracted most frequently, or those that will be the most expensive to query. The DAD file for an XML column can map the location paths of each element and attribute to relational tables (side tables) that contain these objects. The side tables are then indexed.

For example, Table 7 shows an example of types of data and location paths of elements and attributes from the Getting Started scenario for XML columns. The data was specified as information to be frequently searched and the location paths point to elements and attributes that contain the data. The DAD file can map these location paths to side tables.

Table 7. Elements and attributes to be searched

Data	Location path
order key	/Order/@key
customer	/Order/Customer/Name
price	/Order/Part/ExtendedPrice
shipping date	/Order/Part/Shipment/ShipDate

The DAD file for XML columns

For XML columns, the DAD file primarily specifies how documents that are stored in an XML column are to be indexed. The DAD file specifies a DTD to use for validating documents that are inserted into the XML column. The DAD file has a data type of CLOB. This file can be up to 100 KB.

The DAD file for XML columns provides a map of any XML data that is to be stored in side tables for indexing.

To specify the XML column access and storage method, you use the <Xcolumn> tag in the DAD file. The <Xcolumn> tag specifies that the XML data is to be stored and retrieved as entire XML documents in DB2 UDB columns that are enabled for XML data.

An XML-enabled column is of the XML Extender's UDT. Applications can include the column in any *user table*. You access the XML column data mainly through SQL statements and the XML Extender's UDFs.

Related concepts:

- "Planning side tables" on page 58

Planning for XML collections

When planning for XML collections, you have different considerations for composing documents from DB2® data, decomposing XML document into DB2 data, or both. The following sections address planning issues for XML collections, and address composition and decomposition considerations.

Validation

After you choose an access and storage method, you can determine whether to validate your data. You validate XML data using a DTD or a schema. Using a DTD or schema to validate ensures that the XML document is valid.

To validate using a DTD, you might need to have a DTD in the XML Extender repository.

Important: Make the decision whether to validate XML data before you insert XML data into DB2. The XML Extender does not validate data that is already inserted into DB2.

Considerations:

- You can use only one DTD for composition.
- You can use multiple schemas for composition.
- If you do not choose to validate a document, the DTD specified by the XML document is not processed. It is important that DTDs be processed to resolve entities and attribute defaults even when processing document fragments that cannot be validated.

The DAD file for XML collections

For XML collections, the DAD file maps the structure of the XML document to the DB2 UDB tables from which you compose the document, or where you decompose the document.

For example, if you have an element called <Tax> in your XML document, you might need to map <Tax> to a column called TAX. You define the relationship between the XML data and the relational data in the DAD.

You specify the DAD file name when you enable a collection, or when you use the DAD file in XML collection stored procedures. If you choose to validate XML documents with a DTD, the DAD file can be associated with that DTD. When used as the input parameter of the XML Extender stored procedures, the DAD file has a data type of CLOB. This file can be up to 100 KB.

To specify the XML collection access and storage method, you use the tag in the DAD file. The <Xcollection> tag specifies that the XML data is either to be decomposed from XML documents into a collection of relational tables, or to be composed into XML documents from a collection of relational tables.

An XML collection is a virtual name for a set of relational tables that contains XML data. Applications can enable an XML collection of any user tables. These user tables can be existing tables of legacy business data or tables that the XML Extender recently created.

The DAD file defines the XML document tree structure, using the following kinds of nodes:

root_node
Specifies the root element of the document.

element_node
Identifies an element, which can be the root element or a child element.

text_node
Represents the CDATA text of an element.

attribute_node
Represents an attribute of an element.

Figure 5 shows a fragment of the mapping that is used in a DAD file. The nodes map the XML document content to table columns in a relational table.

```
<?xml version="1.0"?>
<!DOCTYPE DAD SYSTEM "dxx_install/samples/db2xml/dtd/dad.dtd">
<DAD>
  ...
<Xcollection>
<SQL_stmt>
       ...
</SQL_stmt>
<prolog>?xml version="1.0"?</prolog>
<doctype>!DOCTYPE Order SYSTEM "dxx_install/samples/db2xml/dtd/
getstart.dtd"</doctype><root_node>
   <element_node name="Order">     --> Identifies the element <Order>
     <attribute_node name="key">   --> Identifies the attribute "key"
        <column name="order_key"/> --> Defines the name of the column,
                                     "order_key", to which the element
                                      and attribute are mapped
                                     </attribute_node>
     <element_node name="Customer">  --> Identifies a child element of
                                          <Order> as <Customer>
        <text_node>                  --> Specifies the CDATA text for
                                          the element<Customer>
          <column name="customer">    --> Defines the name of the column,
                                         "customer", to which the child
                                          element is mapped
        </text_node>
     </element_node>
        ...
   </element_node>

      ...
<root_node>
</Xcollection>
</DAD>
```

Figure 5. Node definitions in a DAD file for an XML collection

In the above figure, the first two columns in the SQL statement have elements and attributes mapped to them.

The XML Extender also supports processing instructions for stylesheets, using the <stylesheet> element. The <stylesheet> element must be inside the root node of the DAD file, with the doctype and prolog defined for the XML document. For example:

```
<Xcollection>
...
<prolog>...</prolog>
<doctype>...</doctype>
<stylesheet>?xml-stylesheet type="text/css"
href="order.css"?</stylesheet>
<root_node>...</root_node>
...

</Xcollection>
```

You can use the Websphere Studio Application Developer to create and update the DAD file. The <stylesheet> element is not currently supported by the XML Extender Administration wizard.

Mapping schemes for XML collections

If you are using an XML collection, you must select a *mapping scheme* that defines how XML data is represented in a relational database. Because XML collections must match a hierarchical structure that is used in XML documents with a relational structure, you should understand how the two structures compare. Figure 6 shows how the hierarchical structure can be mapped to relational table columns.

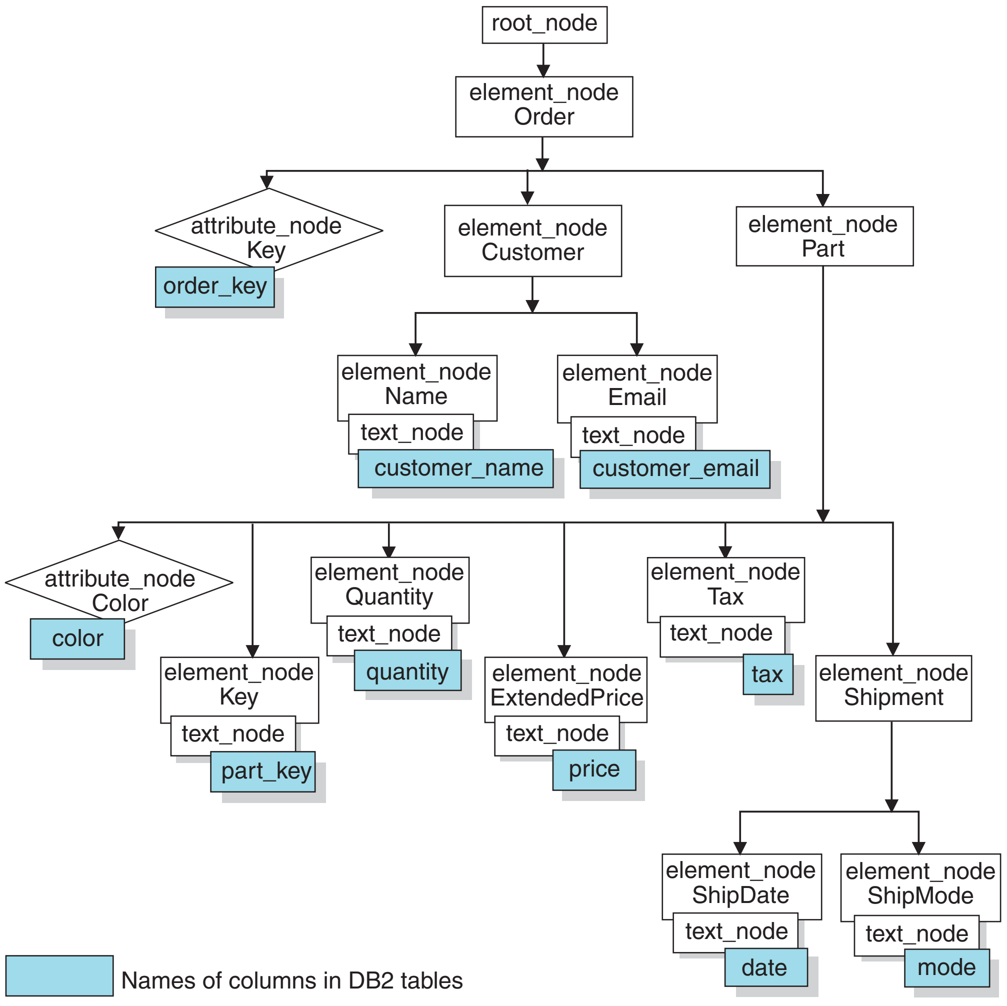

Figure 6. XML document structure mapped to relational table columns

The XML Extender uses the mapping scheme when composing or decomposing XML documents that are located in multiple relational tables. The XML Extender provides a wizard that assists you with creating the DAD file. However, before you create the DAD file, you must consider how your XML data is mapped to the XML collection.

Types of mapping schemes

The mapping scheme is specified in the <Xcollection> element in the DAD file. The XML Extender provides two types of mapping schemes: *SQL mapping* and *relational database (RDB_node) mapping*.

SQL mapping

Allows direct mapping from relational data to XML documents through a single SQL statement. SQL mapping is used for composition; it is not used for decomposition. SQL mapping is defined with the SQL_stmt element in the DAD file. The content of the SQL_stmt element is a valid SQL statement. The SQL_stmt element maps the columns in the SELECT clause to XML elements or attributes that are used in the XML document. The column names in the SQL statement's SELECT clause are used to define the value of an attribute_node or the content of text_node. The FROM clause defines the tables containing the data; the WHERE clause specifies the join and search condition.

The SQL mapping gives DB2 UDB for z/Os users the power to map the data using SQL. When using SQL mapping, you must be able to join all tables in one SELECT statement to form a query. If one SQL statement is not sufficient, consider using RDB_node mapping. To tie all tables together, the primary key and foreign key relationship is recommended among these tables.

RDB_node mapping

Defines the location of the content of an XML element or the value of an XML attribute so that the XML Extender can determine where to store or retrieve the XML data.

This method uses the XML Extender-provided *RDB_node*, which contains one or more node definitions for tables, optional columns, and optional conditions. The tables and columns are used to define how the XML data is to be stored in the database. The condition specifies the criteria for selecting XML data or the way to join the XML collection tables.

To define a mapping scheme, you create a DAD with an <Xcollection> element. Figure 7 on page 48 shows a fragment of a sample DAD file with an XML collection SQL mapping that composes a set of XML documents from data in three relational tables.

```
<?xml version="1.0"?>
<!DOCTYPE DAD SYSTEM "dxx_install/samples/db2xml/dtd/dad.dtd">
<DAD>
  <dtdid>dxx_install/samples/db2xml/dtd/dad/
   getstart.dtd</dtdid>
  <validation>YES</validation>
  <Xcollection>
    <SQL_stmt>
       SELECT o.order_key, customer, p.part_key, quantity, price, tax, date,
              ship_id, mode, comment
         FROM order_tab o, part_tab p,
               table(select
               db2xml.generate_unique()
               as ship_id, date, node, from ship_tab)  shipid
        WHERE p.price > 2500.00 and s.date > "1996-06-01" AND
              p.order_key = o.order_key and s.part_key = p.part_key
    </SQL_stmt>
    <prolog>?xml version="1.0"?</prolog>
    <doctype>!DOCTYPE DAD SYSTEM "dxx_install
     /samples/db2xml/dtd/getstart.dtd"</doctype>
    <root_node>
    <element_node name="Order">
    <attribute_node name="key">
   <column_name="order_key"/>
    </attribute_node>
    <element_node name="Customer">
     <text_node>
      <column name="customer"/>
     </text_node>
    <element_node>

  ...

    </element_node><!-end Part->
    </element_node><!-end Order->
    </root_node>
  </Xcollection>
</DAD>
```

Figure 7. SQL mapping scheme

The XML Extender provides several stored procedures that manage data in an XML collection. These stored procedures support both types of mapping, but require that the DAD file follow the rules that are described in “Mapping scheme requirements.”

Mapping scheme requirements

The following sections describe requirements for each type of the XML collection mapping schemes.

Mapping scheme requirements for SQL mapping

In this mapping scheme, you must specify the SQL_stmt element in the DAD <Xcollection> element. The SQL_stmt should contain a single SQL statement that can join multiple relational tables with the query predicate. In addition, the following clauses are required:

- **SELECT clause**
  - Ensure that the name of the column is unique. If two tables have the same column name, use the AS keyword to create an alias name for one of them.
  - Group the columns of the same table together, and use the logical hierarchical level of the relational tables. This means group the tables according to the level of importance according to how the tables map

to the hierarchical structure of your XML document. In the SELECT clause, the columns of the higher-level tables should proceed the columns of lower-level tables. The following example demonstrates the hierarchical relationship among tables:

```
SELECT o.order_key, customer, p.part_key, quantity, price, tax,
       ship_id, date, mode
```

In this example, `order_key` and `customer` from table ORDER_TAB have the highest relational level because they are higher on the hierarchical tree of the XML document. The `ship_id`, `date`, and `mode` from table SHIP_TAB are at the lowest relational level.

– Use a single-column candidate key to begin each level. If such a key is not available in a table, the query must generate one for that table using a table expression and the user-defined function, generate_unique(). In the above example, the `o.order_key` is the primary key for ORDER_TAB, and the `part_key` is the primary key of PART_TAB. They appear at the beginning of their own group of columns that are to be selected. Because the SHIP_TAB table does not have a primary key, one must be generated, in this case, `ship_id`. This primary key is listed as the first column for the SHIP_TAB table group. Use the FROM clause to generate the primary key column, as shown in the following example.

- **FROM clause**
  - Use a table expression and the user-defined function, generate_unique(), to generate a single key for tables that do not have a primary single key. For example:

```
FROM order_tab as o, part_tab as p,
        table(select db2xml.generate_unique() as
        ship_id, date, mode from ship_tab) as s
```

In this example, a single column candidate key is generated with the function, generate_unique() and given an alias named `ship_id`.

  - Use an alias name when needed to make a column distinct. For example, you could use `o` for ORDER_TAB, `p` for PART_TAB, and `s` for SHIP_TAB.
- **WHERE clause**
  - Specify a primary and foreign key relationship as the join condition that ties tables in the collection together. For example:

```
WHERE p.price > 2500.00 AND s.date > "2003-06-01" AND
      p.order_key = o.order_key AND s.part_key = p.part_key
```

  - Specify any other search condition in the predicate. Any valid predicate can be used.
- **ORDER BY clause**
  - Define the ORDER BY clause at the end of the SQL_stmt element.
  - Ensure that the column names match the column names in the SELECT clause.
  - Specify the column names or identifiers that uniquely identify entities in the entity-relationship design of the database. An identifier can be generated using a table expression and the function generate_unique, or a user-defined function (UDF).
  - Maintain the top-down order of the hierarchy of the entities. The column specified in the ORDER BY clause must be the first column

  listed for each entity. Keeping the order ensures that the XML documents to be generated do not contain incorrect duplicates.
  – Do not qualify the columns in ORDER BY by any schema or table name.

Although the SQL_stmt element has the preceding requirements, it is powerful because you can specify any predicate in your WHERE clause if the expression in the predicate uses the columns in the tables.

Mapping scheme requirements for RDB_node mapping

When using this mapping method, do not use the element SQL_stmt in the <Xcollection> element of the DAD file. Instead, use the RDB_node element as a child of the top element_node and of each attribute_node and text_node.

There are no ordering restrictions on predicates of the root node condition.

- **RDB_node for the top element_node**

  The top element_node in the DAD file represents the root element of the XML document. Specify an RDB_node for the top element_node based on these requirements:
  – Line ending characters are allowed in condition statements.
  – Condition elements can reference a column name an unlimited number of times.
  – Specify all tables that are associated with the XML documents. For example, the following mapping specifies three tables in the RDB_node of the element_node <Order>, which is the top element_node:

```
<element_node name="Order">
    <RDB_node>
        <table name="order_tab"/>
        <table name="part_tab"/>
        <table name="ship_tab"/>
        <condition>
           order_tab.order_key = part_tab.order_key AND
           part_tab.part_key = ship_tab.part_key
        </condition>
    </RDB_node>
```

  The condition element can be empty or missing if there is only one table in the collection.
  – If you are decomposing, or are enabling the XML collection specified by the DAD file, specify a primary key for each table. The primary key can consist of a single column or multiple columns, called a composite key. The primary key is specified by adding an attribute key to the table element of the RDB_node. When a composite key is supplied, the key attribute is specified by the names of key columns separated by a space. For example:

```
<table name="part_tab" key="part_key price"/>
```

  The information specified for decomposition is ignored when composing a document.
  – Use the orderBy attribute to recompose XML documents that contain elements or attributes with multiple occurrences back to their original structure. This attribute allows you to specify the name of a column

that will be the key used to preserve the order of the document. The orderBy attribute is part of the table element in the DAD file, and it is an optional attribute.

- **RDB_node for each attribute_node and text_node**

  You need to specify an RDB_node for each attribute_node and text_node, that tells the stored procedure from which table, which column, and under which query condition to get the data. You must specify the table and column values; the condition value is optional.

  – Specify the name of the table that contains the column data. The table name must be included in the RDB_node of the top element_node. In this example, for text_node of element <Price>, the table is specified as PART_TAB.

  ```
  <element_node name="Price">
      <text_node>
          <RDB_node>
              <table name="part_tab"/>
              <column name="price"/>
              <condition>
                   price > 2500.00
              </condition>
          </RDB_node>
      </text_node>
  </element_node>
  ```

  – Specify the name of the column that contains the data for the element text. In the previous example, the column is specified as PRICE.

  – Specify a condition if you want XML documents to be generated using the query condition. Allowable syntax for <condition> is as follows:

    - columnname
    - operator
    - literal

    In the example above, the condition is specified as `price > 2500.00`. Only the data that meets the condition is in the generated XML documents. The condition must be a valid WHERE clause.

  – If you are decomposing a document, or are enabling the XML collection specified by the DAD file, specify the column type for each attribute_node and text_node. This ensures the correct data type for each column when new tables are created when an XML collection is enabled. Column types are specified by adding the attribute type to the column element. For example:

    ```
    <column name="order_key" type="integer"/>
    ```

    The information specified for decomposition is ignored when composing a document.

With the RDB_node mapping approach, you don't need to supply SQL statements. However, putting complex query conditions in the RDB_node element can be more difficult.

Decomposition table size requirements for RDB node mapping

Decomposition uses RDB_node mapping to specify how an XML document is decomposed into DB2 UDB tables by extracting the element and attribute values into table rows. The values from each XML document are stored in one or more DB2 tables. Each table can have a maximum of 10240 rows decomposed from each document. For example, if an XML document is decomposed into five tables, each of the five tables can have up to 10240 rows for that particular document.

Using multiple-occurring elements (elements with location paths that can occur more than once in the XML structure) affects the number of rows inserted for each document. For example, a document that contains an element <Part> that occurs 20 times, might be decomposed as 20 rows in a table. When using multiple occurring elements, consider that a maximum of 10240 rows can be decomposed into one table from a single document.

Related concepts:

- "DAD files for XML collections" on page 169

Related tasks:

- "Storing a DTD in the repository table" on page 54

Validating XML documents automatically

After you choose an access and storage method, either XML column or XML collection, you can determine whether to *validate* the XML documents. You can also validate XML documents that are composed from XML collections.

You can have your XML data validated automatically by specifying YES for validation in the DAD file. To have a document validated when it is stored into DB2, you must specify a DTD within the `<dtdid>` element or in the `<!DOCTYPE>` specification in the original document. To have a document validated when it is composed from an XML collection in DB2, you must specify a DTD within the `<dtdid>` element or within the `<doctype>` element in the DAD file.

The following factors should be taken into consideration when you decide whether to validate your documents.

- The DTD ID or schema is useful only if you decide to validate the XML document.

  To validate the DAD with a schema, insert the schema tags that associate the DAD file with the schema file. For example:

  ```
  <schemabindings>
  <nonamespacelocation location="path/schema_name.xsd"/>
  </schemabindings>
  ```
- You do not need a DTD to store or archive XML documents.
- You must decide whether to validate before inserting XML data into DB2. The XML Extender does not validate data that has already been inserted into DB2.
- It might be necessary to process the DTD to set entity values and attribute defaults regardless of whether you choose to validate.
- If you specify NO for validation in the DAD, then the DTD specified by the XML document is not processed.
- Validating your XML data has a performance impact.

Enabling servers for XML

Before you can store or retrieve XML documents from DB2 UDB with XML Extender, you must enable the server for XML. The XML Extender enables the server that you are connected to.

When you enable a server for XML, the XML Extender does these tasks:

- Creates all the user-defined types (UDTs), user-defined functions (UDFs), and stored procedures for XML Extender
- Creates and populates control tables with the necessary metadata that the XML Extender requires
- Creates the DB2XML schema in user-defined table spaces and assigns the necessary privileges

  The fully qualified name of an XML function is db2xml.*function-name*, where db2xml is an identifier that provides a logical grouping for SQL objects. You can use the fully qualified name anywhere that you refer to a UDF or a UDT. You can also omit the schema name when you refer to a UDF or a UDT; in this case, DB2 UDB uses the function path to determine the function or data type.

Procedure:

You can enable a server with the administration wizard or from a command line. To do this task from the command line, type **dxxadm** from the command line and specify the server that is to be enabled.

The following example enables an existing server.

```
dxxadm enable_server -a V81A wlm environment wlmenv1 security DB2
```

To enable a server using the administration wizard, complete the following tasks:

1. Start the administration wizard and click **Enable Server** from the Launchpad window.

   If a server is already enabled, the **Disable Server** button appears. If the server is disabled, the **Enable Server** button appears.

   When the server is enabled, you return to the LaunchPad window.

After you enable a server, you can use the XML Extender UDTs, UDFs, and SPs.

Related concepts:

- "Migrating XML Extender from Version 7 to Version 8" on page 37

Creating an XML table

This task is part of the larger task of defining and enabling an XML column.

An XML table is used to store intact XML documents. To store whole documents in your database with DB2 UDB XML Extender, you must create a table so that it contains a column with an XML user-defined type (UDT). DB2 UDB XML Extender provides you with three user-defined types to store your XML documents as column data. These UDTs are: XMLVARCHAR, XMLCLOB, and XMLFILE. When a table contains a column of XML type, you can then enable the table for XML.

You can create a new table to add a column of XML type using the administration wizard or the command line.

Procedure:

To create a table with a column of XML type using the command line:

Open the DB2 UDB command prompt and type a Create Table statement.

For example, in a sales application, you might want to store an XML-formatted line-item order in a column called ORDER of a table called SALES_TAB. This table also has the columns INVOICE_NUM and SALES_PERSON. Because it is a small order, you store the sales order using the XMLVARCHAR type. The primary key is INVOICE_NUM. The following CREATE TABLE statement creates a table with a column of XML type:

```
CREATE TABLE sales_tab(
            invoice_num    char(6)   NOT NULL PRIMARY KEY,
            sales_person   varchar(20),
            order          XMLVarchar);
```

After you have created a table, the next step is to enable the column for XML data.

Related concepts:

- "Planning side tables" on page 58
- Chapter 13, "XML Extender administration support tables," on page 269

Storing a DTD in the repository table

You can use a DTD to validate XML data in an XML column or in an XML collection. DTDs can be stored in the DTD repository table, a DB2 UDB table called DTD_REF. The DTD_REF table has a schema name of DB2XML. Each DTD in the DTD_REF table has a unique ID. The XML Extender creates the DTD_REF table when you enable a database for XML. You can insert the DTD from the command line or by using the administration wizard.

Procedure:

To insert the DTD using the administration wizard:

1. Start the administration wizard and click **Import a DTD** from the Launchpad window to import an existing DTD file into the DTD repository for the current database. The Import a DTD window opens.
2. Specify the DTD file name in the **DTD file name** field.
3. Type the DTD ID in the **DTD ID** field.

   The DTD ID is an identifier for the DTD. It can also be the path that specifys the location of the DTD on the local system. The DTD ID must match the value that is specified in the DAD file for the <DTDID> element.
4. Optional: Type the name of the author of the DTD in the **Author** field.
5. Click **Finish** to insert the DTD into the DTD repository table, DB2XML.DTD_REF, and return to the Launchpad window.

To insert a DTD from the command line, issue a SQL INSERT statement from Table 8 on page 55. For example:

```
DB2 INSERT into DB2XML.DTD_REF values('dxx_install
/samples/db2xml/dtd/getstart.dtd',
DB2XML.XMLClobFromFile('dxx_install/dxxsamples/dtd/getstart.dtd',
0, 'user1', 'user1', 'user1');
```

Table 8. The column definitions for the DTD repository table

Column name	Data type	Description
DTDID	VARCHAR(128)	ID of the DTD.
CONTENT	XMLCLOB	Content of the DTD.
USAGE_COUNT	INTEGER	Number of XML columns and XML collections in the database that use this DTD to define a DAD.
AUTHOR	VARCHAR(128)	Author of the DTD, optional information for the user to input.
CREATOR	VARCHAR(128)	User ID that does the first insertion.
UPDATOR	VARCHAR(128)	User ID that does the last update.
ROW_ID	ROWID	Identifier for the row.

Enabling XML columns

To store an XML document in a DB2 UDB database, you must enable for XML the column that will contain the document. Enabling a column prepares it for indexing so that it can be searched quickly. You can enable a column by using the XML Extender Administration wizard or the command line. The column must be of XML type.

When XML Extender enables an XML column, it performs the following operations:
- Reads the DAD file to:
  - Check for the existence of the DTD in the DTD_REF table, if the DTDID was specified.
  - Create side tables on the XML column for indexing purpose.
  - Prepare the column to contain XML data.
- Optionally creates a default view of the XML table and side tables. The default view displays the application table and the side tables.
- Specifies a ROOT ID column, if one is not specified.

After you enable the XML column, you can:
- Create indexes on the side tables.
- Insert XML documents in the XML column.
- Query, update, or search the XML documents in the XML column.

You can enable XML columns using the Administration wizard or from a DB2 command line.

Procedure (using the administration wizard):

To enable XML columns using the administration wizard:
1. Set up and start the Administration wizard.
2. Click **Work with XML Columns** from the Launchpad window to view the tasks related to the XML Extender columns. The Select a Task window opens.

3. Click **Enable a Column** and then **Next**.
4. Specify the table and column.
   - Select the table that contains the XML column from the **Table name** field.
   - Select the column to enable from the **Column name** field.
5. Specify the DAD path and file name in the **DAD file name** field. For example:
   `dxx_install/samples/dad/getstart.dad`
6. Optional: Type the name of an existing table space in the **Table space** field.

   The default table space contains side tables that XML Extender created. If you specify a table space, the side tables are created in the specified table space. If you do not specify a table space, the side tables are created in the default table space.
7. Optional: Type the name of the default view in the **Default view** field.

   If specified, the default view is automatically created when the column is enabled. The default view joins the XML table and all of the related side tables.
8. Recommended: Type the column name of the primary key for the table in the **Root ID** field.

   XML Extender uses the value of **Root ID** as a unique identifier to associate all side tables with the application table. The XML Extender adds the DXXROOT_ID column to the application table and generates an identifier.
9. Click **Finish** to enable the XML column, create the side tables, and return to the Launchpad window.
   - If the column is successfully enabled, you receive the message: `column is enabled`.
   - If the column is not successfully enabled, an error message is displayed, along with prompts for you to correct the values of the entry fields until the column is successfully enabled.

Procedure (using the command line):

To enable an XML column using the command line, use the DXXADM enable_column command.

Syntax:

```
►►—dxxadm—enable_column——-a—subsystem_name—tbName—colName—DAD_file——————————►

►—┬——————————————┬—┬————————————————┬—┬———————————┬——————————————————————————►◄
  └-t—tablespace—┘ └-v—default_view—┘ └-r—root_id—┘
```

Parameters:

subsystem_name
: The name of the DB2 UDB subsystem.

tbName
: The name of the table that contains the column to be enabled.

colName
: The name of the XML column that is being enabled.

DAD_file
: The name of the file that contains the document access definition (DAD).

tablespace
: A previously created tablespace that contains side tables that XML Extender created. If not specified, the default tablespace is used.

default_view
: Optional. The name of the default view that XML Extender created to join an application table and all of the related side tables.

root_id
: Optional, but recommended. The column name of the primary key in the application table and a unique identifier that associates all side tables with the application table. Known as ROOT_ID. XML Extender uses the value of ROOT_ID as a unique identifier to associate all side tables with the application table. If the ROOT ID is not specified, XML Extender adds the DXXROOT_ID column to the application table and generates an identifier.

  Restriction: If the application table has a column name of DXXROOT_ID, you must specify the *root_id* parameter; otherwise, an error occurs.

Example:

```
dxxadm enable_column -a SUBSYS1 SALES_TAB ORDER getstart.dad
   -v SALODVW -r INVOICE_NUMBER
```

In this example, the ORDER column is enabled in the SALES_TAB table . The DAD file is `getstart.dad`, the default view is sales_order_view, and the ROOT ID is INVOICE_NUMBER.

Using this example, the SALES_TAB table has the following columns:

Column name	Data type
INVOICE_NUM	CHAR(6)
SALES_PERSON	VARCHAR(20)
ORDER	XMLVARCHAR

The following side tables are created based on the DAD specification:

ORDER_SIDE_TAB:

Column name	Data type	Path expression
ORDER_KEY	INTEGER	`/Order/@key`
CUSTOMER	VARCHAR(50)	`/Order /Customer /Name`
INVOICE_NUM	CHAR(6)	N/A

PART_SIDE_TAB:

Column name	Data type	Path expression
PART_KEY	INTEGER	`/Order/Part/@key`
PRICE	DOUBLE	`/Order/Part /ExtendedPrice`
INVOICE_NUM	CHAR (6)	N/A

SHIP_SIDE_TAB:

Column name	Data type	Path expression
DATE	DATE	/Order/Part/ Shipment/ShipDate
INVOICE_NUM	CHAR (6)	N/A

All of the side tables have the column INVOICE_NUM of the same type, because the ROOT ID is specified by the primary key INVOICE_NUM in the application table. After the column is enabled, the value of the INVOICE_NUM column is inserted in side tables when a row is inserted in the main table. If you specify a default view when enabling the XML column ORDER, then XML Extender creates a default view, sales_order_view. The view joins the above tables using the following statement:

```
CREATE VIEW sales_order_view(invoice_num, sales_person, order,
                             order_key, customer, part_key, price, date)
     AS
     SELECT sales_tab.invoice_num, sales_tab.sales_person, sales_tab.order,
            order_side_tab.order_key, order_side_tab.customer,
            part_side_tab.part_key, part_side_tab.price,
            ship_tab.date
     FROM sales_tab, order_side_tab, part_side_tab, ship_side_tab
     WHERE sales_tab.invoice_num = order_side_tab.invoice_num
                AND sales_tab.invoice_num = part_side_tab.invoice_num
                AND sales_tab.invoice_num = ship_side_tab.invoice_num
```

If you specify the table space when you enabled, the side tables are created in the specified table space. If the table space is not specified, the side tables are created in the default table space.

Planning side tables

Side tables are DB2® tables used to extract the content of an XML document that will be searched frequently. The XML column is associated with side tables that hold the contents of the XML document. When the XML document is updated in the application table, the values in the side tables are automatically updated.

Figure 8 on page 59 shows an XML column with side tables.

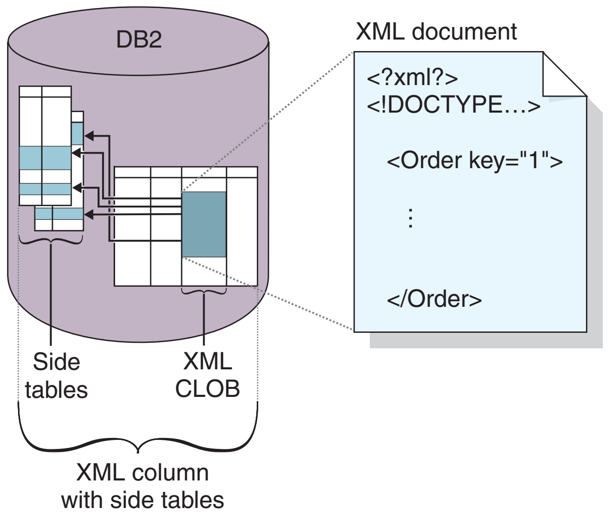

Figure 8. An XML column whose content is mapped in side tables. There is an XML file in the column that is associated with side tables that hold the contents of the XML document.

Multiple occurrence:

When elements and attributes occur multiple times in side tables, consider the following issues in your planning:

- For elements or attributes in an XML document that have multiple occurrences, you must create a separate side table for each XML element or attribute with multiple occurrences, due to the complex structure of XML documents. This means that elements or attributes have location paths that occur multiple times and must be mapped to a table with only one column. You cannot have any other columns in the table.
- When a document has multiple occurring location paths, XML Extender adds a column named DXX_SEQNO with a type of INTEGER in each side table to track the order of elements that occur more than once. With DXX_SEQNO, you can retrieve a list of the elements in the same order as the original XML document by specifying ORDER BY DXX_SEQNO in an SQL query.

Default views and query performance:

When you enable an XML column, you can specify a default, read-only view that joins the application table with the side tables using a unique ID, called the ROOT ID. With the default view, you can search XML documents by querying the side tables. For example, if you have the application table SALES_TAB, and the side tables ORDER_TAB, PART_TAB and SHIP_TAB, your query might look as follows:

```
SELECT sales_person FROM sales_order_view
      WHERE price > 2500.00
```

The SQL statement returns the names of salespeople in the SALES_TAB who have orders stored in the column ORDER, and where the PRICE column is greater than 2500.00.

The advantage of querying the default view is that it provides a virtual single view of the application table and side tables. However, the more side tables that are created, the more expensive the query. Therefore, creating the default view is recommended only when the total number of side-table columns is small. Applications can create their own views that join the important side table columns.

Indexing side tables

This task is part of the larger task of defining and enabling an XML column.

Side tables contain the XML data in the columns that you specified when you created the DAD file. After you enable an XML column and create side tables, you can index the side tables. Indexing these tables helps you improve the performance of the queries against the XML documents.

Procedure:

To create an index for your side tables from a DB2 UDB command line, use the DB2 CREATE INDEX SQL statement.

from the DB2 UDB command line.

The following example creates indexes on four side tables using the DB2 command prompt.

```
DB2 CREATE INDEX KEY_IDX
      ON ORDER_SIDE_TAB(ORDER_KEY)

DB2 CREATE INDEX CUSTOMER_IDX
      ON ORDER_SIDE_TAB(CUSTOMER)

DB2 CREATE INDEX PRICE_IDX
      ON PART_SIDE_TAB(PRICE)

DB2 CREATE INDEX DATE_IDX
      ON SHIP_SIDE_TAB(DATE)
```

Composing XML documents by using SQL mapping

You can compose XML documents using SQL mapping either from the command line or by using the administration wizard.

You should use SQL mapping if you are composing an XML document and you want to use an SQL statement to define the table and columns that you will derive the data in the XML document. You can use SQL mapping only for composing XML documents. You create a DAD file to compose the XML document with SQL mapping.

Prerequisites:

Before you compose your documents, you must first map the relationship between your DB2 UDB tables and the XML document. This step includes mapping the hierarchy of the XML document and specifying how the data in the document maps to a DB2 UDB table.

Procedure:

To compose XML documents from the command line, complete the following steps:

1. Create a new document in a text editor and type the following syntax:
   ```
   <?XML version="1.0"?>
   ```
2. Insert the <DAD> </DAD> tags.

   The DAD element will contain all the other elements.
3. Insert the tags used for validating the DAD with a DTD or schema.

- To validate the composed XML document with a DTD, insert the DTDID tags that associate the DAD file with the XML document DTD. For example:

  ```
  <dtdid>path/dtd_name.dtd>
  ```

- To validate the composed XML document with a schema, insert the schema tags that associate the DAD file with the schema file. For example:

  ```
  <schemabindings>
  <nonamespacelocation location="path/schema_name.xsd"/>
  </schemabindings>
  ```

The dtd or schema is useful only if you decide to validate the XML document. Use the validation tag to indicate whether DB2 UDB XML Extender validates the XML document:

- If you want to validate the XML document, then type:

  ```
  <validation>YES</validation>
  ```

- If you do not want to validate the XML document type:

  ```
  <validation>NO</validation>
  ```

4. Type `<XCollection> </XCollection>` tags to specify that you are using XML collections as the access and storage method for your XML data.
5. Inside the <Xcollection> </Xcollection> tags, insert the <SQL_stmt> </SQL_stmt> tags to specify the SQL statement that will map the relational data to the XML documents. This statement is used to query data from DB2 UDB tables. The following example shows a sample SQL query:

   ```
   <SQL_stmt>
     SELECT o.order_key, customer_name, customer_email, p.part_key, color,
     quantity, price, tax, ship_id, date, mode from order_tab o, part_tab p,
     table (select substr(char(timestamp(generate_unique())),16)
       as ship_id, date, mode, part_key from ship_tab)  s
           WHERE o.order_key = 1 and
                 p.price > 20000 and
                 p.order_key = o.order_key and
                 s.part_key = p.part_key
           ORDER BY order_key, part_key, ship_id
   </SQL_stmt>
   ```

   The example SQL statement for mapping the relational data to the XML document has the following syntax:

   - Columns are specified in top-down order by the hierarchy of the XML document structure.
   - The columns for an entity are grouped together.
   - The object ID column is the first column in each group.
   - The Order_tab table does not have a single key column, and therefore, the generate_unique DB2 UDB built-in function is used to generate the ship_id column.
   - The object ID column is then listed in a top-down order in an ORDER BY statement. The column in ORDER BY should not be qualified by any schema. and the column names must match the column names in the SELECT clause.
6. Add the following prolog information to be used in the composed XML document:

   ```
   <prolog>?xml version="1.0"?</prolog>
   ```

7. Type the <doctype> </doctype> tag. This tag contains the path to the DTD against which the composed document will be validated. For example:

   ```
   <doctype>! DOCTYPE Order SYSTEM "dxx_install
   /samples/db2xml/dtd/getstart.dtd"</doctype>
   ```

8. Specify the root element and the elements and attributes that make up the XML document:
   a. Add the <root></root_node> tag to define the root element. All the elements and attributes that make up the XML document are specified within the root_node.
   b. Use the `<element_node>`, `<attribute_node>`, and `<text_node>` tags to map the elements and attributes in the XML document to element and attribute nodes that correspond to DB2 UDB data.

      <element_node> tag
      Specifies the elements in the XML document. Set the name attribute of the element_node tag to the name of the element. Each element_node can have child element_nodes.

      <attribute_node> tag
      Specifies the attributes of an element in the XML document. The attributes are nested in their element node. Set the name attribute of the attribute_node tag to the name of the attribute.

      <text_node> tag
      Specifies the text content of the element and the column data in a relational table for bottom-level element_nodes. For each bottom-level element, specify <text_node> tags that indicate that the element contains character data to be extracted from DB2 when the document is composed. For each bottom-level element_node, use a <column> tag to specify from which column to extract data when the XML document is composed. Column tags are typically inside the <attribute_node> or the <text_node> tags. All column names defined must be in the <SQL_stmt> SELECT clause at the beginning of the DAD file.
9. Ensure that the ending tags are in the appropriate places:
   a. Ensure that an ending </root_node> tag is after the last </element_node> tag.
   b. Ensure that an ending </Xcollection> tag is after the </root_node> tag.
   c. Ensure that an ending </DAD> tag is after the </Xcollection> tag.
10. Save the file as *file.dad*. Where *file* is the name of your file.

The following Windows example shows a complete DAD:

```
<?xml version'"1.0">
<!DOCTYPE DAD SYSTEM "C:\dxx_xml\test\dtd\dad.dtd'>
<DAD>
<validation>NO</validation>
<Xcollection>
<SQL_stmt> select o.order_key, customer_name, customer_email,
 p.part_key, color, qty, price, tax, ship_id, date, mode from order_tab o,
 part_tab p, (select db2xml.generate_unique() as
ship_id, date, mode, part_key from ship_tab) s where
 o.order_key = 1 and p.price . 20000 and p.order_key
 = o.order_key and s.part_key =p.part_key ORDER BY order_key,
part_key, ship_id</SQL_stmt>
<prolog>?XML version="1.0"<?/prolog>
<doctype>!DOCTYPE ORDER SYSTEM "C:\dxx_install\samples\db2xml\dtd/Order.dtd"
 </doctype>
 <root_node>
 <element_node name="Order">
  <attribute_node name="key">
   <column name="order_key"/>
   </attribute_node>
   <element_node name="Customer">
```

```
<element_node name="NAME">
 <text_node><column name="customer_name"/></text_node>
 </element_node>
 </element_node>
<element_node name="Part">
 <attribute_node name="color">
  <column name="color"/>
 </attribute_node>
 <element_node name="key">
  <text_node><column name="part_key"/></text_node>
 </element_node>
 <element_node name ="Quantity">
  <text_node><column name="qty"/></text_node>
  </element_node>
 <element_node name="ExtendedPrice">
  <text_node><column name="price"/></text_node>
  </element_node>
 <element_node name="Tax">
  <text_node><column name="tax"/></text_node>
   </element_node>
  <element_node name="Shipment" multi_occurrence="YES">
   <element_node name=shipDate">
    <text_node><column name="date"/><text_node>
     <element_node>
    <element_node name="ShipMode">
     <text_node><column name="mode"/></text_node>
    </element_node>
   </element_node>
  </element_node>
 </element_node>
 </root_node>
 </Xcollection>
 </DAD>
```

Composing XML collections by using RDB_node mapping

RDB_node mapping uses the <RDB_node> tags to specify DB2 UDB tables, columns, and conditions for an element or attribute node. Use this method if you want to compose XML documents by using an XML-like structure. The <RDB_node> uses the following elements:

table	Defines the table that corresponds to the element.
column	Defines the column that contains the corresponding element.
condition	Optionally specifies a condition on the column.

The child elements that are used in the RDB_node element depend on the context of the node and use the following rules:

If the node type is:	**The following RDB child elements are used:**		
	Table	**Column**	**Condition**[1]
Root element	Yes	No	Yes
Attribute	Yes	Yes	Optional
Text	Yes	Yes	Optional

[1] Required with multiple tables

You can use the administration wizard or a command line to compose XML documents by using RDB_node mapping.

Restrictions:

If you compose your XML collections using RDB_node mapping, all statements of a given element must map to columns in the same table.

Procedure:

To compose an XML document from the command line using RDB_node mapping:

1. Open a text editor and create a DAD header by typing the following syntax:

   ```
   <?xml version="1.0"?>
   <!DOCTYPE DAD SYSTEM "path/dad.dtd">
   ```

   Where *path*/dad.dtd is the path and file name of the DTD for the DAD.
2. Insert the<DAD></DAD> tags. This element will contain all the other elements.
3. Insert the tags used for validating the DAD with a DTD or schema.
   - To validate the DAD with a DTD, insert the DTDID tags that associate the DAD file with the XML document DTD. For example:

     ```
     <dtdid>path/dtd_name.dtdid>
     ```
   - To validate the DAD with a schema, insert the schema tags that associate the DAD file with the schema file. For example:

     ```
     <schemabindings>
     <nonamespacelocation location="path/schema_name.xsd"/>
     </schemabindings>
     ```

   The dtdid or schema is useful only if you decide to validate the XML document. Use the validation tag to indicate whether DB2 UDB XML Extender validates the XML document:
   - If you want to validate the XML document, then type:

     ```
     <validation>YES</validation>
     ```
   - If you do not want to validate the XML document type:

     ```
     <validation>NO</validation>
     ```
4. Insert the `<XCollection> </XCollection>` tags to specify that you are using XML collections as the access and storage method for your XML data.
5. Add the following prolog information:

   ```
   <prolog>?xml version="1.0"?</prolog>
   ```
6. Add the <doctype> </doctype> tags. For example:

   ```
   <doctype>! DOCTYPE Order SYSTEM "dxx_install
   /samples/db2xml/dtd/getstart.dtd"</doctype>
   ```
7. Insert the <root_node> </root_node> tags. Inside the root_node tags, specify the elements and attributes that make up the XML document.
8. Inside the <root_node> tag, map the elements and attributes in the XML document to element and attribute nodes that correspond to DB2 UDB data. Use the RDB_node element for the element_node, text_node, and attribute_node. These nodes provide a path from the XML data to the DB2 UDB data. To map the elements and attributes in your XML document:
   1. Specify an RDB_node for the top element_node. This element specifies all the tables that are associated with the XML document. To specify an RDB_node for the top element_node, insert <RDB_node> tags after the root_node tag.
      - Specify an RDB_node for the attribute_node.
      - Specify an RDB_node for the text_node.

b. Define a table node for each table that contains data to be included in the XML document. For example, if you have three tables (ORDER_TAB, PART_TAB, and SHIP_TAB) that have column data to be in the document, create a table node for each. For example:

```
<RDB_node>
<table name="ORDER_TAB">
<table name="PART_TAB">
<table name="SHIP_TAB">
</RDB_node>
```

If you are decomposing an XML document using the DAD file, you must specify a primary key for each table. The primary key can consist of a single column or multiple columns, called a composite key. The primary key is specified by adding an attribute key to the table element of the RDB_node. You must also specify a primary key for each table if you are going to enable a collection. The example below shows how you specify a key column for each table specified in the element_node.

```
<RDB_node>
<table name="ORDER_TAB" key="order_key">
<table name="PART_TAB" key="part_key">
<table name="SHIP_TAB" key="ship_key">
</RDB_node>
```

Related concepts:

- "Mapping schemes for XML collections" on page 105
- "Location paths" on page 112
- "DAD files for XML collections" on page 169
- "Requirements for RDB_Node mapping" on page 109
- "XML Extender composition stored procedures" on page 200

Related tasks:

- "Decomposing an XML collection by using RDB_node mapping" on page 65
- "Managing data in XML collections" on page 92
- "Updating, deleting, and retrieving data in XML collections" on page 101

Decomposing an XML collection by using RDB_node mapping

Use RDB_node mapping to decompose XML documents. This method uses the <RDB_node> to specify DB2 UDB tables, columns, and conditions for an element or attribute node. The <RDB_node> uses the following elements:

table	Defines the table that corresponds to the element.
column	Defines the column that contains the corresponding element.
condition	Optionally specifies a condition on the column.

The child elements that are used in the <RDB_node> depend on the context of the node and use the following rules:

If the node type is:	**RDB child element is used:**		
	Table	**Column**	**Condition**[1]
Root element	Yes	No	Yes
Attribute	Yes	Yes	optional

If the node type is:	RDB child element is used:		
	Table	**Column**	**Condition**[1]
Text	Yes	Yes	optional
(1) Required with multiple tables			

Procedure using a command line::

To decompose XML documents using a command line:

1. Create a file in any text editor. Create a DAD header by typing the following syntax:

   ```
   <?xml version="1.0"?>
   <!DOCTYPE DAD SYSTEM "path/dad.dtd">
   ```

   Where *path*/dad.dtd is the path and file name of the DTD for the DAD.
2. Insert the <DAD> </DAD> tags.
3. Insert the tags used for validating the DAD with a DTD or schema.
   - To validate the DAD with a DTD, insert the DTDID tags that associate the DAD file with the XML document DTD. For example:

     ```
     <dtdid>path/dtd_name.dtd>
     ```
   - To validate the DAD with a schema, insert the schema tags that associate the DAD file with the schema file. For example:

     ```
     <schemabindings>
     <nonamespacelocation location="path/schema_name.xsd"/>
     </schemabindings>
     ```

   The dtdid or schema is useful only if you decide to validate the XML document. Use the validation tag to indicate whether DB2 UDB XML Extender validates the XML document:
   - If you want to validate the XML document, then type:

     ```
     <validation>YES</validation>
     ```
   - If you do not want to validate the XML document type:

     ```
     <validation>NO</validation>
     ```
4. Insert `<XCollection>` `</XCollection>` tags to specify that you are using XML collections as the access and storage method for your XML data.
5. Add the following prolog information:

   ```
   <prolog>?xml version="1.0"?</prolog>
   ```
6. Add the <doctype></doctype> tags. For example:

   ```
   <doctype>! DOCTYPE Order SYSTEM "dxx_install
      /samples/db2xml/dtd/getstart.dtd"</doctype>
   ```

   If you need to specify an encoding value for internationalization, add the ENCODING attribute and value.
7. Define the root_node using the <root_node> </root_node> tags.
8. Inside the root_node, map the elements and attributes in the XML document to element nodes and attribute nodes that correspond to DB2 UDB data. These nodes provide a path from the XML data to the DB2 UDB data.
   a. Define a top level, root element_node. This element_node contains:
      - Table nodes with a join condition to specify the collection.
      - Child elements
      - Attributes

To specify the table nodes and condition:

1) Create an RDB_node element. For example:

```
<RDB_node>
</RDB_node>
```

2) Define a table_node for each table that contains data to be included in the XML document. For example, if you have three tables, ORDER_TAB, PART_TAB, and SHIP_TAB, that have column data to be in the document, create a table node for each. For example:

```
<RDB_node>
<table name="ORDER_TAB">
<table name="PART_TAB">
<table name="SHIP_TAB">
</RDB_node>
```

3) Define a join condition for the tables in the collection. The syntax is:

```
table_name.table_column = table_name.table_column AND
table_name.table_column = table_name.table_column ...
```

For example:

```
<RDB_node>
<table name="ORDER_TAB">
<table name="PART_TAB">
<table name="SHIP_TAB">
<condition>
   order_tab.order_key = part_tab.order_key AND
   part_tab.part_key = ship_tab.part_key
</condition>
</RDB_node>
```

4) Specify a primary key for each table. The primary key consists of a single column or multiple columns, called a composite key. To specify the primary key, add an attribute key to the table element of the RDB_node. The following example defines a primary key for each of the tables in the RDB_node of the root element_node Order:

```
<element_node name="Order">
    <RDB_node>
         <table name="order_tab" key="order_key"/>
         <table name="part_tab" key="part_key price"/>
         <table name="ship_tab" key="date mode"/>
         <condition>
             order_tab.order_key = part_tab.order_key AND
             part_tab.part_key = ship_tab.part_key
         </condition>
    <RDB_node>
```

The key attribute is required for decomposition and enabling a collection because the DAD file used must support both composition and decomposition.

b. Define an <element_node> tag for each element in your XML document that maps to a column in a DB2 UDB table. For example:

```
<element_node name="name">
</element_node>
```

An element node can have one of the following types of elements:

text_node
To specify that the element has content to a DB2 UDB table It does not have child elements.

attribute_node
To specify an attribute.

child elements
Children of the element_node.

The text_node contains an RDB_node to map content to a DB2 UDB table and column name.

RDB_nodes are used for bottom-level elements that have content to map to a DB2 UDB table. An RDB_node has the following child elements:

table	Defines the table that corresponds to the element.
column	Defines the column that contains the corresponding element .
condition	Optionally specifies a condition on the column.

For example, you might have an XML element <Tax> for which you want to store the untagged content in a column called TAX:

XML document:

```
<Tax>0.02</Tax>
```

In this case, you want the value `0.02` to be stored in the column TAX.

In the DAD file, you specify an <RDB_node> tag to map the XML element to the DB2 UDB table and column.

DAD file:

```
<element_node name="Tax">
   <text_node>
      <RDB_node>
         <table name="part_tab"/>
         <column name="tax"/>
      </RDB_node>
   </text_node>
</element_node>
```

The <RDB_node> tag specifies that the value of the Tax element is a text value, the data is stored in the PART_TAB table in the TAX column.

c. Define an <attribute_node> tag for each attribute in your XML document that maps to a column in a DB2 UDB table. For example:

```
<attribute_node name="key">
</attribute_node>
```

The attribute_node has an RDB_node to map the attribute value to a DB2 UDB table and column. An RDB_node has the following child elements:

table	Defines the table that corresponds to the element.
column	Defines the column that contains the corresponding element .
condition	Optionally specifies a condition on the column.

For example, you might have an attribute key for an Order element. The value of key needs to be stored in a column PART_KEY.

XML document:

```
<Order key="1">
```

In the DAD file, create an attribute_node for key and indicate the table where the value of 1 is to be stored.

DAD file:

```
<attribute_node name="key">
  <RDB_node>
    <table name="part_tab">
    <column name="part_key"/>
  <RDB_node>
</attribute_node>
```

9. Specify the column type for the RDB_node for each attribute_node and text_node. This ensures the correct data type for each column where the untagged data will be stored. To specify the column types, add the attribute type to the column element. The following example defines the column type as an INTEGER:

   ```
   <attribute_node name="key">
       <RDB_node>
           <table name="order_tab"/>
           <column name="order_key" type="integer"/>
       </RDB_node>
   </attribute_node>
   ```

10. Ensure that the ending tags are in the appropriate places:
    a. Ensure that an ending </root_node> tag is after the last </element_node> tag.
    b. Ensure that an ending </Xcollection> tag is after the </root_node> tag.
    c. Ensure that an ending </DAD> tag is after the </Xcollection> tag.

Related concepts:

- “XML Extenders decomposition stored procedures” on page 215

Related tasks:

- “Decomposing XML documents into DB2 UDB data” on page 97
- “Calling XML Extender composition stored procedures” on page 201

Part 3. Programming

This part describes programming techniques for managing your XML data.

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Chapter 3. XML columns

This chapter describes how to manage data in XML columns using DB2.

Managing data in XML columns

When you use XML columns to store data, you store an entire XML document in its native format as column data in DB2. This access and storage method allows you to keep the XML document intact, while giving you the ability to index and search the document, retrieve data from the document, and update the document.

After you enable a database for XML, the following user-defined types (UDTs), provided by XML Extender, are available for your use:

XMLCLOB
Use this UDT for XML document content that is stored as a character large object (CLOB) in DB2.

XMLVARCHAR
Use this UDT for XML document content that is stored as a VARCHAR in DB2.

XMLFILE
Use this UDT for an XML document that is stored in a file on a local file system.

You can create or alter application tables to have columns of XML UDT data type. These tables are known as XML tables.

After you enable a column in a table for XML, you can create the XML column and perform the following management tasks:
- Store XML documents in DB2
- Retrieve XML data or documents from DB2
- Update XML documents
- Delete XML data or documents

To perform all of these tasks, use the user-defined functions (UDFs) provided by XML Extender. Use default casting functions to store XML documents in DB2. Default casting functions cast the SQL base type to the XML Extender user-defined types and convert instances of a data type (origin) into instances of a different data type (target).

Related concepts:
- "XML columns as a storage and access method" on page 73
- "Using indexes for XML column data" on page 75

XML columns as a storage and access method

There will be times when you want to store and maintain the document structure as it currently is. XML contains all the necessary information to create a set of documents.

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For example, if you are a news publishing company that serves articles over the Web, you might want to maintain an archive of published articles. In such a scenario, XML Extender lets you store your complete or partial XML articles in a column of a DB2® table, which is the *XML column*, as shown in Figure 9.

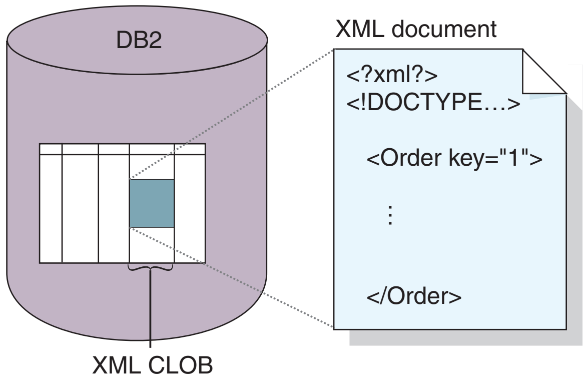

Figure 9. Storing structured XML documents in a DB2 UDB table column

The XML column storage and access method allows you to manage your XML documents using DB2. You can store XML documents in a column of XML type and you can query the contents of the document to find a specific element or attribute. You can associate and store a DTD in DB2 UDB for one or more documents. Additionally, you can map element and attribute content to DB2 UDB tables, called *side tables*. These side tables can be indexed for improved query performance, but are not indexed automatically. The column that is used to store the document is called an XML column. It specifies that the column is used for the XML column storage and access method.

In the document access definition (DAD) file you enter <Xcolumn> and </Xcolumn> tags to denote that the storage and access method that you will use is XML column. The DAD will then map the XML element and attribute content to be stored in side tables.

Before you begin working with XML Extender to store your documents, you need to understand the structure of the XML document so that you can determine how to index elements and attributes in the document. When planning how to index the document, you need to determine:

- The XML user-defined type in which you will store the XML document
- The XML elements and attributes that your application will frequently search, so that their content can be stored in side tables and indexed to improve performance
- Whether or not you want to validate XML documents in the column with a DTD

Defining and enabling an XML column

You use XML columns to store and access entire XML documents in the database. This storage method allows you to store documents using the XML file types, index the columns in side tables, and query or search XML documents.

Use XML columns when you want to store entire XML documents into a DB2 table column if the document is not going to be frequently updated or if you want to store intact XML documents.

If you want to map XML document structures to DB2 UDB tables so that you can compose XML documents from existing DB2 UDB data or decompose XML documents into DB2 data, then you should use XML collections instead of XML columns.

Procedure:

To define and enable an XML column from the command line :
1. Create a document access definition (DAD) file.
2. Create a table in which the XML documents are stored.
3. Enable the column for XML data. If the DAD specifies validation, then insert the column into dtd_ref table.
4. Index the side tables.

The XML column is created as an XML user data type. After these tasks are complete, you will be able to store XML documents in the column. These documents can then be updated, searched, and extracted.

Related concepts:
- "XML columns as a storage and access method" on page 73
- "Using indexes for XML column data" on page 75
- "Validating XML documents automatically" on page 52
- "Lesson: Storing an XML document in an XML column" on page 8

Related tasks:
- "Creating a DAD file for XML columns" on page 167
- "Creating an XML table" on page 53
- "Enabling XML columns" on page 55
- "Indexing side tables" on page 60
- "Managing data in XML columns" on page 73

Using indexes for XML column data

An important planning decision when using XML columns, is whether to index the side tables for XML column documents. This decision should be made based on how often you need to access the data and how critical performance is during structural searches.

When using XML columns, which contain entire XML documents, you can create side tables to contain columns of XML element or attribute values, then create indexes on these columns. You must determine the elements and attributes for which you need to create the index.

XML column indexing allows frequently queried data of general data types (such as integer, decimal, or date) to be indexed using the native DB2® index support from the database engine. The XML Extender extracts the values of XML elements or attributes from XML documents and stores them in the side tables, allowing you to create indexes on these side tables. You can specify each column of a side table with a location path that identifies an XML element or attribute and an SQL data type.

The XML Extender automatically populates the side table when you store XML documents in the XML column.

For fast search, create indexes on these columns using the DB2 UDB *B-tree indexing* technology. See the DB2 UDB documentation for more information on *B-tree indexing*.

You must keep the following considerations in mind when creating an index:

- For elements or attributes in an XML document that have *multiple occurrences*, you must create a separate side table for each XML element or attribute with multiple occurrences due to the complex structure of XML documents.
- You can create multiple indexes on an XML column.
- You can associate side tables with the application table using the ROOT ID, the column name of the primary key in the application table and a unique identifier that associates all side tables with the application table. You can decide whether you want the primary key of the application table to be the ROOT ID, although it cannot be the composite key. This method is recommended.

  If the single primary key does not exist in the application table, or for some reason you don't want to use it, XML Extender alters the application table to add a column DXXROOT_ID, which stores a unique ID that is created at the insertion time. All side tables have a DXXROOT_ID column with the unique ID. If the primary key is used as the ROOT ID, all side tables have a column with the same name and type as the primary key column in the application table, and the values of the primary keys are stored.
- If you enable an XML column for the DB2 UDB Text Extender, you can also use the Text Extender's structural-text feature. The Text Extender has *"section search"* support, which extends the capability of a conventional full-text search by allowing search words to be matched within a specific document context that is specified by location paths. The *structural-text index* can be used with XML Extender's indexing on general SQL data types.

Storing XML data

Using XML Extender, you can insert intact XML documents into an XML column. If you define side tables, XML Extender automatically updates these tables. When you store an XML document directly, XML Extender stores the base type as an XML type.

Prerequisites:

- Ensure that you created or updated the DAD file.
- Determine what data type to use when you store the document.
- Choose a method (casting functions or UDFs) for storing the data in the DB2® table.

Specify an SQL INSERT statement that specifies the XML table and column to contain the XML document.

The XML Extender provides two methods for storing XML documents: default casting functions and storage UDFs.

Table 9 shows when to use each method.

Table 9. The XML Extender storage functions

If the DB2 UDB base type is ...	Store in DB2 UDB as ...			
	XMLVARCHAR	**XMLCLOB**	**XMLDBCLOB**	**XMLFILE**
VARCHAR	XMLVARCHAR()	N/A	N/A	XMLFile FromVarchar()
CLOB	N/A	XMLCLOB()	XMLDB CLOB, casting function	XMLFile FromCLOB()
FILE	XMLVarcha rFromFile()	XMLCLOB FromFile()	XMLDB CLOBFrom File, UDF	XMLFILE

Default casting functions for storing XML data

For each UDT, a default casting function exists to cast the SQL base type to the UDT. You can use the casting functions provided by XML Extender in your VALUES clause to insert data. Table 10 shows the provided casting functions:

Table 10. The XML Extender default casting functions

Casting function	Return type	Description
XMLVARCHAR(VARCHAR)	XMLVARCHAR	Input from memory buffer of VARCHAR
XMLCLOB(CLOB)	XMLCLOB	Input from memory buffer of CLOB or a CLOB locator
XMLFILE(VARCHAR)	XMLFILE	Store only the file name

For example, the following statement inserts a cast VARCHAR type into the XMLVARCHAR type:

```
INSERT INTO sales_tab
VALUES('123456', 'Sriram Srinivasan', DB2XML.XMLVarchar(:xml_buff))
```

Storage UDFs for storing XML data

For each XML Extender UDT, a storage UDF exists to import data into DB2 from a resource other than its base type. For example, if you want to import an XML file document to DB2 UDB as an XMLCLOB data type, you can use the function XMLCLOBFromFile().

Table 11 shows the storage functions provided by the XML Extender.

| *Table 11. The XML Extender storage UDFs*

Storage user-defined function	Return type	Description
XMLVarcharFromFile()	XMLVARCHAR	Reads an XML document from a file on the server and returns the value of the XMLVARCHAR data type. Optional: Specify the encoding of the file.

Table 11. The XML Extender storage UDFs (continued)

Storage user-defined function	Return type	Description
XMLCLOBFromFile()	XMLCLOB	Reads an XML document from a file on the server and returns the value of the XMLCLOB data type. Optional: Specify the encoding of the file.
XMLFileFromVarchar()	XMLFILE	Reads an XML document from memory as VARCHAR data, writes the document to an external file, and returns the value of the XMLFILE data type, which is the file name. Optional: Specify the encoding of the external file.
XMLFileFromCLOB()	XMLFILE	Reads an XML document from memory as CLOB data or as a CLOB locator, writes the document to an external file, and returns the value of the XMLFILE data type, which is the file name. Optional: Specify the encoding of the external file.

For example, using the XMLCLOBFromFile() function, the following statement stores a record in an XML table as an XMLCLOB:

```
EXEC SQL INSERT INTO sales_tab(ID, NAME, ORDER)
    VALUES('1234', 'MyName',
      XMLCLOBFromFile('dxx_install/samples/db2xml/xml/getstart.xml'))
```

The example imports the XML document from the file named `dxx_install/samples/db2xml/xml/getstart.xml` into the column ORDER in the table SALES_TAB.

Method for retrieving an XML document

Using XML Extender , you can retrieve either an entire document or the contents of elements and attributes. When you retrieve an XML column directly, the XML Extender returns the UDT as the column type. For details about retrieving data, see the following sections:

- “Retrieving an entire XML document” on page 79
- “Retrieving element contents and attribute values from XML documents” on page 80

The XML Extender provides two methods for retrieving data: default casting functions and the Content() overloaded UDF. Table 12 on page 79 shows when to use each method.

Table 12. The XML Extender retrieval functions

When the XML type is ...	Retrieve from DB2 UDB as ...			
	VARCHAR	**CLOB**	**DBCLOB**	**FILE**
XMLVARCHAR	**VARCHAR**	N/A	N/A	Content() UDF
XMLCLOB	N/A	**XMLCLOB**	N/A	Content() UDF
XMLFILE	N/A	Content() UDF	N/A	FILE

Retrieving an entire XML document

Procedure:

To retrieve an entire XML document:

1. Ensure that you stored the XML document in an XML table and determine what data you want to retrieve.
2. Choose a method (casting functions or UDFs) for retrieving the data in the DB2 UDB table.
3. If you are using the overloaded Content() UDF, determine the data type of the data that is being retrieved, and which data type is to be exported.
4. The XML column from which the element or attribute is to be extracted must be defined as either an XMLVARCHAR, XMLCLOB as LOCATOR, or XMLFILE data type.

Specify an SQL query that specifies the XML table and column from which to retrieve the XML document.

Default casting functions for retrieving XML data

The default casting function provided by DB2 UDB for UDTs converts an XML UDT to an SQL base type, and then operates on it. In your SELECT statement, you can use the casting functions that are provided by XML Extender to retrieve data. Table 13 shows the provided casting functions.

Table 13. The XML Extender default cast functions

Casting used in SELECT clause	Return type	Description
varchar(XMLVARCHAR)	VARCHAR	XML document in VARCHAR
clob(XMLCLOB)	CLOB	XML document in CLOB
varchar(XMLFile)	VARCHAR	XML file name in VARCHAR

For example, the following statement retrieves the XMLVARCHAR and stores it in memory as a VARCHAR data type:

```
EXEC SQL SELECT DB2XML.XMLVarchar(order) from SALES_TAB
```

Using the Content() UDF for retrieving XML data

Use the Content() UDF to retrieve the document content from external storage to memory, or export the document from internal storage to an external file, which is a file that is external to DB2 UDB on the DB2 UDB server.

For example, you might have your XML document stored as an XMLFILE data type. If you want to operate on it in memory, you can use the Content() UDF, which can take an XMLFILE data type as input and return a CLOB.

The Content() UDF performs two different retrieval functions, depending on the specified data type. It can:

- Retrieve a document from external storage and put it in memory.

  You can use Content() UDF to retrieve the XML document to a memory buffer or a CLOB *locator* (a host variable with a value that represents a single LOB value in the database server) when the document is stored as the external file.

  Use the following function syntax, where *xmlobj* is the XML column being queried:

  XMLFILE to CLOB:

  ```
  Content(xmlobj XMLFile)
  ```
- Retrieve a document from internal storage and export it to an external file.

  You can use the Content() UDF to retrieve an XML document that is stored inside DB2 UDB as an XMLCLOB data type and export it to a file on the database server file system. The Content() UDF returns the name of the file as a VARCHAR data type.

  Use the following function syntax:

  XML type to external file:

  ```
  Content(xmlobj XML type, filename varchar(512), targetencoding varchar(100))
  ```
  Where:

  xmlobj Is the name of the XML column from which the XML content is to be retrieved. *xmlobj* can be of type XMLVARCHAR or XMLCLOB.

  filename
  Is the name of the external file in which the XML data is to be stored.

  targetencoding
  Optional: Specifies the encoding of the output file.

In the example below, a small C program segment with embedded SQL statements (SQL statements coded within an application program) shows how an XML document is retrieved from a file to memory. This example assumes that the data type of the ORDER column is XMLFILE.

```
EXEC SQL BEGIN DECLARE SECTION;
     SQL TYPE IS CLOB_LOCATOR xml_buff;
EXEC SQL END DECLARE SECTION;
EXEC SQL CONNECT TO SALES_DB;
EXEC SQL DECLARE c1 CURSOR FOR
         SELECT Content(order) from sales_tab
EXEC SQL OPEN c1;
    do {
    EXEC SQL FETCH c1 INTO :xml_buff;
       if (SQLCODE != 0) {
          break;}
       else { /* do whatever you need to do with the XML doc in buffer */}
       }
    EXEC SQL CLOSE c1;
    EXEC SQL CONNECT RESET;
```

Retrieving element contents and attribute values from XML documents

You can retrieve (extract) the content of an element or the value of an attribute from one or more XML documents (single document or collection document search). The XML Extender provides user-defined extracting functions that you can specify in the SQL SELECT clause for each of the SQL data types.

Retrieving element content and attribute values is useful when developing your applications, because you can access XML data as relational data. For example, you might have 1000 XML documents that are stored in the ORDER column in the SALES_TAB table. To retrieve the names of all customers who have ordered items over $2500, use the following SQL statement with the extracting UDF in the SELECT clause:

```
SELECT extractVarchar(Order, '/Order/Customer/Name') from sales_order_view
       WHERE price > 2500.00
```

In this example, the extracting UDF retrieves the content of the <customer> element from the ORDER column and stores it as a VARCHAR data type. The location path is `/Order/Customer/Name`. Additionally, the number of returned values is reduced by using a WHERE clause, which specifies that only the contents of the <customer> element with a sub-element <ExtendedPrice> that has a value greater than 2500.00.

Table 14 on page 82 shows the UDFs that you can use to extract element content and attribute values, using the following syntax as either table or scalar functions.

Syntax:

extract*retrieved_datatype*(*xmlobj*, *path*)

retrieved_datatype
: The data type that is returned from the extracting function; it can be one of the following types:
- INTEGER
- SMALLINT
- DOUBLE
- REAL
- CHAR
- VARCHAR
- CLOB
- DATE
- TIME
- TIMESTAMP

xmlobj The name of the XML column from which the element or attribute is to be extracted. This column must be defined as one of the following XML user-defined types:
- XMLVARCHAR
- XMLCLOB as LOCATOR
- XMLFILE

path The location path of the element or attribute in the XML document (such as `/Order/Customer/Name`).

Restriction: Extracting UDFs can support location paths that have predicates with attributes, but not elements. For example, the following predicate is supported:

```
'/Order/Part[@color="black "]/ExtendedPrice'
```

The following predicate is not supported:

```
'/Order/Part/Shipment/[Shipdate < "11/25/00"]'
```

Table 14 shows the extracting functions, both in scalar and table format.

Table 14. The XML Extender extracting functions

Scalar function	Table function	Returned column name (table function)	Return type
extractInteger()	extractIntegers()	returnedInteger	INTEGER
extractSmallint()	extractSmallints()	returnedSmallint	SMALLINT
extractDouble()	extractDoubles()	returnedDouble	DOUBLE
extractReal()	extractReals()	returnedReal	REAL
extractChar()	extractChars()	returnedChar	CHAR
extractVarchar()	extractVarchars()	returnedVarchar	VARCHAR
extractCLOB()	extractCLOBs()	returnedCLOB	CLOB
extractDate()	extractDates()	returnedDate	DATE
extractTime()	extractTimes()	returnedTime	TIME
extractTimestamp()	extractTimestamps()	returnedTimestamp	TIMESTAMP

Scalar function example: In the following example, one value is inserted with the attribute key value of 1. The value is extracted as an integer and automatically converted to a DECIMAL type.

```
CREATE TABLE t1(key decimal(3,2));
INSERT into t1 values
SELECT * from table(DB2XML.extractInteger(DB2XML.XMLFile
   ('c:\dxx_install\samples\db2xml\xml\getstart.xml'), '/Order/@key="1"]'));
SELECT * from t1;
```

Updating XML data

With XML Extender, you can update the entire XML document by replacing the XML column data, or you can update the values of specified elements or attributes.

Procedure

To update XML data:

1. The XML document must be stored in an XML table.
2. You must know what data you want to retrieve.
3. You must choose a method for updating the data in the DB2 UDB table (casting functions or UDFs).
4. Specify an SQL query that specifies the XML table and column to update.

Updating an entire XML document

You can update an XML document by using a default casting function, or by using a storage UDF.

Updating with a default casting function

For each user-defined type (UDT), a default casting function exists to cast the SQL base type to the UDT. You can use the XML Extender-provided casting functions to update the XML document.

For example, the following statement updates the XMLVARCHAR type from the cast VARCHAR type, assuming that `xml_buf` is a host variable that is defined as a VARCHAR type.

```
UPDATE sales_tab SET=DB2XML.XMLVarchar(:xml_buff)
```

Updating XML documents with a storage UDF

For each of the XML Extender UDTs, a storage UDF exists to import data into DB2 UDB from a resource other than its base type. You can use a storage UDF to update the entire XML document by replacing it.

The following example updates the XML object from the file named `dxx_install/samples/db2xml/xml/getstart.xml` to the ORDER column in the SALES_TAB table.

```
UPDATE sales_tab
       set order = XMLVarcharFromFile('dxx_install/samples/db2xml
       /xml/getstart.xml) WHERE sales_person = 'MyName'
```

Updating specific elements and attributes of an XML document

Use the Update UDF to make specific changes, rather than updating the entire document. When you use this UDF, you specify the location path of the element or attribute whose value will be replaced. You do not need to edit the XML document; XML Extender makes the change for you.

Syntax:

```
Update(xmlobj, path, value)
```

The syntax has the following components:

xmlobj	The name of the XML column for which the value of the element or attribute is to be updated.
path	The location path of the element or attribute that is to be updated.
value	The new value that is to be updated.

For example, the following statement replaces the value of the <Customer> element with IBM:

```
UPDATE sales_tab
       set order = Update(order, '/Order/Customer/Name', 'IBM')
   WHERE sales_person = 'Sriram Srinivasan'
```

Multiple occurrence: When you specify a location path in the Update UDF, the content of every element or attribute with a matching path is updated with the supplied value. If a location path occurs in a document more than once, the Update UDF replaces all of the existing values with the value provided in the *value* parameter.

Methods for searching XML documents

Searching XML data is similar to retrieving XML data: both techniques retrieve data for further manipulation but they search by using the content of the WHERE clause as the criteria for retrieval.

The XML Extender provides several methods for searching XML documents that are stored in an XML column. You can:

- Search document structure and return results based on element content or attribute values.
- Search a view of the XML column and its side tables.
- Search the side tables directly for better performance.
- Search using extracting UDFs with WHERE clauses.
- Use the DB2® Text Extender to search column data within the structural content for a text string.

With XML Extender you can use indexes to quickly search columns in side tables. These columns contain XML element content or attribute values that are extracted from XML documents. By specifying the data type of an element or attribute, you can search on an SQL data type or do range searches. For example, in the purchase order example, you could search for all orders that have an extended price of over 2500.00.

Additionally, you can use the Text Extender to do structural text search or full text search. For example, you might have a column called RESUME that contains resumes in XML format. If you want to find the names of all applicants who have Java™ skills, you could use the DB2 UDB Text Extender to search on the XML documents for all resumes where the <skill> element contains the character string "JAVA".

The following sections describe search methods:
- "Searching the XML document by structure"
- "Using the DB2 UDB Text Extender for structural text searches of XML documents" on page 86

Searching the XML document by structure

Using XML Extender search features, you can search XML data in a column based on the document structure (the elements and attributes in the document).

Procedures:

To search the data, you can:
- Directly query the side tables.
- Use a *joined view.*
- Use extracting UDFs.

These search methods are described in the following examples are based on the following scenario. The SALES_TAB table has an XML column named ORDER. This column has three side tables, ORDER_SIDE_TAB, PART_SIDE_TAB, and SHIP_SIDE_TAB. A default view, sales_order_view, was specified when the ORDER column was enabled. This view joins these tables using the following CREATE VIEW statement:

```
CREATE VIEW sales_order_view(invoice_num, sales_person, order,
                             order_key, customer, part_key, price, date)
     AS
     SELECT sales_tab.invoice_num, sales_tab.sales_person, sales_tab.order,
            order_side_tab.order_key, order_side_tab.customer,
            part_side_tab.part_key, ship_side_tab.date
     FROM sales_tab, order_side_tab, part_side_tab, ship_side_tab
     WHERE sales_tab.invoice_num = order_side_tab.invoice_num
                AND sales_tab.invoice_num = part_side_tab.invoice_num
                AND sales_tab.invoice_num = ship_side_tab.invoice_num
```

Example: searching with direct query on side tables

Direct query with subquery search provides the best performance for a structural search when the side tables are indexed.

Procedure:

You can use a query or subquery to search side tables correctly.

For example, the following statement uses a query and subquery to directly search a side table:

```
SELECT sales_person from sales_tab
   WHERE invoice_num in
     (SELECT invoice_num from part_side_tab
      WHERE price > 2500.00)
```

In this example, invoice_num is the primary key in the SALES_TAB table.

Example: searching from a joined view

The XML Extender can create a default view that joins the application table and the side tables using a unique ID. You can use this default view, or any view that joins an application table and side tables, to search column data and query the side tables. This method provides a single virtual view of the application table and its side tables. However, the more side tables that are created, the longer the query takes to run.

Tip: You can use the root ID, or DXXROOT_ID (created by XML Extender), to join the tables when you create your own view.

For example, the following statement searches the view named SALES_ORDER_VIEW and returns the values from the SALES_PERSON column where the line item orders have a price greater than 2500.00.

```
SELECT sales_person from sales_order_view
   WHERE price > 2500.00
```

Example: searching with extracting UDFs

You can also use XML Extender's extracting UDFs to search on elements and attributes, when you did not create indexes or side tables for the application table. Using the extracting UDFs to scan the XML data is expensive and should only be used with WHERE clauses that restrict the number of XML documents that are included in the search.

The following statement searches with an extracting XML Extender UDF:

```
SELECT sales_person from sales_tab
     WHERE extractVarchar(order, '/Order/Customer/Name')
      like '%IBM%'
    AND invoice_num > 100
```

In this example, the extracting UDF extracts </Order/Customer/Name> elements that contain the substring IBM.

Example: searching on elements or attributes with multiple occurrence

When you search on elements or attributes that have multiple occurrence, use the DISTINCT clause to prevent duplicate values.

The following statement searches with the DISTINCT clause:

```
SELECT sales_person from sales_tab
            WHERE invoice_num in
              (SELECT DISTINCT invoice_num from part_side_tab
               WHERE price > 2500.00 )
```

In this example, the DAD file specifies that `/Order/Part/Price` has multiple occurrence and creates a side table, PART_SIDE_TAB, for it. The PART_SIDE_TAB table might have more than one row with the same invoice_num. Using DISTINCT returns only unique values.

Using the DB2 UDB Text Extender for structural text searches of XML documents

If DB2 UDB Text Extender is installed, you can use it to perform a structural text search.

Procedure:

To use the DB2 UDB Text Extender:

1. Decide whether you want to use structural text search or full text search.
2. Enable an XML column for the DB2 UDB Text Extender.
3. Create a query to perform the search.

To learn how to use the DB2 UDB Text Extender search, see DB2 Universal Database Extenders: Text Extender Administration and Programming, Version 7.

Using structural text searches and full text searches

When searching the XML document structure, XML Extender searches elements that are converted to general data types, but it does not search text. You can use the Text Extender for structural text search or full text search on a column that is enabled for XML. The DB2 UDB Text Extender supports XML document search in DB2 UDB Version 6.1 or later. Text Extender is available on AIX, Windows® operating systems, iSeries™, and the Solaris Operating Environment.

Structural text search
: Searches text strings that are based on the tree structure of the XML document. For example, in a document structure of `/Order/Customer/Name`, you can use a structural text search to find the character string ″IBM″ within the <Customer> sub-element. However, the document might also have the string ″IBM″ in a <Comment> sub-element or as part of the name of a product. A structural text search looks for the string only in the element that is specified. In this example, only the documents that have ″IBM″ in the </Order/Customer/Name> sub-element are found; any document that has ″IBM″ in other elements but not in the </Order/Customer/Name> sub-element is not returned.

Full text search
: Searches text strings anywhere in the document structure, without regard to elements or attributes. Using the previous example, all documents that contain the string ″IBM″ would be returned, regardless of where the string occurs.

Enabling an XML column for the DB2 UDB Text Extender

In an XML-enabled server, you enable the DB2 UDB Text Extender to search the content of an XML-enabled column.

1. See the `install.txt` file on the DB2 UDB Extenders™ CD for information on installing the Text Extender.

2. Run the **txstart** command:
   - On UNIX® operating systems, enter the command from the instance owner's command prompt.
   - On Windows NT, enter the command from the command window where DB2INSTANCE is specified.
3. Enable the database for the DB2 UDB Text Extender.

   From the **db2tx** command prompt, type:
   ```
   enable server for db2text
   ```
4. Enable the columns in the XML table for the DB2 UDB Text Extender, and define the data types of the XML document, the language, code pages, and other information about the column.
   - For the VARCHAR column XVARCHAR, type:
     ```
     db2tx enable text column order xvarchar function
     db2xml.varchartovarchar handle varcharhandle ccsid 1252
     language us_english format xml indextype precise
         indexproperty sections_enabled
     documentmodel (Order) updateindex update
     ```
   - For the CLOB column XCLOB, type:
     ```
     db2tx enable text column order xclob
     function db2xml.clob handle clobhandle ccsid 1252
     language us_english indextype precise updateindex update
     ```
5. Check the status of the index.
   - For the XVARCHAR column, type:
     ```
     get index status order handle varcharhandle
     ```
   - For the XCLOB column, type:
     ```
     get index status order handle clobhandle
     ```
6. Define the XML document model in a document model initialization file called `desmodel.ini`. This file is located in the `/db2tx/txins000` directory on UNIX and in the `/instance/db2tx/txins000` directory on Windows NT. For example, for the `textmodel.ini`:
   ```
   ;list of document models
   [MODELS]
   modelname=Order

   ; an 'Order' document model definition
   ; left side = section name identifier
   ; right side = section name tag

   [Order]
   Order = /Order
   Order/Customer/Name = /Order/Customer/Name
   Order/Customer/Email = /Order/Customer/Email
   Order/Part/Shipment/ShipMode = /Order/Part/Shipment/ShipMode
   ```

Searching for text using the DB2 UDB Net Search Extender

To search for text using the DB2 UDB Net Search Extender, you create a query that specifies the element or attribute for which you want to search. The DB2 UDB Net Search Extender then uses the query to search the element content or attribute values.

For example enter the following statements in a DB2 UDB command window to use the DB2 UDB Net Search Extender to search the text of an XML document:

```
select xvarchar from order where db2tx.contains(varcharhandle,
  'model Order section(Order/Customer/Name) "Motors"')=1

select xclob from order where db2tx.contains(clobhandle,
  'model Order section(Order/Customer/Name) "Motors"')=1
```

The Net Search Extender Contains() UDF searches that search the text of an XML document.

This example does not contain all of the steps that are required to use the DB2 UDB Net Search Extender to search column data. To learn about the Net Search Extender search concepts and capability, see *DB2 Universal Database Extenders for z/OS: Net Search Extender Administration and Programming*.

Deleting XML documents

Use the SQL DELETE statement to delete the row containing an XML document from an XML column. You can specify a WHERE clause to delete specific documents.

For example, the following statement deletes all documents that have a value for <ExtendedPrice> greater than 2500.00:

```
DELETE from sales_tab
       WHERE invoice_num in
          (SELECT invoice_num from part_side_tab
           WHERE price > 2500.00)
```

The corresponding rows in the side tables are automatically deleted.

Related concepts:

- “XML columns as a storage and access method” on page 73

Related tasks:

- “Managing data in XML columns” on page 73

Limitations when invoking functions from Java Database (JDBC)

When using parameter markers in functions, a JDBC restriction requires that the parameter marker for the function must be cast to the data type of the column into which the returned data will be inserted. The function selection logic does not know what data type the argument might turn out to be, and it cannot resolve the reference.

For example, JDBC cannot resolve the following code:

```
DB2XML.XMLdefault_casting_function(length)
```

You can use the CAST specification to provide a type for the parameter marker, such as VARCHAR, and then the function selection logic can proceed:

```
DB2XML.XMLdefault_casting_function(CAST(? AS cast_type(length))
```

Example 1: In the following example, the parameter marker is cast as VARCHAR. The parameter being passed is an XML document, which is cast as VARCHAR(1000) and inserted into the column ORDER.

```
String query = "insert into sales_tab(invoice_num, sales_person, order) values
    (?,?,DB2XML.XMLVarchar(cast (? as varchar(1000))))";
```

Example 2: In the following example, the parameter marker is cast as VARCHAR. The parameter being passed is a file name and its contents are converted to VARCHAR and inserted into the column ORDER.

```
String query = "insert into sales_tab(invoice_num, sales_person, order) values
    (?,?,DB2XML.XMLVarcharfromFILE(cast (? as varchar(1000))))";
```

Chapter 4. Managing data in XML collections

XML collections as a storage and access method

Relational data is either *decomposed* from incoming XML documents or used to *compose* outgoing XML documents. Decomposed data is the untagged content of an XML document stored in one or more database tables. Or, XML documents are composed from existing data in one or more database tables. If your data is to be shared with other applications, you might want to be able to compose and decompose incoming and outgoing XML documents and manage the data as necessary to take advantage of the relational capabilities of DB2. This type of XML document storage is called *XML collection*.

An example of an XML collection is shown in Figure 10.

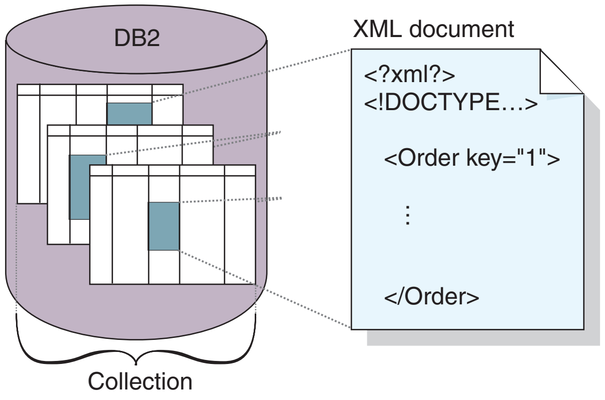

Figure 10. Storing documents as untagged data in DB2 UDB tables

The XML collection is defined in a DAD file, which specifies how elements and attributes are mapped to one or more relational tables. The collection is a set of columns, associated with a DAD file, that contain the data in a particular XML document or set of XML documents. You can define a collection name by enabling it, and then refer to it by name when issuing a stored procedure to compose or decompose XML documents. It is called an enabled XML collection. The collection is given a name so that it is easily run with stored procedures that compose and decompose the XML documents.

When you define a collection in the DAD file, you use one of two types of mapping schemes, *SQL mapping* or *RDB_node mapping* that define the tables, columns, and conditions used to associate XML data with DB2 UDB tables. SQL mapping uses SQL SELECT statements to define the DB2 UDB tables and conditions used for the collection. RDB_node mapping uses an XPath-based relational database node, or RDB_node, which has child elements.

Stored procedures are provided to compose or decompose XML documents. Stored procedure names are qualified by DB2XML, which is the *schema name* of XML Extender.

Managing data in XML collections

An XML collection is a set of relational tables that contain data that is mapped to XML documents. This access and storage method lets you compose an XML document from existing data, decompose an XML document, and use XML as an interchange method.

The relational tables that make up the collection can be new tables, or existing tables that have data that is to be used with XML Extender to compose XML documents for your applications. Column data in these tables does not contain XML tags; it contains the content and values that are associated with elements and attributes, respectively. You use stored procedures to store, retrieve, update, search, and delete XML collection data.

You can increase the CLOB sizes for the results of the stored procedures.

Preparing to compose XML documents from DB2 data

Composition is the generation of a set of XML documents from relational data in an XML collection. You can compose XML documents using stored procedures. To use these stored procedures, create a document access definition (DAD) file. A DAD file specifies the mapping between the XML document and the DB2 table structure. The stored procedures use the DAD file to compose the XML document.

Procedure::

Before you begin composing XML documents:

1. Map the structure of the XML document to the relational tables that contain the contents of the element and attribute values.
2. Select a mapping method: SQL mapping or RDB_node mapping.
3. Prepare the DAD file.

The XML Extender provides four stored procedures, dxxGenXML(), dxxGenXMLCLOB(), dxxRetrieveXML(), and dxxRetrieveXMLCLOB to compose XML documents. The frequency with which you plan to update the XML document is a key factor in selecting the stored procedure that you will use.

Composing XML documents that will be updated occasionally

If your document will be updated only occasionally, use the dxxGenXML stored procedure to compose the document. You do not have to enable a collection to use this stored procedure. The stored procedure uses a DAD file instead.

The dxxGenXML stored procedure constructs XML documents using data that is stored in XML collection tables, which are specified by the <Xcollection> element in the DAD file. This stored procedure inserts each XML document as a row into a result table. You can also open a cursor on the result table and fetch the result set. The result table must be created by the application and always has at least one column of VARCHAR, CLOB, XMLVARCHAR, or XMLCLOB type.

If the value of the validation element in the DAD is YES, the application must also create a validation column of type INTEGER in the result table. You can specify any name for the validate column as long as its data type is integer. The default column value for a column with a data type of integer is 0. You do not have to set the value. XML Extender will set the value to 1 if the document is valid, otherwise it is 0.

The stored procedure dxxGenXML also allows you to specify the maximum number of rows that are to be generated in the result table. This shortens processing time. The stored procedure returns the actual number of rows in the table and any return codes and messages.

The corresponding stored procedure for decomposition is dxxShredXML; it also takes the DAD as the input parameter and does not require that the XML collection be enabled.

Procedure:

To compose an XML collection using the dxxGenXML stored procedure, embed a stored procedure call in your application using the following stored procedure declaration:

```
dxxGenXML(CLOB(100K)     DAD,               /* input */
          char( 32) resultTabName,     /* input */
          char(30)       result_column, /* input */
          char(30)       valid_column,  /* input */
          integer        overrideType,      /* input */
          varchar(1024)  override,          /* input */
          integer        maxRows,           /* input */
          integer        numRows,           /* output */
          long           returnCode,        /* output */
          varchar(1024)  returnMsg)         /* output */
```

Example: The following example composes an XML document:

```
#include "dxx.h"
#include "dxxrc.h"

EXEC SQL INCLUDE SQLCA;
EXEC SQL BEGIN DECLARE SECTION;
SQL TYPE is CLOB(100K) dad;    /* DAD */
EXEC SQL DECLARE :dad VARIABLE CCSID 1047;
                       /* specifies the CCSID for DAD when running from USS */
                       /* to ensure that DB2 UDB converts the */
        /* code page correctly*/
char  result_tab[32];     /* name of the result table */
char  result_colname[32]; /* name of the result column */
char  valid_colname[32];  /* name of the valid column, will set to NULL */
char  override[2];        /* override, will set to NULL*/
short overrideType;       /* defined in dxx.h */
short max_row;            /* maximum number of rows */
short num_row;            /* actual number of rows */
long  returnCode;         /* return error code */
char  returnMsg[1024];    /* error message text */
short dad_ind;
short rtab_ind;
short rcol_ind;
short vcol_ind;
short ovtype_ind;
short ov_ind;
short maxrow_ind;
short numrow_ind;
short returnCode_ind;
short returnMsg_ind;
EXEC SQL END DECLARE SECTION;

FILE  *file_handle;
long  file_length=0;

/* create table */
EXEC SQL CREATE TABLE xml_order_tab (xmlorder XMLVarchar);
```

```
/* initialize the DAD CLOB object. */
file_handle = fopen("/dxx/samples/dad
    /getstart_xcollection.dad", "r");
if ( file_handle != NULL ) {
  file_length = fread ((void *) &dad.data,
                      1, FILE_SIZE, file_handle);
  if (file_length == 0) {
    printf ("Error reading dad file
             /dxx/samples/dad
              /getstart_xcollection.dad\n");
    rc = -1;
    goto exit;
 } else
    dad.length = file_length;
}
else {
  printf("Error opening dad file  \n", );
  rc = -1;
  goto exit;
}
/* initialize host variable and indicators */
strcpy(result_tab,"xml_order_tab");
strcpy(result_colname, "xmlorder")
valid_colname = '\0';
override[0] = '\0';
overrideType = NO_OVERRIDE;
max_row = 500;
num_row = 0;
returnCode = 0;
msg_txt[0] = '\0';
dad_ind = 0;
rtab_ind = 0;
rcol_ind = 0;
vcol_ind = -1;
ov_ind = -1;
ovtype_ind = 0;
maxrow_ind = 0;
numrow_ind = -1;
returnCode_ind = -1;
returnMsg_ind = -1;

/* Call the store procedure */
EXEC SQL CALL "DB2XML.dxxGenXML"
       (:dad:dad_ind;
        :result_tab:rtab_ind,
        :result_colname:rcol_ind,
        :valid_colname:vcol_ind,
        :overrideType:ovtype_ind,:override:ov_ind,
        :max_row:maxrow_ind,:num_row:numrow_ind,
        :returnCode:returnCode_ind,:returnMsg:returnMsg_ind);

if (SQLCODE < 0) {
    EXEC SQL ROLLBACK;
  else
    EXEC SQL COMMIT;
}

exit:
  return rc;
```

After the stored procedure is called, the result table contains 250 rows because the SQL query specified in the DAD file generated 250 XML documents.

Composing XML documents that will be updated frequently

If your document will be updated frequently, use the dxxRetrieveXML stored procedure to compose the document. Because the same tasks are repeated, improved performance is important.

The dxxRetrieveXML stored procedure works in the same way as the dxxGenXML stored procedure, except that it takes the name of an enabled XML collection instead of a DAD file. When an XML collection is enabled, a DAD file is stored in the XML_USAGE table. Therefore, XML Extender retrieves the DAD file and uses it to compose the document in the same way as the dxxGenXML stored procedure.

The dxxRetrieveXML stored procedure allows the same DAD file to be used for both composition and decomposition.

The corresponding stored procedure for decomposition is dxxInsertXML; it also takes the name of an enabled XML collection.

Procedure:

To compose an XML collection using the dxxRetrieveXML stored procedure, embed a stored procedure call in your application using the following stored procedure declaration:

```
dxxRetrieveXML(char(32) collectionName,  /* input */
               char(32) resultTabName,   /* input */
               char(30)          result_column, /* input */
               char(30)       valid_column,    /* input */
               integer        overrideType,    /* input */
               varchar(1024)  override,        /* input */
               integer        maxRows,         /* input */
               integer        numRows,         /* output */
               long           returnCode,      /* output */
               varchar(1024)  returnMsg)       /* output */
```

Example: The following example is of a call to dxxRetrieveXML(). It assumes that a result table is created with the name of XML_ORDER_TAB and that the table has one column of XMLVARCHAR type.

```
#include "dxx.h"
#include "dxxrc.h"

EXEC SQL INCLUDE SQLCA;
EXEC SQL BEGIN DECLARE SECTION;
char  collectionName[32]; /* name of an XML collection */
char  result_tab[32];     /* name of the result table */
char  result_colname[32]; /* name of the result column */
char  valid_colname[32];  /* name of the valid column, will set to NULL*/
char  override[2];        /* override, will set to NULL*/
short overrideType;       /* defined in dxx.h */
short max_row;            /* maximum number of rows */
short num_row;            /* actual number of rows */
long  returnCode;         /* return error code */
char  returnMsg[1024];    /* error message text */
short collectionName_ind;
short rtab_ind;
short rcol_ind;
short vcol_ind;
short ovtype_ind;
short ov_ind;
short maxrow_ind;
short numrow_ind;
short returnCode_ind;
short returnMsg_ind;
```

```
EXEC SQL END DECLARE SECTION;

/* create table */
EXEC SQL CREATE TABLE xml_order_tab (xmlorder XMLVarchar);

/* initial host variable and indicators */
strcpy(collection, "sales_ord");
strcpy(result_tab,"xml_order_tab");
strcpy(result_col,"xmlorder");
valid_colname[0] = '\0';
override[0] = '\0';
overrideType = NO_OVERRIDE;
max_row = 500;
num_row = 0;
returnCode = 0;
msg_txt[0] = '\0';
collectionName_ind = 0;
rtab_ind = 0;
rcol_ind = 0;
vcol_ind = -1;
ov_ind = -1;
ovtype_ind = 0;
maxrow_ind = 0;
numrow_ind = -1;
returnCode_ind = -1;
returnMsg_ind = -1;

/* Call the store procedure */
EXEC SQL CALL "DB2XML.DXXRETRIEVE" (:collectionName:collectionName_ind,
                                   :result_tab:rtab_ind,
                                   :result_colname:rcol_ind,
                                   :valid_colname:vcol_ind,
                                   :overrideType:ovtype_ind,:override:ov_ind,
                                   :max_row:maxrow_ind,:num_row:numrow_ind,
                                   :returnCode:returnCode_ind,
            :returnMsg:returnMsg_ind);

if (SQLCODE < 0) {
    EXEC SQL ROLLBACK;
  else
    EXEC SQL COMMIT;
}
```

Related concepts:

- "XML collections as a storage and access method" on page 91
- "Mapping schemes for XML collections" on page 105
- "Location paths" on page 112
- "DAD files for XML collections" on page 169
- "XML Extender composition stored procedures" on page 200

Related tasks:

- "Composing XML collections by using RDB_node mapping" on page 63
- "Stylesheets for an XML collection" on page 112
- "Decomposing an XML collection by using RDB_node mapping" on page 65
- "Updating, deleting, and retrieving data in XML collections" on page 101
- "Searching XML collections" on page 103

Decomposing XML documents into DB2 UDB data

To decompose an XML document is to break down the data inside of an XML document and store it in relational tables. The XML Extender provides stored procedures to decompose XML data from source XML documents into relational tables. To use these stored procedures, you must create a DAD file, which specifies the mapping between the XML document and DB2 UDB table structure. The stored procedures use the DAD file to decompose the XML document.

Enabling an XML collection for decomposition

In most cases, you need to enable an XML collection before using the stored procedures. Cases where you must enable the collections are:

- When decomposing XML documents into new tables, an XML collection must be enabled because all tables in the XML collection are created by the XML Extender when the collection is enabled.
- When keeping the sequence of elements and attributes that have multiple occurrence is important. The XML Extender preserves only the sequence order of elements or attributes of multiple occurrence for tables that are created when a collection is enabled. When XML documents are decomposed into existing relational tables, the sequence order is not guaranteed to be preserved.

See the section about the dxxadm administration command for information about the enable_collection option.

If you want to pass the DAD file when the tables already exist in your database, you do not need to enable an XML collection.

Before you decompose an XML document into DB2 UDB data:

1. Map the structure of the XML document to the relational tables that contain the contents of the elements and attributes values.
2. Prepare the DAD file, using RDB_node mapping.
3. Optional: Enable the XML collection.

Procedure::

Use one of the two stored procedures provided by DB2 UDB XML Extender to decompose XML documents, dxxShredXML() or dxxInsertXML.

dxxShredXML()

This stored procedure is used for applications that do occasional updates or for applications that do not want the overhead of administering the XML data. The stored procedure dxxShredXML() does not required an enabled collection; it uses a DAD file instead.

The stored procedure dxxShredXML() takes two input parameters, a DAD file and the XML document that is to be decomposed; it returns two output parameters: a return code and a return message. It inserts data from an XML document into an XML collection according to the <Xcollection> specification in the input DAD file. The dxxShredXML() stored procedure then decomposes the XML document, and inserts untagged XML data into the tables specified in the DAD file. The tables that are used in the <Xcollection> of the DAD file are assumed to exist, and the columns are assumed to meet the data types specified in the DAD mapping. If this is not true, an error message is returned.

The corresponding stored procedure for composition is dxxGenXML(); it also takes the DAD as the input parameter and does not require that the XML collection be enabled.

To decompose an XML collection with dxxShredXML()

Embed a stored procedure call in your application using the following stored procedure declaration:

```
dxxShredXML(CLOB(100K)    DAD,          /* input */
            CLOB(1M)      xmlobj,       /* input */
            long          returnCode,   /* output */
            varchar(1024) returnMsg)    /* output */
```

Example: The following example is a call to dxxShredXML():

```
#include "dxx.h"
#include "dxxrc.h"

EXEC SQL INCLUDE SQLCA;
EXEC SQL BEGIN DECLARE SECTION;
SQL TYPE is CLOB(100K) dad;    /* DAD */
EXEC SQL DECLARE :dad VARIABLE CCSID 1047;
                   /* specifies the CCSID for DAD when running */
                   /* from USS to ensure that DB2 UDB converts the */
                   /* code page correctly */
SQL TYPE is CLOB(100K) xmlDoc; /* input xml document */
EXEC SQL DECLARE :xmlDoc VARIABLE CCSID 1047;
                   /* specifies the CCSID for DAD when running */
                   /* from USS to ensure that DB2 UDB converts the */
                   /* code page correctly */
long    returnCode;            /* return error code */
char    returnMsg[1024];       /* error message text */
short   dad_ind;
short   xmlDoc_ind;
short   returnCode_ind;
short   returnMsg_ind;
EXEC SQL END DECLARE SECTION;

FILE   *file_handle;
long    file_length=0;

/* initialize the DAD CLOB object. */
file_handle = fopen( "/dxx/samples
/dad/getstart_xcollection.dad", "r" );
if ( file_handle != NULL ) {
  file_length = fread ((void *) &dad.data, 1, FILE_SIZE,
  file_handle);
  if (file_length == 0) {
    printf ("Error reading dad file getstart_xcollection.dad\n");
    rc = -1;
    goto exit;
 } else
    dad.length = file_length;
}
else {
  printf("Error opening dad file  \n");
  rc = -1;
  goto exit;
}

/* Initialize the XML CLOB object. */
  file_handle = fopen( "/dxx/samples
/xml/getstart_xcollection.xml", "r" );
  if ( file_handle != NULL ) {
    file_length = fread ((void *) &xmlDoc.data, 1,
        FILE_SIZE, file_handle);
    if (file_length == 0) {
      printf ("Error reading xml file
         getstart_xcollection.xml \n");
      rc = -1;
      goto exit;
    } else
       xmlDoc.length = file_length;
  }
  else {
    printf("Error opening xml file \n");
    rc = -1;
    goto exit;
  }

/* initialize host variable and indicators */
returnCode = 0;
msg_txt[0] = '\0';
dad_ind = 0;
xmlDoc_ind = 0;
returnCode_ind = -1;
returnMsg_ind = -1;

/* Call the store procedure */
EXEC SQL CALL "DB2XML.DXXSHRED"  (:dad:dad_ind;
                                  :xmlDoc:xmlDoc_ind,
                                  :returnCode:returnCode_ind,
                                  :returnMsg:returnMsg_ind);

if (SQLCODE < 0) {
    EXEC SQL ROLLBACK;
  else
    EXEC SQL COMMIT;
}

exit:
  return rc;
```

dxxInsertXML()

This stored procedure is used for applications that make regular updates. The stored procedure dxxInsertXML() works the same as dxxShredXML(), except that dxxInsertXML() takes an enabled XML collection as its first input parameter.

The stored procedure dxxInsertXML() inserts data from an XML document into an enabled XML collection, which is associated with a DAD file. The DAD file contains specifications for the collection tables and the mapping. The collection tables are checked or created according to the specifications in the <Xcollection>. The stored procedure dxxInsertXML() then decomposes the XML document according to the mapping, and it inserts untagged XML data into the tables of the named XML collection.

The corresponding stored procedure for composition is dxxRetrieveXML(); it also takes the name of an enabled XML collection.

Procedure:

To decompose an XML collection: dxxInsertXML():

Embed a stored procedure call in your application using the following stored procedure declaration:

```
dxxInsertXML(char(collectionName
             32) collectionName,   /* input */
             CLOB(1M)       xmlobj,           /* input */
             long           returnCode,       /* output */
             varchar(1024)  returnMsg)        /* output */
```

Example: The following is an example of a call to dxxInsertXML():

```
#include "dxx.h"
#include "dxxrc.h"

EXEC SQL INCLUDE SQLCA;
EXEC SQL BEGIN DECLARE SECTION;
char    collectionName[32];   /* name of an XML collection */
SQL TYPE is CLOB(100K) xmlDoc; /* input xml document */
long    returnCode;            /* return error code */
char    returnMsg[1024];       /* error message text */
short   collectionName_ind;
short   xmlDoc_ind;
short   returnCode_ind;
short   returnMsg_ind;
EXEC SQL END DECLARE SECTION;

FILE   *file_handle;
long    file_length=0;

/* initialize the DAD CLOB object. */
file_handle = fopen( "/dxx_install/samples/db2xml/dad
/getstart_xcollection.dad", "r" );

 if ( file_handle != NULL ) {
  file_length = fread ((void *) &dad.data, 1, FILE_SIZE,
     file_handle);
 if (file_length == 0) {
    printf ("Error reading dad file getstart_xcollection.dad\n");
    rc = -1;
    goto exit;
 } else
    dad.length = file_length;
}
else {
  printf("Error opening dad file  \n");
  rc = -1;
  goto exit;
}

/* initialize host variable and indicators */
strcpy(collectionName, "sales_ord");
returnCode = 0;
msg_txt[0] = '\0';
collectionName_ind = 0;
xmlDoc_ind = 0;
returnCode_ind = -1;
returnMsg_ind = -1;

/* Call the store procedure */
EXEC SQL CALL "db2xml.DXXINSERTXML"
                   (:collection_name:collection_name_ind,
                    :xmlDoc:xmlDoc_ind,
                    :returnCode:returnCode_ind,
                    :returnMsg:returnMsg_ind);

if (SQLCODE < 0) {
    EXEC SQL ROLLBACK;
  else
    EXEC SQL COMMIT;
}

exit:
  return rc;
```

Decomposition table size limits

Decomposition uses RDB_node mapping to specify how an XML document is decomposed into DB2 UDB tables by extracting the element and attribute values and storing them in table rows. The values from each XML document are stored in one or more DB2 UDB tables. Each table can have a maximum of 10240 rows decomposed from each document.

For example, if an XML document is decomposed into five tables, each of the five tables can have up to 10240 rows for that particular document. If the table has rows for multiple documents, it can have up to 1024 rows for each document.

Using multiple-occurring elements (elements with location paths that can occur more than once in the XML structure) affects the number of rows . For example, a document that contains an element <Part> that occurs 20 times, might be decomposed as 20 rows in a table. When using multiple occurring elements, consider that a maximum of 1024 rows can be decomposed into one table from a single document.

Related concepts:

- "XML Extenders decomposition stored procedures" on page 215

Related tasks:

- "Decomposing an XML collection by using RDB_node mapping" on page 65
- "Calling XML Extender composition stored procedures" on page 201

Related reference:

- "dxxInsertXML() stored procedure" on page 218
- "dxxShredXML() stored procedure" on page 215

Updating, deleting, and retrieving data in XML collections

You can update, delete, search, and retrieve XML collections. However, the purpose of using an XML collection is to store or retrieve untagged, pure data in database tables. The data in existing database tables has nothing to do with any incoming XML documents; update, delete, and search operations consist of normal SQL access to these tables.

The XML Extender provides the ability to perform operations on the data from an XML collection view. You can UPDATE and DELETE SQL statements to modify the data that is used for composing XML documents, and therefore, update the XML collection. Performing SQL operations on the collection tables affects the generated documents.

Restrictions:

- To update a document, do not delete a row containing the primary key of the table, which is the foreign key row of the other collection tables. When the primary key and foreign key row is deleted, the document is deleted.
- To replace or delete elements and attribute values, you can delete and insert rows in lower-level tables without deleting the document.
- To delete a document, delete the row that composes the top element_node specified in the DAD.

Updating data in an XML collection

The XML Extender allows you to update untagged data that is stored in XML collection tables. By updating XML collection table values, you are updating the text of an XML element, or the value of an XML attribute. Updates can also delete an instance of data from multiple-occurring elements or attributes.

From an SQL point of view, changing the value of the element or attribute is an update operation, and deleting an instance of an element or attribute is a delete operation. From an XML point of view, if the element text or attribute value of the root element_node exists, the XML document still exists and is, therefore, an update operation. SQL operations on collection tables affect documents that will be generated from the tables.

Requirements: When you update data in an XML collection, observe the following rules:

- Specify the primary-foreign key relationship among the collection tables when the existing tables have this relationship. If they do not, ensure that there are columns that can be joined.
- Include the join condition that is specified in the DAD file:
  - For SQL mapping, include the join condition in the <SQL_stmt> element.
  - For RDB_node mapping, include the join condition in the top <condition> element of the root element node.

Updating element and attribute values

In an XML collection, element text and attribute values are all mapped to columns in database tables. Regardless of whether the column data previously exists or is decomposed from incoming XML documents, you replace the data using the normal SQL update technique.

To update an element or attribute value, specify a WHERE clause in the SQL UPDATE statement that contains the join condition that is specified in the DAD file.

Example:

```
UPDATE SHIP_TAB
    set MODE = 'BOAT'
  WHERE MODE='AIR' AND PART_KEY in
    (SELECT PART_KEY from PART_TAB WHERE ORDER_KEY=68)
```

The <ShipMode> element value is updated from AIR to BOAT in the SHIP_TAB table, where the key is 68.

Deleting element and attribute instances

To update composed XML documents by eliminating multiple-occurring elements or attributes, delete a row containing the field value that corresponds to the element or attribute value, using the WHERE clause. If you do not delete the row that contains the values for the top element_node, deleting element values is considered an update of the XML document.

For example, in the following DELETE statement, you are deleting a <shipment> element by specifying a unique value of one of its sub-elements.

```
DELETE from SHIP_TAB
   WHERE DATE='1999-04-12'
```

Specifying a DATE value deletes the row that matches this value. The composed document originally contained two <shipment> elements, but now contains one.

Deleting an XML document from an XML collection

You can delete an XML document that is composed from a collection. This means that if you have an XML collection that composes multiple XML documents, you can delete one of these composed documents. Performing SQL operations on the collection tables affects the generated documents.

Procedure:

To delete the document, delete a row in the table that composes the top element_node that is specified in the DAD file. This table contains the primary key for the top-level collection table and the foreign key for the lower-level tables. Deleting the document with this method works only if the primary-key and foreign-key constraints are fully specified in the SQL and if the relationship of the tables shown in the DAD match those constraints exactly.

Example:

The following DELETE statement specifies the value of the primary key column.

```
DELETE from order_tab
   WHERE order_key=1
```

ORDER_KEY is the primary key in the table ORDER_TAB, which is the top-level table as specified in the DAD. Deleting this row deletes one XML document that is generated during composition. Therefore, from the XML point of view, one XML document is deleted from the XML collection.

Retrieving XML documents from an XML collection

Retrieving XML documents from an XML collection is similar to composing documents from the collection.

DAD file consideration: When you decompose XML documents in an XML collection, you can lose the order of multiple-occurring elements and attribute values, unless you specify the order in the DAD file. To preserve this order, you should use the RDB_node mapping scheme. This mapping scheme allows you to specify an orderBy attribute for the table containing the root element in its RDB_node.

Searching XML collections

This section describes searching an XML collection in terms of generating XML documents using search criteria, and searching for decomposed XML data.

Composing XML documents using search criteria

This task is the same as composition using a condition.

Procedure:

You can specify the search criteria using the following search criteria:

- Specify the condition in the text_node and attribute_node of the DAD file
- Specify the *overwrite* parameter when using the dxxGenXML() and dxxRetrieveXML() stored procedures.

For example, if you enabled an XML collection, sales_ord, using the DAD file, `order.dad`, but you now want to override the price using form data derived from the Web, you can override the value of the <SQL_stmt> DAD element, as follows:

```
EXEC SQL INCLUDE SQLCA;
EXEC SQL BEGIN DECLARE SECTION;
       ...
              EXEC SQL END DECLARE SECTION;

         float    price_value;

         /* create table */
         EXEC SQL CREATE TABLE xml_order_tab (xmlorder XMLVarchar);

         /* initialize host variable and indicators */
         strcpy(collection,"sales_ord");
         strcpy(result_tab,"xml_order_tab");
         overrideType = SQL_OVERRIDE;
         max_row = 20;
         num_row = 0;
         returnCode = 0;
         msg_txt[0] = '\0';
         override_ind = 0;
         overrideType_ind = 0;
         rtab_ind = 0;
         maxrow_ind = 0;
         numrow_ind = -1;
         returnCode_ind = -1;
         returnMsg_ind = -1;

         /* get the price_value from some place, such as form data */
         price_value = 1000.00         /* for example*/

         /* specify the overwrite */
         sprintf(overwrite,
                "SELECT o.order_key, customer, p.part_key, quantity, price,
                       tax, ship_id, date, mode
                FROM order_tab o, part_tab p,
                    table
(select db2xml.generate_unique()
                    as ship_id, date, mode from ship_tab)  s
                WHERE p.price > %d and s.date >'1996-06-01' AND
                    p.order_key = o.order_key and s.part_key = p.part_key",
                    price_value);

        /* Call the store procedure */
        EXEC SQL CALL db2xml.dxxRetrieve(:collection:collection_ind,
                :result_tab:rtab_ind,
                :overrideType:overrideType_ind,:overwrite:overwrite_ind,
                :max_row:maxrow_ind,:num_row:numrow_ind,
                :returnCode:returnCode_ind,:returnMsg:returnMsg_ind);
```

The condition of price > 2500.00 in `order.dad` is overridden by price > ?, where ? is based on the input variable *price_value*.

Searching for decomposed XML data

You can use normal SQL query operations to search collection tables. You can join collection tables, or use subqueries, and then do a structural-text search on text columns. Apply the results of the structural search to retrieve or generate the specified XML document.

Mapping schemes for XML collections

If you are using an XML collection, you must select a *mapping scheme*, which specifies how XML data is represented in a relational database. Because XML collections must match the hierarchical structure of XML documents with a relational structure for relational databases, you should understand how the two structures compare. Figure 11 shows how the hierarchical structure can be mapped to relational table columns.

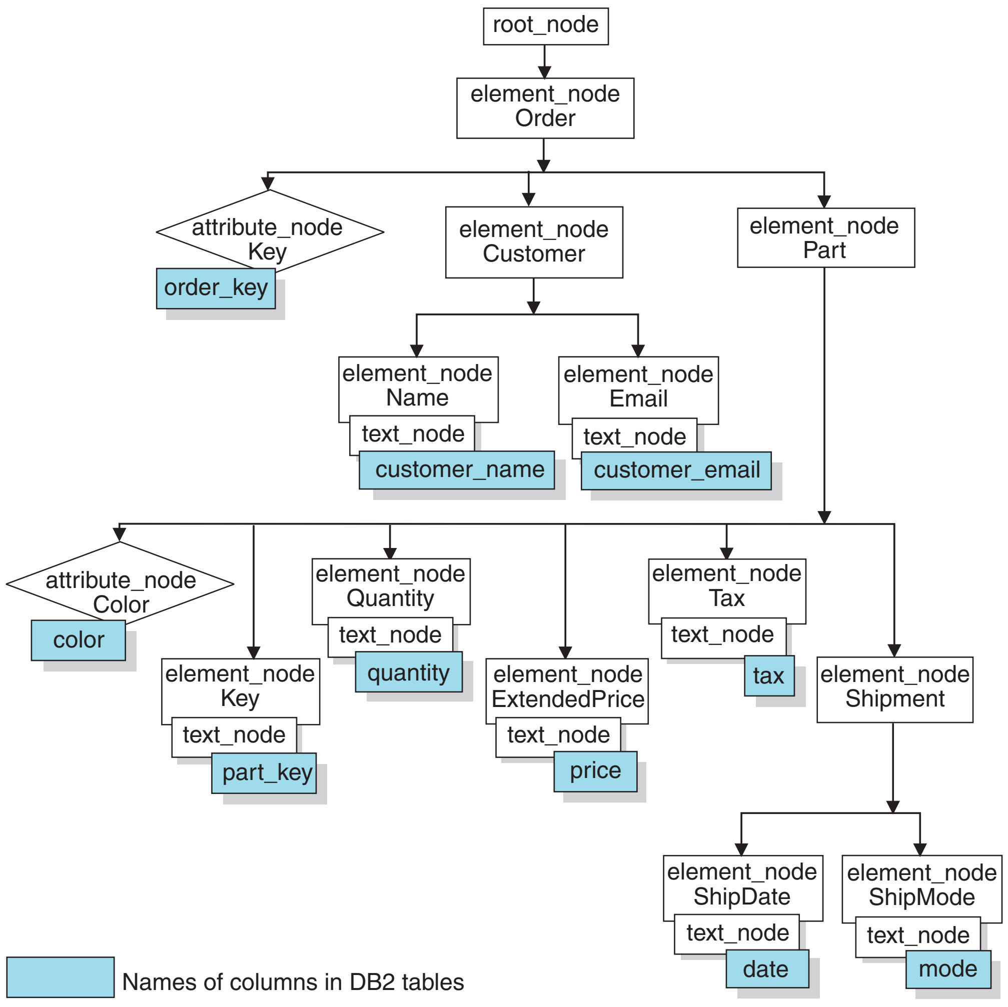

Figure 11. XML document structured mapped to relational table columns

The XML Extender uses a mapping scheme when composing or decomposing XML documents that are located in multiple relational tables. The XML Extender provides a wizard that assists you in creating the DAD file. However, before you create the DAD file, you must think about how your XML data is mapped to the XML collection.

Types of mapping schemes:

Use <Xcollection> to specify the mapping scheme in the DAD file. The XML Extender provides two types of mapping schemes: *SQL mapping* and *Relational Database (RDB_node) mapping*.

SQL mapping

This method allows direct mapping from relational data to XML documents through a single SQL statement. SQL mapping is used for composition only. The content of the <SQL_stmt> element must be a valid SQL statement. The <SQL_stmt> element specifies columns in the SELECT clause that are mapped to XML elements or attributes later in the DAD. When defined for composing XML documents, the column names in the SELECT clause of the SQL statement are used to associate the value of an *attribute_node* or a content of *text_node* with columns that have the same *name_attribute*. The FROM clause defines the tables containing the data; the WHERE clause specifies the *join* and search *condition*.

SQL mapping gives DB2® users the power to map the data using SQL. When using SQL mapping, you must be able to join all tables in one SELECT statement to form a query. If one SQL statement is not sufficient, consider using RDB_node mapping. To tie all tables together, the *primary key* and *foreign key* relationship is recommended among these tables.

RDB_node mapping

Defines the location of the content of an XML element or the value of an XML attribute so that XML Extender can determine where to store or retrieve the XML data.

This method uses XML Extender-provided *RDB_node*, which contains one or more node definitions for tables, optional columns, and optional conditions. The <table> and <column> elements in the DAD define how the XML data is to be stored in the database. The condition specifies the criteria for selecting XML data or the way to join the XML collection tables.

To define a mapping scheme, you must create a DAD file with an <Xcollection> element. Figure 12 on page 107 shows a fragment of a sample DAD file with SQL mapping for an XML collection, which composes a set of XML documents from data in three relational tables.

```
<?xml version="1.0"?>
<!DOCTYPE DAD SYSTEM "dxx_install/samples/db2xml/dtd/dad.dtd">
<DAD>
  <dtdid>dxx_install/samples/dad/getstart.dtd</dtdid>
  <validation>YES</validation>
  <Xcollection>
    <SQL_stmt>
       SELECT o.order_key, customer, p.part_key, quantity, price, tax, date,
              ship_id, mode, comment
         FROM order_tab o, part_tab p,
               table(select db2xml.generate_unique()
                as ship_id, date, mode, from ship_tab)
         WHERE p.price > 2500.00 and s.date > "1996-06-01" AND
              p.order_key = o.order_key and s.part_key = p.part_key
    </SQL_stmt>
    <prolog>?xml version="1.0"?</prolog>
    <doctype>!DOCTYPE DAD SYSTEM
    "dxx_install/samples/db2xml/dtd/getstart.dtd
     "</doctype>
    <root_node>
    <element_node name="Order">
    <attribute_node name="key">
   <column name="order_key"/>
    </attribute_node>
    <element_node name="Customer">
     <text_node>
      <column name="customer"/>
     </text_node>
    <element_node>

  ...

    </element_node><!-end Part->
    </element_node><!-end Order->
    </root_node>
  </Xcollection>
</DAD>
```

Figure 12. SQL mapping scheme

The XML Extender provides several stored procedures that manage data in an XML collection. These stored procedures support both types of mapping.

Related concepts:

- “DAD files for XML collections” on page 169
- “Requirements for using SQL mapping” on page 107
- “Requirements for RDB_Node mapping” on page 109

Related tasks:

- “Composing XML documents by using SQL mapping” on page 60
- “Composing XML collections by using RDB_node mapping” on page 63
- “Decomposing an XML collection by using RDB_node mapping” on page 65

Requirements for using SQL mapping

Requirements when using SQL mapping

In this mapping scheme, you must specify the <SQL_stmt> element inside the DAD <Xcollection> element. The <SQL_stmt> must contain a single SQL statement that can join multiple relational tables with the query *predicate*. In addition, the following clauses are required:

- **SELECT clause**
  - Ensure that the name of the column is unique. If two tables have the same column name, use the AS keyword to create an alias name for one of them.
  - Group columns of the same table together and order the tables according to the tree level as they map to the hierarchical structure of your XML document. The first column in each column grouping is an object ID. In the SELECT clause, the columns of the higher-level tables must precede the columns of lower-level tables. The following example demonstrates the hierarchical relationship among tables:

    ```
    SELECT o.order_key, customer, p.part_key, quantity, price, tax,
           ship_id, date, mode
    ```

    In this example, the `order_key` and `customer` columns from the ORDER_TAB table have the highest relational level because they are higher on the hierarchical tree of the XML document. The `ship_id`, `date`, and `mode` columns from the SHIP_TAB table are at the lowest relational level.
  - Use a single-column candidate key to begin each level. If such a key is not available in a table, the query should generate one for that table using a table expression and the generate_unique()user-defined function. In the above example, the `o.order_key` is the primary key for ORDER_TAB, and the `part_key` is the primary key of PART_TAB. They appear at the beginning of their own group of columns that are to be selected. The `ship_id` is generated as a primary key because the SHIP_TAB table does not have a primary key. `ship_id` is listed as the first column for the SHIP_TAB table group. Use the FROM clause to generate the primary key column, as shown in the following example.
- **FROM clause**
  - Use a table expression and the generate_unique()user-defined function to generate a single key for tables that do not have a primary single key. For example:

    ```
    FROM order_tab as o, part_tab as p,
            table(select
             db2xml.generate_unique() as
              ship_id, date, mode, part key from ship_tab) as s
    ```

    In this example, a single column candidate key is generated with the generate_unique() function and given an alias named `ship_id`.
  - Use an alias name when it is necessary to make a column distinct. For example, you could use `o` for columns in the ORDER_TAB table, `p` for columns in the PART_TAB table, and `s` for columns in the SHIP_TAB table.
- **WHERE clause**
  - Specify a primary and foreign key relationship as the join condition that ties tables in the collection together. For example:

    ```
    WHERE p.price > 2500.00 AND s.date > "1996-06-01" AND
          p.order_key = o.order_key AND s.part_key = p.part_key
    ```

  - Specify any other search condition in the predicate. Any valid predicate can be used.
- **ORDER BY clause**
  - Define the ORDER BY clause at the end of the SQL_stmt. Ensure that there is nothing after the column names such as ASC or DESC.
  - Ensure that the column names match the column names in the SELECT clause.
  - List all object ID's in the same relative order as they appear in the SELECT clause.
  - An identifier can be generated using a table expression and the generate_unique() function or a user defined function.
  - Maintain the top-down order of the hierarchy of the entities. The first column specified in the ORDER BY clause must be the first column listed for each entity. Keeping the order ensures that the XML documents to be generated do not contain incorrect duplicates.
  - Do not qualify the columns in the ORDER BY clause with a schema or table name.

The <SQL_stmt> element is powerful because you can specify any predicate in your WHERE clause, as long as the expression in the predicate uses the columns in the tables.

Related reference:
- Appendix A, "Samples," on page 293

Requirements for RDB_Node mapping

When using RDB_Node as your mapping method, do not use the <SQL_stmt>element in the <Xcollection> element of the DAD file. Instead, use the RDB_node element as a child of the top element_node and of each attribute_node and text_node.

- **RDB_node for the top element_node**

  The top element_node in the DAD file represents the root element of the XML document. Specify an RDB_node for the top element_node as follows:
  - Specify all tables that are associated with the XML collection. For example, the following mapping specifies three tables in the <RDB_node> of the<Order> element node, which is the top element node:

```
<element_node name="Order">
    <RDB_node>
        <table name="order_tab"/>
        <table name="part_tab"/>
        <table name="ship_tab"/>
        <condition>
           order_tab.order_key = part_tab.order_key AND
           part_tab.part_key = ship_tab.part_key
        </condition>
    </RDB_node>
```

    The condition element can be empty or missing if there is only one table in the collection.
  - Condition elements can reference a column name an unlimited number of times.

- If you are decomposing, or enabling, the XML collection specified by the DAD file, you must specify a primary key for each table. The primary key can consist of a single column or multiple columns, called a composite key. Specify the primary key by adding an *attribute key* to the table element of the RDB_node. When you supply a composite key, the *key* attribute will be specified by the names of key columns separated by a space. For example:

  ```
  <table name="part_tab" key="part_key price"/>
  ```

  The information specified for decomposition is ignored if the same DAD is used for composition.
- Use the orderBy attribute to recompose XML documents containing elements or attributes with multiple occurrence back to their original structure. This attribute allows you to specify the name of a column that will be the key used to preserve the order of the document. The orderBy attribute is part of the table element in the DAD file, and it is an optional attribute.

Spell out the table name and the column name in the <table>tag.

- **RDB_node for each attribute_node and text_node**

  The XML Extender needs to know from where in the database to retrieve the data. XML Extender also needs to know where in the database to put the content from an XML document. You must specify an RDB_node for each attribute node and text node. You must also specify the table and column names; the condition value is optional.

  1. Specify the name of the table containing the column data. The table name must be included in the RDB_node of the top element_node. In this example, for text_node of element <Price>, the table is specified as PART_TAB.

     ```
     <element_node name="Price">
         <text_node>
             <RDB_node>
                 <table name="part_tab"/>
                 <column name="price"/>
                 <condition>
                      price > 2500.00
                 </condition>
             </RDB_node>
         </text_node>
     </element_node>
     ```
  2. Specify the name of the column that contains the data for the element text. In the previous example, the column is specified as PRICE.
  3. Specify a query condition if you want XML documents to be generated using that condition. Only the data meeting the condition is in the generated XML documents. The condition must be a valid WHERE clause. In the example above, the condition is specified as `price > 2500.00`, so only rows where the price is over 2500 will be included in the XML documents.
  4. If you are decomposing a document, or enabling the XML collection specified by the DAD file, you must specify the column type for each attribute node and text node. By specifying the column type for each attribute node and text node, you ensure that he correct data type for each column when new tables are created during the enabling of an XML collection. Column types are specified by adding the attribute type to the column element. For example:

     ```
     <column name="order_key" type="integer"/>
     ```

     The column type specified when decomposing a document is ignored for composition.
- Maintain the top-down order of the hierarchy of the entities. Ensure that the element nodes are nested properly so that XML Extender understands the

relationship between the elements when composing or decomposing documents. For example, the following DAD file does not nest Shipment inside of Part:

```
      <element_node name="Part">
          ...
          <element_node name="ExtendedPrice">
                ...
          </element_node>
                ...
      </element_node> <!-- end of element Part -->

     <element_node name="Shipment" multi_occurrence="YES">
               <element_node name="ShipDate">
                   ...
               </element_node>
               <element_node name="ShipMode">
                   ...
               </element_node>

      </element_node> <!-- end of element Shipment-->
```

This DAD file produces an XML documents in which the Part and Shipment elements are siblings.

```
  <Part color="black ">
    <key>68</key>
    <Quantity>36</Quantity>
    <ExtendedPrice>34850.16</ExtendedPrice>
    <Tax>6.000000e-2</Tax>
  </Part>

  <Shipment>
      <ShipDate>1998-08-19</ShipDate>
      <ShipMode>BOAT  </ShipMode>
  </Shipment>
```

The following code shows the shipment element nested inside the Part element in the DAD file.

```
   <element_node name="Part">
       ...
       <element_node name="ExtendedPrice">
             ...
       </element_node>
       ...
      <element_node name="Shipment" multi_occurrence="YES">
            <element_node name="ShipDate">
                ...
            </element_node>
            <element_node name="ShipMode">
                ...
            </element_node>

       </element_node> <!-- end of element Shipment-->
   </element_node> <!-- end of element Part -->
```

Nesting the shipment element inside the part element produces an XML file with Shipment as a child element of the Part element:

```
  <Part color="black ">
    <key>68</key>
    <Quantity>36</Quantity>
    <ExtendedPrice>34850.16</ExtendedPrice>
    <Tax>6.000000e-2</Tax>
    <Shipment>
      <ShipDate>1998-08-19</ShipDate>
      <ShipMode>BOAT  </ShipMode>
    </Shipment>
  </Part>
```

There are no ordering restrictions on predicates of the root node condition.

With the RDB_node mapping approach, you don't need to supply SQL statements. However, putting complex query conditions in the RDB_node element can be more difficult.

For a subtree of the DAD with element_nodes and attribute_nodes that map to the same table, the following is true:

- Attribute nodes do not have to be the first children of the lowest common ancestor of the element nodes that map to the same table.
- Attribute nodes can appear anywhere in the subtree, as long as they are not involved in a join condition.

Restrictions: The limit for the number of tables allowed in a RDB_node mapping DAD is 30. The number of columns allowed per table is 500. The number of times each table or column can be specified in the join predicates of the condition statement is unlimited

Stylesheets for an XML collection

When composing documents, XML Extender also supports processing instructions for stylesheets, using the <stylesheet> element. The processing instructions must be inside the <Xcollection> root element, located with the <doctype> and <prolog> defined for the XML document structure. For example:

```
<?xml version="1.0"?>
<!DOCTYPE DAD SYSTEM "c:\dtd\dad.dtd">
<DAD>
<SQL_stmt>
        ...
</SQL_stmt>
<Xcollection>
...
<prolog>...</prolog>
<doctype>...</doctype>
<stylesheet>?xml-stylesheet type="text/css" href="order.css"?</stylesheet>
<root_node>...</root_node>
...

</Xcollection>
...
</DAD>
```

Location paths

A *location path* defines the location of an XML element or attribute within the structure of the XML document. The XML Extender uses the location path for the following purposes:

- To locate the elements and attributes to be extracted when using extraction UDFs such as dxxRetrieveXML.
- To specify the mapping between an XML element or attribute and a DB2® column when defining the indexing scheme in the DAD for XML columns
- For structural text search, using the Text Extender
- To override the XML collection DAD file values in a stored procedure.

Figure 13 shows an example of a location path and its relationship to the structure of the XML document.

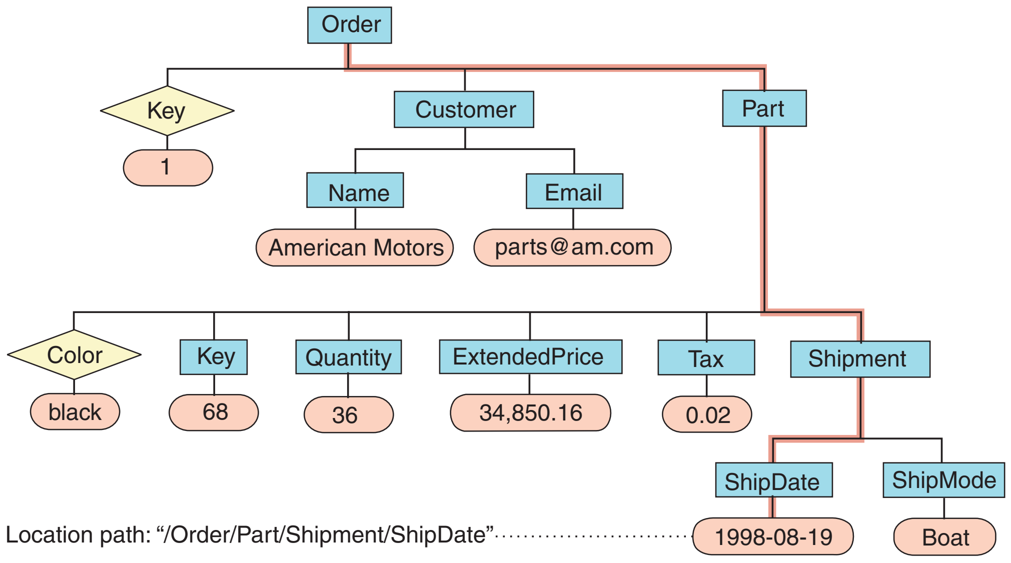

Figure 13. Storing documents as structured XML documents in a DB2 UDB table column

Related reference:

- "Location path syntax" on page 113

Location path syntax

XML Extender uses the location path to navigate the XML document structure. The following list describes the location path syntax that is supported by the XML Extender. A single slash (/) path indicates that the context is the whole document.

1. */*
Represents the XML root element. This the element that contains all the other elements in the document.

2. */tag1*
Represents the element *tag1* under the root element.

3. */tag1/tag2/..../tagn*
Represents an element with the name *tagn* as the child of the descending chain from root, *tag1*, *tag2*, through *tagn*-1.

4. *//tagn*
Represents any element with the name *tagn*, where double slashes (//) denote zero or more arbitrary tags.

5. */tag1//tagn*
Represents any element with the name *tagn*, a descendent of an element with the name *tag1* under root, where double slashes (//) denote zero or more arbitrary tags.

6. */tag1/tag2/@attr1*
Represents the attribute *attr1* of an element with the name *tag2*, which is a child of element *tag1* under root.

7. */tag1/tag2[@attr1="5"]*
Represents an element with the name *tag2* whose attribute *attr1* has the value 5. The*tag2* is a child of the *tag1*element under root.

8. */tag1/tag2[@attr1="5"]/.../tagn*
Represents an element with the name *tagn*, which is a child of the descending chain from root, *tag1*, *tag2*, through *tagn*-1, where the attribute *attr1* of *tag2* has the value 5.

Simple location path

Simple location path is a type of location path used in the XML column DAD file. A simple location path is represented as a sequence of element-type names that are connected by a single slash (/). The values of each attribute are enclosed within square brackets following the element type. Table 15 summarizes the syntax for simple location path.

Table 15. Simple location path syntax

Subject	Location path	Description
XML element	*/tag1/tag2/..../tagn-1/tagn*	An element content identified by the element named *tagn* and its parents
XML attribute	*/tag_1/tag_2/..../tag_n-1/tag_n/@attr1*	An attribute named*attr1* of the element identified by *tagn* and its parents

Location path usage

The syntax of the location path is dependent on the context in which you are accessing the location of an element or attribute. Because the XML Extender uses one-to-one mapping between an element or attribute, and a DB2 column, it restricts the syntax rules for the DAD file and functions. Table 16 describes in which contexts the syntax options are used.

Table 16. The XML Extender's restrictions using location path

Use of the location path	Location path supported
Value of path attribute in the XML column DAD mapping for side tables	3, 6 (simple location path described in Table 15)
Extracting UDFs	1-8[1]
Update UDF	1-8[1]
Text Extender's search UDF	3 – Exception: the root mark is specified without the slash. For example: `tag1/tag2/..../tagn`

[1] The extracting and updating UDFs support location paths that have predicates with attributes, but not elements.

Related concepts:
- "Location paths" on page 112

Enabling XML collections

Enabling an XML collection parses the DAD file to identify the tables and columns related to the XML document, and records control information in the XML_USAGE table. Enabling an XML collection is optional for:
- Decomposing an XML document and storing the data in new DB2 UDB tables
- Composing an XML document from existing data in multiple DB2 UDB tables

If the same DAD file is used for composing and decomposing, you can enable the collection for both composition and decomposition.

You can enable an XML collection with the XML Extender Administration wizard, with the **dxxadm** command with the enable_collection option, or with the XML Extender stored procedure dxxEnableCollection().

Using the Administration wizard:

To enable an XML collection using the wizard:
1. Set up and start the Administration wizard.
2. Click **Work with XML Collections** from the Launchpad window. The Select a Task window opens.
3. Click **Enable a Collection** and then **Next**. The Enable a Collection window opens.
4. Select the name of the collection that you want to enable in the **Collection name** field.
5. Specify the DAD file name in the **DAD file name** field.
6. Optional: Type the name of a previously created table space in the **Table space** field.

   The table space will contain new DB2 UDB tables generated for decomposition.
7. Click **Finish** to enable the collection and return to the Launchpad window.
   - If the collection is successfully enabled, an `Enabled collection is successful` message is displayed.
   - If the collection is not successfully enabled, an error message is displayed. Repeat the steps above until the collection is successfully enabled.

Enabling collections using the dxxadm command:

To enable an XML collection, enter the **dxxadm** command from a DB2 UDB command line:

Syntax:

```
►►──enable_collection──-a──subsystem_name──collection──DAD_file──────────────►

►──┬──────────────────┬────────────────────────────────────────────────────►◄
   └─-t──tablespace─┘
```

Parameters:

-a *subsystem_name*
: The name of the DB2 UDB subsystem.

collection
: The name of the XML collection. This value is used as a parameter for the XML collection stored procedures.

DAD_file
: The name of the file that contains the document access definition (DAD).

tablespace
: An existing table space that contains new DB2 UDB tables that were generated for decomposition. If not specified, the default table space is used.

Example: The following example enables a collection called sales_ord using the command line. The DAD file uses SQL mapping.

```
dxxadm enable_collection -a SUBSYS1 ORDRPSC SALES_ORD
     'dxx/samples/dad/getstart_xcollection.dad'
```

After you enable the XML collection, you can compose or decompose XML documents using the XML Extender stored procedures.

Related concepts:

- "XML collections as a storage and access method" on page 91

Related tasks:

- "Disabling XML collections" on page 116
- "Managing data in XML collections" on page 92

Disabling XML collections

Disabling an XML collection removes the record in the XML_USAGE table that identifies tables and columns as part of a collection. It does not drop any data tables. You disable a collection when you want to update the DAD and need to re-enable a collection, or when you want to drop a collection.

You can disable an XML collection with the XML Extender Administration wizard, with the **dxxadm** command with the disable_collection option, or with the XML Extender stored procedure dxxDisableCollection().

Procedure:

To disable an XML collection using the Administration wizard:

1. Start the Administration wizard.
2. Click **Work with XML Collections** from the Launchpad window to view the XML Extender collection related tasks. The Select a Task window opens.
3. Click **Disable an XML Collection** and then **Next** to disable an XML collection. The Disable a Collection window opens.
4. Type the name of the collection that you want to disable in the **Collection name** field.
5. Click **Finish** to disable the collection and return to the Launchpad window.
   - If the collection is successfully disabled, `Disabled collection is successful message` is displayed.
   - If the collection is not successfully disabled, an error box is displayed. Repeat the steps above until the collection is successfully disabled.

To disable an XML collection from the command line, enter the **dxxadm** command.

Syntax:

```
►►──dxxadm──disable_collection──-a──subsystem_name──collection──────────────────►◄
```

Parameters:

- a *subsystem_name*
  The name of the DB2 subsystem.

collection
The name of the XML collection. This value is used as a parameter for the XML collection stored procedures.

Example:

```
dxxadm disable_collection -a SUBSYS1 SALES_ORD
```

Related concepts:

- "XML collections as a storage and access method" on page 91
- "XML Extender administration stored procedures" on page 195

Related tasks:

- "Managing data in XML collections" on page 92

Chapter 5. XML schemas

The XML schema can be used in place of a DTD to define the specifications for the content of XML documents. The XML schema uses XML format or SML syntax to define the elements and attribute names of an XML document, and defines the type of content that the elements and attributes are allowed to contain.

Advantages of using XML schemas instead of DTDs

DTDs are easier to code and validate than an XML schema. However, the advantages to using an XML schema are shown in the following list:

- XML schemas are valid XML documents that can be processed by tools such as the XSD Editor in WebSphere® Studio Application Developer, XML Spy, or XML Authority.
- XML schemas are more powerful than DTDs. Everything that can be defined by the DTD can also be defined by schemas, but not vice versa.
- XML schemas support a set of data types, similar to the ones used in most common programming languages, and provide the ability to create additional types. You can constrain the document content to the appropriate type. For example, you can replicate the properties of fields found in DB2.
- XML schemas support regular expressions to set constraints on character data, which is not possible if you use a DTD.
- XML schemas provide better support for XML namespaces, which enable you to validate documents that use multiple namespaces, and to reuse constructs from schemas already defined in different namespaces.
- XML schemas provide better support for modularity and reuse with include and import elements.
- XML schemas support inheritance for element, attribute, and data type definitions.

Related tasks:

- "Data types, elements and attributes in schemas" on page 121

Related reference:

- "Examples of an XML schema" on page 122

UDTs and UDF names for XML Extender

The full name of a DB2® function is *schema-name.function-name*, where *schema-name* is an identifier that provides a logical grouping for a set of SQL objects. The schema name for XML Extender UDFs and UDTs is DB2XML. In the documentation, references are made only to the function name.

You can specify UDTs and UDFs without the schema name if you add the schema name to the function path. The function path is an ordered list of schema names. DB2 UDB uses the order of schema names in the list to resolve references to functions and UDTs. You can specify the function path by specifying the SQL statement SET CURRENT FUNCTION PATH. This statement sets the function path in the CURRENT FUNCTION PATH special register.

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Recommendation: Add the DB2XML schema name to the function path. By adding this schema name, you can enter XML Extender UDF and UDT names without having to qualify them with DB2XML. The following example shows how to add the DB2XML schema to the function path:

```
SET CURRENT FUNCTION PATH = DB2XML, CURRENT FUNCTION PATH
```

Restriction: Do not add DB2XML as the first schema in the function path if you log on with a user ID of DB2XML. DB2XML is automatically set as the first schema when you log on as DB2XML. If you add DB2XML as the first schema in the function path, you will receive an error condition because the function path will start with two DB2XML schemas.

XML schema complexType element

The XML schema element complexType is used to define an element type that can consist of sub-elements. For example, the following tags show the projection of an address in an XML document:

```
<billTo country="US">
    <name>Dan Jones</name>
    <street>My Street</street>
    <city>My Town</city>
    <state>CA</state>
    <zip>99999</zip>
</billTo>
```

The structure of this element can be defined in the XML schema as follows:

```
1 <xsd:element name="billTo" type="USAddress"/>
2 < xsd:complexType name="USAddress">
 3  <xsd:sequence>
 4   < xsd:element name="name" type="xsd:string"/>
 5   < xsd:element name="street" type="xsd:string"/>
 6   < xsd:element name="city" type="xsd:string"/>
 7   < xsd:element name="state" type="xsd:string"/>
 8   < xsd:element name="zip" type="xsd:decimal"/>
 9  </xsd:sequence>
 10  < xsd:attribute name="country"
                        type="xsd:NMTOKEN" use="fixed"
                        value="US"/>
 12</xsd:complexType>
```

In the above example, it is assumed that the `xsd` prefix has been bound to the XML schema namespace. Lines 2 through 5 define the complexType USAddress as a sequence of five elements and one attribute. The order of the elements is determined by the order in which they appear in the sequence tag.

The inner elements are from data type xsd:string or xsd:decimal. Both are predefined simple data types.

Alternatively, you can use the all tag or the choice tag instead of the sequence tag. With the all tag, all sub-elements must appear, but do not need to appear in any particular order. With the choice tag, exactly one of the sub-elements must appear in the XML document

You can also use a user-defined data type to define other elements.

Data types, elements and attributes in schemas

Simple data types in XML schemas

XML schemas provide a set of simple built-in data types. You can derive other data types from them by applying constraints.

In Example 1, the range of base type xsd:positiveInteger is limited to 0 to 100.

Example 1

```
< xsd:element name="quantity">
   < xsd:simpleType>
    < xsd:restriction base="xsd:positiveInteger">
     < xsd:maxExclusive value="100"/>
    </xsd:restriction>
   </xsd:simpleType>
  </xsd:element>
```

In Example 2, the base type xsd:string is limited by a regular expression.

Example 2

```
<xsd:simpleType name="SKU">
   < xsd:restriction base="xsd:string">
    < xsd:pattern value="\d{3}-[A-Z]{2}"/>
   </xsd:restriction>
  </xsd:simpleType>
```

Example 3 shows an enumerated type based on the string built-in type.

Example 3

```
<xsd:simpleType name="SchoolClass">
   < xsd:restriction base="xsd:string">
    < xsd:enumeration value="WI"/>
    < xsd:enumeration value="MI"/>
    < xsd:enumeration value="II"/>
    < xsd:enumeration value="DI"/>
    < xsd:enumeration value="AI"/>
   </xsd:restriction>
  </xsd:simpleType>
```

Elements in XML schemas

To declare an element in an XML schema you must indicate the name and type as an attribute of the element element. For example:

```
<xsd:element name="street" type="xsd:string"/>
```

Additionally, you can use the attributes minOccurs and maxOccurs to determine the maximum or minimum number of times that the element must appear in the XML document. The default value of minOccurs and maxOccurs is 1.

Attributes in XML schemas

Attribute declarations appear at the end of an element definition. For example:

```
<xsd:complexType name="PurchaseOrderType">
< xsd:sequence>
  < xsd:element name="billTo" type="USAddress"/>
< xsd:sequence>
  < xsd:attribute name="orderDate" type="xsd:date"/>
 </xsd:complexType>
```

Related concepts:

- “Advantages of using XML schemas instead of DTDs” on page 119

Related tasks:

- "Validation functions" on page 163

Related reference:

- "Examples of an XML schema" on page 122
- "XML schema complexType element" on page 120

Examples of an XML schema

It is a good strategy to write XML schemas by first designing the data structure of your XML document using a UML tool. After you design the structure, you can map the structure into your schema document. The following example shows an XML schema.

```
 1 <?xml version="1.0" encoding="UTF-8"?>
 2 <xs:schema xmlns:xs='http://www.w3.org/2001/XMLSchema'>
 3
 4   <xs:element name="personnel">
 5    <xs:complexType>
 6     <xs:sequence>
 7       <xs:element ref="person" minOccurs='1' maxOccurs='unbounded'/>
 8    </xs:sequence>
 9   </xs:complexType>
10  </xs:element>
11
12   <xs:element name="person">
13    <xs:complexType>
14     <xs:sequence>
15       <xs:element ref="name"/>
16       <xs:element ref="email" minOccurs='0' maxOccurs='4'/>
17    </xs:sequence>
18     <xs:attribute name="id"  type="xs:ID" use='required'/>
19   </xs:complexType>
20  </xs:element>
21
22   <xs:element name="name">
23    <xs:complexType>
24     <xs:sequence>
25      <xs:element ref="family"/>
26      <xs:element ref="given"/>
27    </xs:sequence>
28   </xs:complexType>
29  </xs:element>
30
31   <xs:element name="family" type='xs:string'/>
32   <xs:element name="given" type='xs:string'/>
33   <xs:element name="email" type='xs:string'/>
34 </xs:schema>
```

The first two lines declare that this XML schema is XML 1.0 compatible and Unicode 8 decoded, and specify use of the XML schema standard namespace, which enables access to basic XML schema data types and structures.

Lines 4 to 10 define the personnel as a complexType that consists of a sequence of 1 to n persons. The complexType is then defined in lines 12 to 20. It consists of the complexType element name and the element email. The email element is optional (minOcccurs = '0'), and can appear up to four times (maxOccurs = '4'). The greater the number of occurrences of an element, the longer it will take to validate the schema. In contrast, in a DTD you can choose only 0, 1, or unlimited appearances of an element.

Lines 22 to 29 define the name type that is used for the person type. The name type consists of a sequence of a family and a given element.

Lines 31 to 33 define the single elements *family, given,* and *e-mail*, which contain type strings that have been declared.

XML document instance using the schema

The following example is an XML document that is an instance of the *personalnr.xsd* schema.

```
1 <?xml version="1.0" encoding="UTF-8"?>
2 <personnel xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
3     xsi:noNamespaceSchemaLocation='personsnr.xsd'>
4
5   <person id="Big.Boss" >
6      <name><family>Boss</family><given>Big</given></name>
7     <email>chief@foo.com</email>
8   </person>
9
10   <person id="one.worker">
11   <name><family>Worker</family><given>One</given></name>
12      <email>one@foo.com</email>
13   </person>
14
15    <person id="two.worker">
16   <name><family>Worker</family><given>Two</given></name>
17      <email>two@foo.com</email>
18   </person>
19 </personnel>
```

XML document instance using a DTD

This example shows how this XML schema would be realized as a DTD.

```
<?xml version="1.0" encoding="UTF-8"?>
<!ELEMENT email (#PCDATA)>
<!ELEMENT family (#PCDATA)>
<!ELEMENT given (#PCDATA)>
<!ELEMENT name (family, given)>
<!ELEMENT person (name, email*)>

<!ATTLIST person
id ID #REQUIRED>
<!ELEMENT personnel (person+)>
```

Using a DTD you can set the maximum occurrence of email to only 1 or unlimited occurrences.

Using this DTD, the XML document instance would be the same as shown in the top example, except line 2 would be changed to:

```
<!DOCTYPE personnel SYSTEM "personsnr.dtd">
```

Related concepts:

- “Advantages of using XML schemas instead of DTDs” on page 119

Related tasks:

- “Data types, elements and attributes in schemas” on page 121
- “Validation functions” on page 163

Related reference:

- “XML schema complexType element” on page 120

Part 4. Reference

This part provides syntax information for the XML Extender administration command, user-defined data types (UDTs), user-defined functions (UDFs), and stored procedures. Message text is also provided for problem determination activities.

Chapter 6. The dxxadm administration command

dxxadm command overview

You perform the following XML Extender administration tasks by calling **dxxadm** using various subcommands:

Related concepts:

- "Administration tools for XML Extender" on page 37
- "XML Extender administration planning" on page 38

Syntax of the dxxadm administration command

```
►►── dxxadm──'──-a──subsystem name──┬─enable_server──parameters───────┬─'────────►◄
                                     ├─disable_server──────────────────┤
                                     ├─enable_column──parameters───────┤
                                     ├─disable_column──parameters──────┤
                                     ├─enable_collection──parameters───┤
                                     └─disable_collection──parameters──┘
```

Parameters:

Table 17. dxxadm parameters

Parameter	Description
subsystem name	The name of the DB2 UDB subsystem to which the application attaches.
enable_server	Enables XML Extender features for a server.
disable_server	Disables XML Extender features for a server.
enable_column	Enables an XML column so that it can contain the XML Extender UDTs.
disable_column	Disables the XML-enabled column.
enable_collection	Enables an XML collection according to the specified DAD.
enable_collection	Disables an XML-enabled collection.

Subcommands of the administration command

The following **dxxadm** subcommands are available to system programmers:

- enable_column
- enable_collection
- enable_server
- disable_column
- disable_collection
- disable_server

enable_server option of the dxxadm command

Purpose:

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Enables XML Extender features for a server. When the server is enabled, the XML Extender creates the following objects:

- The XML Extender user-defined types (UDTs).
- The XML Extender user-defined functions (UDFs).
- The XML Extender stored procedures
- The XML Extender DTD repository table, DTD_REF, which stores DTDs and information about each DTD.
- The XML Extender usage table, XML_USAGE, which stores common information for each column that is enabled for XML and for each collection.

Syntax:

```
►►──dxxadm──enable_server───-a──subsystem_name──┬─────────────────────────────┬──────────►
                                                └─security──security_level─┘

►─WLM environment──WLM_name1──┬───────────────┬──────────────────────────────────────►◄
                              └─, WLM_name2─┘
```

Parameters:

Table 18. enable_server parameters

Parameter	Description
subsystem_name	The name of the DB2 subsystem.
security_level	Determines the user ID that is authorized to access external resources when running stored procedures. Choices are DB2, USER, DEFINER. DB2 UDB is the default.
WLM name	The names of the WLM environments. At least one name is required. If one is specified, the name is for all stored procedures and UDFs. If two are specified, the first name is for the stored procedures, the second name is for the UDFs.

The following table describes the tablespaces that will be created while enabling the server:

Table 19. enable_server tablespaces

Tablespace	Description
DXXDTDRF	The tablespace name in which the **DTD_REF** table is stored.
DXXXMLUS	The tablespace name in which the **XML_USAGE** table is stored.
DXXDTDL1	The tablespace name in which the CLOB column **CONTENT** of the **DTD_REF** table is stored.
DXXDTDL2	The tablespace name in which the CLOB column **DAD** of the **XML_USAGE** table is stored.

You can create any or all of the above tablespaces before enabling the server. If you do not create the tablespaces before enabling the server, the following commands will be executed to create the tablespaces when the **enable_server** command is run:

```
CREATE TABLESPACE DXXDTDRF USING STOGROUP SYSDEFLT
PRIQTY 288 SECQTY 48 IN DB2XML

CREATE TABLESPACE DXXXMLUS USING STOGROUP SYSDEFLT
PRIQTY 288 SECQTY 48 IN DB2XML

CREATE LOB TABLESPACE DXXDTDL1 LOG NO USING STOGROUP SYSDEFLT
PRIQTY 1920 SECQTY 480 IN DB2XML

CREATE LOB TABLESPACE DXXDTDL2 LOG NO USING STOGROUP SYSDEFLT
PRIQTY 1920 SECQTY 480 IN DB2XML
```

Examples:

The following example enables the database server for XML Extender using the SUBSY1 subsystem and the WML environment ENVIR233:

```
dxxadm 'enable_server -a SUBSYS1 wlm environment envir233'
```

Related reference:

- "dxxadm command overview" on page 127

disable_server option of the dxxadm command

Purpose:

Disables XML Extender features for a database server, called "disabling a database". When the database server is disabled, it can no longer be used by the XML Extender. When the XML Extender disables the database server, it drops the following objects:

- The XML Extender user-defined types (UDTs).
- The XML Extender user-defined functions (UDFs).
- The XML Extender DTD repository table, DTD_REF, which stores DTDs and information about each DTD.
- The XML Extender usage table, XML_USAGE, which stores common information for each column that is enabled for XML and for each collection.

Important: You must disable all XML columns before attempting to disable a database server. The XML Extender cannot disable a database server that contains columns or collections that are enabled for XML.

Syntax:

```
►►──disable_server──-a──subsystem_name──────────────────────────────────►◄
```

Parameters:

Table 20. disable_server parameters

Parameter	Description
-a *subsystem_name*	The name of the DB2 UDB subsystem.

Examples:
The following example disables the database server:

```
dxxadm disable_server -a SUBSYS1
```

Related concepts:

- "XML Extender administration stored procedures" on page 195

Related reference:

- “How to read syntax diagrams” on page x

enable_column option of the dxxadm command

Purpose:

Connects to a database server and enables an XML column so that it can contain the XML Extender UDTs. When enabling a column, the XML Extender completes the following tasks:

- Determines whether the XML table has a primary key; if not, the XML Extender alters the XML table and adds a column called DXXROOT_ID.
- Creates side tables that are specified in the DAD file with a column containing a unique identifier for each row in the XML table. This column is either the root ID that the user specified or the DXXROOT_ID that was named by the XML Extender.
- Creates a default view for the XML table and its side tables, optionally using a name you specify.

Syntax:

```
►►──dxxadm──enable_column──-a──subsystem_name──tab_name──column_name──DAD_file──────►

►──┬───────────────┬──┬─────────────────┬──┬────────────┬──┬──────────┬──────────────►
   └─-t─tablespace─┘  └─-v─default_view─┘  └─-r─root_id─┘  └─-l─login─┘

►──┬──────────────┬─────────────────────────────────────────────────────────────────►◄
   └─-p─password──┘
```

Parameters:

Table 21. enable_column parameters

Parameter	Description
-a *subsystem_name*	The name of the DB2 UDB subsystem.
tab_name	The name of the table in which the XML column resides.
column_name	The name of the XML column.
DAD_file	The name of the DAD file that maps the XML document to the XML column and side tables.
-t *tablespace*	The table space that contains the side tables associated with the XML column. If not specified, the default table space is used.
-v *default_view*	The name of the default view that joins the XML column and side tables.
-r *root_id*	The name of the primary key in the XML column table that is to be used as the root_id for side tables. The root_id is optional.
-l *login*	The user ID, used to connect to the database. If not specified, the current user ID is used.
-p *password*	The password used to connect to the database. If not specified, the current password is used.

Examples:
The following example enables an XML column.

```
dxxadm enable_column -a SUBSYS1 SALES_TAB ORDER getstart.dad -v SALODVW -r INVOICE_NUMBER
```

disable_column option of the dxxadm command

Purpose:

Connects to a database and disables the XML-enabled column. When the column is disabled, it can no longer contain XML data types. When an XML-enabled column is disabled, the following actions are performed:

- The XML column usage entry is deleted from the XML_USAGE table.
- The USAGE_COUNT is decremented in the DTD_REF table.
- All triggers that are associated with this column are dropped.
- All side tables that are associated with this column are dropped.

Important: You must disable an XML column before dropping an XML table. If an XML table is dropped but its XML column is not disabled, the XML Extender keeps both the side tables it created and the XML column entry in the XML_USAGE table.

Syntax:

```
►►──dxxadm──disable_column──-a──subsystem_name──tab_name──column_name──────────►

►─┬──────────┬──┬──────────────┬──────────────────────────────────────────────►◄
  └─-l──login─┘  └─-p──password─┘
```

Parameters:

Table 22. disable_column parameters

Parameter	Description
-a *subsystem_name*	The name of the DB2 UDB subsystem.
tab_name	The name of the table in which the XML column resides.
column_name	The name of the XML column.
-l *login*	The user ID used to connect to the database. If not specified, the current user ID is used.
-p *password*	The password used to connect to the database. If not specified, the current password is used.

Examples:
The following example disables an XML-enabled column.

```
dxxadm disable_column -a SUBSYS1 SALES_TAB ORDER
```

Related concepts:

- "XML columns as a storage and access method" on page 73
- "XML Extender administration stored procedures" on page 195

Related tasks:

- "Calling XML Extender composition stored procedures" on page 201

Related reference:

- "How to read syntax diagrams" on page x

enable_collection option of the dxxadm command

Purpose:

Connects to a database server and enables an XML collection according to the specified DAD. When enabling a collection, the XML Extender does the following tasks:

- Creates an XML collection usage entry in the XML_USAGE table.
- For RDB_node mapping, creates collection tables specified in the DAD if the tables do not exist in the database.

Syntax:

```
►►──enable_collection──-a──subsystem_name──collection_name──DAD_file──────────►

►──┬────────────────┬─────────────────────────────────────────────────────────►◄
   └─-t──tablespace─┘
```

Parameters:

Table 23. enable_collection parameters

Parameter	Description
-a *subsystem_name*	The name of the DB2 UDB subsystem.
-t *tablespace*	The name of the table space associated with the collection. If not specified, the default table space is used.
collection_name	The name of the XML collection.
DAD_file	The name of the DAD file that maps the XML document to the relational tables in the collection.

Example::
The following example enables an XML collection named SALES_ORD with the GETSTART_XCOLLECTION.DAD:

```
dxxadm enable_collection -a SUBSYS1 using ORDRPSC SALES_ORD
     'ORDPRJ.WORK.DAD(GETSTART_XCOLLECTION)'
```

Related reference:

- "dxxadm command overview" on page 127

disable_collection option

Purpose:

Disables an XML-enabled collection. The collection name can no longer be used in the composition (dxxRetrieveXML) and decomposition (dxxInsertXML) stored procedures. When an XML collection is disabled, the associated collection entry is deleted from the XML_USAGE table. Note that disabling the collection does not drop the collection tables that are created when you use the enable_collection option.

Syntax:

```
►►──dxxadm──disable_collection──-a──subsystem_name──collection_name──────────────►◄
```

Parameters:

Table 24. disable_collection parameters

Parameter	Description
-a *subsystem_name*	The name of the DB2 UDB subsystem.
collection_name	The name of the XML collection.

Examples:
The following example disables an XML collection named SALES_ORD.

```
dxxadm disable_collection -a SUBSYS1 SALES_ORD
```

Chapter 7. XML Extender user-defined types

User-defined types (UDTs) are data types created by a DB2® application or tool. The XML Extender creates the following user-defined types for use with XML columns:

- XMLVARCHAR
- XMLCLOB
- XMLFILE

The data types are used to define the column in the application table that will be used to store the XML document. You can also store XML documents as files on the file system, by specifying a file name.

All XML Extender's user-defined types have the qualifier **DB2XML**, which is the *schema name* of the DB2 UDB XML Extender user-defined types. For example:

```
db2xml.XMLVarchar
```

The XML Extender creates UDTs for storing and retrieving XML documents. Table 25 describes the UDTs.

Table 25. The XML Extender UDTs

User-defined type column	Source data type	Usage description
XMLVARCHAR	VARCHAR(*varchar_len*)	Stores an entire XML document as VARCHAR inside DB2.
XMLCLOB	CLOB(*clob_len*)	Stores an entire XML document as a character large object (CLOB) inside DB2.
XMLFILE	VARCHAR(512)	Specifies the file name of the local file server. If XMLFILE is specified for the XML column, then the XML Extender stores the XML document in an external server file. The Text Extender cannot be enabled with XMLFILE. You must ensure integrity between the file content, DB2, and the side table created for indexing.

Where *varchar_len* and *clob_len* are specific to the operating system.

For XML Extender on DB2 UDB, *varchar_len* = 3K and *clob_len* = 2G.

| To change the size of an XMLVARCHAR or XMLCLOB UDT, create the UDT before
| you enable the database for XML Extender.

Procedure:

| To change the size of an XMLVARCHAR or XMLCLOB UDT of an enabled
| database:

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1. Back up all data in the XML Extender-enabled database.
2. Drop all XML collection tables or XML column side tables.
3. Disable the database with the `dxxadm disable_server`command.
4. Create the XMLVARCHAR or XMLCLOB user-defined type.
5. Enable the database with the `dxxadm enable_server`command.
6. Re-create and reload the tables.

These UDTs are used only to specify the types of application columns; they do not apply to the side tables that the XML Extender creates.

Related concepts:

- "XML columns as a storage and access method" on page 73
- "XML collections as a storage and access method" on page 91
- "Preparing to administer XML Extender" on page 37
- "Mapping schemes for XML collections" on page 105

Chapter 8. XML Extender user-defined functions

A user–defined function (UDF) is a function that is defined to the database management system and can be referenced in SQL statements. This chapter describes user-defined functions that are used by DB2 UDB XML Extender.

Types of XML Extender user-defined functions

The XML Extender provides functions for storing, retrieving, searching, and updating XML documents, and for extracting XML elements or attributes. You use XML user-defined functions (UDFs) for XML columns, but not for XML collections.

All the UDFs have the schema name DB2XML.

The types of XML Extender functions are described in the following list:

storage functions
Storage functions insert intact XML documents in XML-enabled columns as XML data types.

retrieval functions
Retrieval functions retrieve XML documents from XML columns in a DB2® database.

extracting functions
Extracting functions extract and convert the element content or attribute value from an XML document to the data type that is specified by the function name. The XML Extender provides a set of extracting functions for various SQL data types.

update function
The Update function modifies an entire XML document or specified element content or attribute values and returns a copy of an XML document with an updated value, which is specified by the location path.

generate_unique function
The generate_unique function returns a unique key.

Validation functions
Validation functions validate XML documents against either an XML schema or a DTD.

The XML user-defined functions allow you to perform searches on general SQL data types. Additionally, you can use the DB2 UDB Text Extender for OS/390® with XML Extender to perform structural and *full text searches* on text in XML documents. This search capability can be used, for example, to improve the usability of a Web site that publishes large amounts of readable text, such as newspaper articles or *Electronic Data Interchange (EDI)* applications, which have frequently searchable elements or attributes.

Restriction: When using parameter markers in UDFs, a Java™ database (JDBC) restriction requires that the parameter marker for the UDF must be cast to the data type of the column into which the returned data will be inserted.

Storage functions

Storage functions in XML Extender overview

Use storage functions to insert XML documents into a DB2 UDB database. You can use the default casting functions of a UDT directly in INSERT or SELECT statements. Additionally, XML Extender provides UDFs to take XML documents from sources other than the UDT base data type and convert them to the specified UDT.

XMLCLOBFromFile() function

Purpose:

Reads an XML document from a server file and returns the document as an XMLCLOB type.

Syntax:

```
►►──XMLCLOBFromFile──(──fileName──,──┬──────────────────┬──────────────────────►◄
                                     └─src_encoding──)──┘
```

Parameters:

Table 26. XMLCLOBFromFile parameter

Parameter	Data type	Description
fileName	VARCHAR(512)	The fully qualified server file name.
src_encoding	VARCHAR(100)	The encoding of the source file.

Results:
XMLCLOB as LOCATOR
Example:
The following example reads an XML document from a file on a server and inserts it into an XML column as an XMLCLOB type. The encoding of the server file is explicitly specified as iso-8859-1.

```
EXEC SQL INSERT INTO sales_tab(ID, NAME, ORDER)
   VALUES('1234', 'Sriram Srinivasan',
           XMLCLOBFromFile('dxx_install/samples/db2xml
           /xml/getstart.xml
           ', 'iso-8859-1'))
```

where *dxx_install* is the directory where XML Extender is installed.

The column ORDER in the SALES_TAB table is defined as an XMLCLOB type.

XMLFileFromCLOB() function

Purpose:

Reads an XML document as CLOB locator, writes it to an external server file, and returns the file name and path as an XMLFILE type.

Syntax:

```
►►—XMLFileFromCLOB—(—buffer—,—fileName—,——————————————————————►◄
                                        └─targetencoding—)─┘
```

Parameters:

Table 27. XMLFileFromCLOB() parameters

Parameters	Data type	Description
buffer	CLOB as LOCATOR	The buffer containing the XML document.
fileName	VARCHAR(512)	The fully qualified server file name.
targetencoding	VARCHAR(100)	The encoding of the output file.

Results:

XMLFILE

Example:

The following example reads an XML document as CLOB locator (a host variable with a value that represents a single LOB value in the database server), writes it to an external server file, and inserts the file name and path as an XMLFILE type in an XML column. The function will encode the output file in ibm-808.

```
EXEC SQL BEGIN DECLARE SECTION;
     SQL TYPE IS CLOB_LOCATOR xml_buff;
EXEC SQL END DECLARE SECTION;

EXEC SQL INSERT INTO sales_tab(ID, NAME, ORDER)
   VALUES('1234', 'Sriram Srinivasan',
          XMLFileFromCLOB(:xml_buf, 'dxx_install/samples/db2xml
          /xml/getstart.xml', 'ibm-808'))
```

where *dxx_install* is the directory where XML Extender is installed.

The column ORDER in the SALES_TAB table is defined as an XMLFILE type. If you have an XML document in your buffer, you can store it in a server file.

XMLFileFromVarchar() function

Purpose:

Reads an XML document from memory as VARCHAR, writes it to an external server file, and returns the file name and path as an XMLFILE type.

Syntax:

```
►►—XMLFileFromVarchar—(—buffer—,—fileName—,———————————————————)——————►◄
                                           └─targetencoding─┘
```

Parameters:

Table 28. XMLFileFromVarchar parameters

Parameter	Data type	Description
buffer	VARCHAR(3K)	The buffer containing the XML document.

Table 28. XMLFileFromVarchar parameters (continued)

Parameter	Data type	Description
fileName	VARCHAR(512)	The fully qualified server file name.
targetencoding	VARCHAR(100)	The encoding of the output file.

Results:

XMLFILE

Example:

The following examples reads an XML document from memory as VARCHAR, writes it to an external server file, and inserts the file name and path as an XMLFILE type in an XML column. The function will encode the output file in iso-8859-1.

```
EXEC SQL BEGIN DECLARE SECTION;
      struct { short len; char data[3000]; } xml_buff;
EXEC SQL END DECLARE SECTION;

EXEC SQL INSERT INTO sales_tab(ID, NAME, ORDER)
  VALUES('1234', 'Sriram Srinivasan',
        XMLFileFromVarchar(:xml_buf, 'dxx_install/samples/db2xml
           /xml/getstart.xml', 'iso-8859-1'))
```

where *dxx_install* is the directory where XML Extender is installed.

The column ORDER in the SALES_TAB table is defined as an XMLFILE type.

XMLVarcharFromFile() function

Purpose:

Reads an XML document from a server file and returns the document as an XMLVARCHAR type.

Syntax:

```
>>──XMLVarcharFromFile──(──fileName──,──┬────────────────────┬──────────────────><
                                        └─src_encoding──)─┘
```

Parameters:

Table 29. XMLVarcharFromFile parameter

Parameter	Data type	Description
fileName	VARCHAR(512)	The fully qualified server file name.
src_encoding	VARCHAR(100)	The encoding of the source file.

Results:

XMLVARCHAR

Example:

The following example reads an XML document from a server file and inserts it into an XML column as an XMLVARCHAR type. The encoding of the server file is explicitly specified as ibm-808.

```
EXEC SQL INSERT INTO sales_tab(ID, NAME, ORDER)
   VALUES('1234', 'Sriram Srinivasan',
           XMLVarcharFromFile('dxx_install/samples/db2xml
           /xml/getstart.xml', 'ibm-808'))
```

where *dxx_install* is the directory where XML Extender is installed.

In this example, a record is inserted into the SALES_TAB table. The function XMLVarcharFromFile() imports the XML document from a file that is explicitly specified to be encoded in ibm-808 into DB2 UDB and stores it as a XMLVARCHAR.

Retrieval functions

Retrieval functions in XML Extender

The XML Extender provides an overloaded function Content(), which is used for retrieval. This overloaded function refers to a set of retrieval functions that have the same name, but behave differently based on where the data is being retrieved. You can also use the default casting functions to convert an XML UDT to the base data type.

The Content() functions provide the following types of retrieval:

- **Retrieval from external storage at the server to a host variable at the client.**

  You can use Content() to retrieve an XML document to a memory buffer when it is stored as an external server file. You can use Content(): retrieve from XMLFILE to a CLOB for this purpose.
- **Retrieval from internal storage to an external server file**

  You can also use Content() to retrieve an XML document that is stored inside DB2 UDB and store it to a server file on the DB2 UDB server's file system. The following Content() functions are used to store information on external server files:
  - Content(): retrieve from XMLVARCHAR to an external server file
  - Content(): retrieval from XMLCLOB to an external server file

The following user-defined functions have a new parameter that specifies the encoding of the source or output file. The value of this parameter is any code page name that is recognized by ICU.

```
db2xml.XMLVarcharFromFile(filename varchar(512), src_encoding  varchar(100))
returns XMLVarchar

db2xml.XMLCLOBFromFile(filename varchar(512), src_encoding varchar(100))
returns XMLCLOB AS LOCATOR

db2xml.XMLFileFromVarchar(doc varchar(3000), targetfilename varchar(512),
targetencoding varchar(100))
returns XMLFile

db2xml.XMLFileFromCLOB(doc CLOB(2G) as LOCATOR, targetfilename varchar(512),
 targetencoding varchar(100))
returns XMLFile

db2xml.Content(doc XMLVarchar, targetfilename varchar(512),
 targetencoding varchar(100))
returns varchar(512)

db2xml.Content(doc XMLCLOB as LOCATOR, targetfilename varchar(512),
 targetencoding varchar(100))
returns varchar(512)
```

Examples:

To import the contents of a file `/home/collins/xml/entail.xml` into a varchar buffer and to specify that the source file is encoded in iso-8859-1:

```
db2xml.XMLVarcharFromFile('/home/collins/xml/entail.xml', 'iso-8859-1')
```

The file is imported into a varchar and converted from iso-8859-1 to the database code page.

To export a varchar buffer into a file /home/raskolnikov/xml/confession.xml and to specify that the output file should be encoded in ibm-808:

```
db2xml.Content('<sequence><thought>I did it!</thought></sequence>',
'/home/raskolnikov/xml/confession.xml', 'ibm-808')
```

The contents of the buffer are exported to a file and converted from the database code page to ibm-808. The encoding declaration of the XML file is then updated appropriately.

The examples in the following section assume you are using the DB2 UDB command shell, in which you do not need to type "DB2" at the beginning of each command.

Content(): retrieve from XMLFILE to a CLOB

Purpose:

Retrieves data from a server file and stores it in a CLOB LOCATOR.

Syntax:

```
►►──Content──(──xmlobj──)─────────────────────────────────────────────►◄
```

Parameters:

Table 30. XMLFILE to a CLOB parameter

Parameter	Data type	Description
xmlobj	XMLFILE	The XML document.

Results:
CLOB (*clob_len*) as LOCATOR

clob_len for DB2 UDB is 2G.

Example:

The following example retrieves data from a server file and stores it in a CLOB locator.

```
char    subsystem[20];
long   retcode = 0, reason = 0;
extern "OS" { int DSNALI(char * functn, ...); }

extern "OS" short DSNTIAR(struct sqlca *sqlca,
                          error_struct *error_message,
                          long *data_len);

EXEC SQL BEGIN DECLARE SECTION;
     SQL TYPE IS CLOB_LOCATOR xml_buff;
EXEC SQL END DECLARE SECTION;

/* Attach to subsystem */
rc = DSNALI("OPEN        ", subsystem, "PLANNAME",
     &retcode, &reason);
if ( retcode != 0 )
{
   /* print error message */
   goto exit;
}

EXEC SQL DECLARE c1 CURSOR FOR

     SELECT Content(order) from sales_tab
     WHERE sales_person = 'Sriram Srinivasan'

EXEC SQL OPEN c1;

do {
   EXEC SQL FETCH c1 INTO :xml_buff;
   if (SQLCODE != 0) {
      break;
      }
   else {
     /* do with the XML doc in buffer */
     }
   }

EXEC SQL CLOSE c1;

/* Detach from sybsystem */
DSNALI("CLOSE       ", "SYNC", &retcode, &reason);
if ( retcode != 0 ) {
   /* print error message */
}
```

The column ORDER in the SALES_TAB table is of an XMLFILE type, so the Content() UDF retrieves data from a server file and stores it in a CLOB locator.

Related tasks:

- "Updating, deleting, and retrieving data in XML collections" on page 101

Content(): retrieve from XMLVARCHAR to an external server file

| **Purpose:**

| Retrieves the XML content that is stored as an XMLVARCHAR type and stores it in
| an external server file.

| **Syntax:**

|

```
▶▶──Content──(──xmlobj──,──filename──,──┬──────────────────────┬──────────────▶◀
                                         └─targetencoding──)─┘
```

Important: If a file with the specified name already exists, the content function overrides its content.

Parameters:

Table 31. XMLVarchar to external server file parameters

Parameter	Data type	Description
xmlobj	XMLVARCHAR	The XML document.
filename	VARCHAR(512)	The fully qualified server file name.
targetencoding	VARCHAR(100)	The encoding of the output file.

Results:

VARCHAR(512)

Example:

The following example retrieves the XML content that is stored as XMLVARCHAR type and stores it in an external file located on the server. The UDF encodes the file in 'ibm-808'.

```
CREATE table app1 (id int NOT NULL, order DB2XML.XMLVarchar);
INSERT into app1 values (1, '<?xml version="1.0"?>
   <!DOCTYPE SYSTEM "dxx_install/samples/db2xml/dtd/getstart.dtd"->

     <Order key="1">
        <Customer>
          <Name>American Motors</Name>
          <Email>parts@am.com</Email>
        </Customer>
        <Part color="black">
          <key>68</key>
          <Quantity>36</Quantity>
          <ExtendedPrice>34850.16</ExtendedPrice>
          <Tax>6.000000e-02</Tax>
          <Shipment>
              <ShipDate>1998-08-19</ShipDate>
              <ShipMode>AIR </ShipMode>
          </Shipment>
          <Shipment>
              <ShipDate>1998-08-19</ShipDate>
              <ShipMode>BOAT </ShipMode>
          </Shipment>
          </Part>
     </Order>');

SELECT DB2XML.Content(order, 'dxx_install/samples/dad/getstart_column.dad'
, 'ibm-808')
  from app1 where ID=1;
```

Related tasks:

- "Method for retrieving an XML document" on page 78

Related reference:

- “Retrieval functions in XML Extender” on page 141

Content(): retrieval from XMLCLOB to an external server file

Purpose:

Retrieves the XML content that is stored as an XMLCLOB type and stores it in an external server file.

Syntax:

```
►►──Content──(──xmlobj──,──filename──,─┬─────────────────────┬──────────────►◄
                                        └─targetencoding──)─┘
```

Important: If a file with the specified name already exists, the content function overrides its content.

Parameters:

Table 32. XMLCLOB to external server file parameters

Parameter	Data type	Description
xmlobj	XMLCLOB as LOCATOR	The XML document.
filename	VARCHAR(512)	The fully qualified server file name.
targetencoding	VARCHAR(100)	The encoding of the output file.

Results:

VARCHAR(512)

Example:

The following example retrieves the XML content that is stored as an XMLCLOB type and stores it in an external file located on the server. The UDF encodes the file in ’ibm-808’.

```
CREATE table app1 (id int NOT NULL, order DB2XML.XMLCLOB not logged);

INSERT into app1 values (1, '<?xml version="1.0"?>
  <!DOCTYPE SYSTEM "dxx_install/samples/db2xml/dtd/getstart.dtd"
->
    <Order key="1">
      <Customer>
          <Name>American Motors</Name>
          <Email>parts@am.com</Email>
      </Customer>
      <Part color="black">
          <key>68</key>
          <Quantity>36</Quantity>
          <ExtendedPrice>34850.16</ExtendedPrice>
          <Tax>6.000000e-02</Tax>
          <Shipment>
              <ShipDate>1998-08-19</ShipDate>
              <ShipMode>AIR </ShipMode>
          </Shipment>
```

```
            <Shipment>
                <ShipDate>1998-08-19</ShipDate>
                <ShipMode>BOAT </ShipMode>
            </Shipment>
        </Part>
      </Order>');

SELECT DB2XML.Content(order,
'dxx_install/samples/db2xml/xml/getstart.xml', 'ibm-808')
 from app1 where ID=1;
```

Extraction functions

Extracting functions in XML Extender

The extracting functions extract the element content or attribute value from an XML document and return the requested SQL data types. The XML Extender provides a set of extracting functions for various SQL data types. The extracting functions take two input parameters. The first parameter is the XML Extender UDT, which can be one of the XML UDTs. The second parameter is the location path that specifies the XML element or attribute. Each extracting function returns the value or content that is specified by the location path.

Because some element or attribute values have multiple occurrence, the extracting functions return either a scalar or a table value; the former is called a scalar function, the latter is called a table function.

extractInteger() and extractIntegers()

Purpose:

Extracts the element content or attribute value from an XML document and returns the data as INTEGER type.

Syntax:

Scalar function:

```
►►—extractInteger—(—xmlobj—,—path—)——————————————————————————►◄
```

Table function:

```
►►—extractIntegers—(—xmlobj—,—path—)—————————————————————————►◄
```

Parameters:

Table 33. extractInteger and extractIntegers function parameters

Parameter	Data type	Description
xmlobj	XMLVARCHAR, XMLFILE, or XMLCLOB	The column name.
path	VARCHAR	The location path of the element or attribute.

Returned type:
INTEGER

Return codes:
returnedInteger
Examples:
Scalar function example:

In the following example, one value is returned when the attribute value of key = ″1″. The value is extracted as an INTEGER.

```
CREATE TABLE t1(key INT);
INSERT INTO t1 values (
    DB2XML.extractInteger(DB2XML.XMLFile('/samples/db2xml
    /xml/getstart.xml
    '),
    '/Order/Part[@color="black "]/key'));
SELECT * from t1;
```

Table function example:

In the following example, each order key for the sales orders is extracted as INTEGER. The examples assume that you are using the DB2 UDB command shell, in which you do not need to type "DB2" at the beginning of each command.

```
SELECT *
FROM TABLE(
  DB2XML.extractIntegers(DB2XML.XMLFile('/samples/db2xml/xml/getstart.xml'),
'/Order/Part/key')) AS X;
```

Related concepts:

- "UDTs and UDF names for XML Extender" on page 119
- "Types of XML Extender user-defined functions" on page 137

Related reference:

- "Extracting functions in XML Extender" on page 146

extractSmallint() and extractSmallints()

Purpose:

Extracts the element content or attribute value from an XML document and returns the data as SMALLINT type.

Syntax:

Scalar function:

```
►►──extractSmallint──(──xmlobj──,──path──)─────────────────────────────►◄
```

Table function:

```
►►──extractSmallints──(──xmlobj──,──path──)────────────────────────────►◄
```

Parameters:

Table 34. extractSmallint and extractSmallints function parameters

Parameter	Data type	Description
xmlobj	XMLVARCHAR, XMLFILE, or XMLCLOB	The column name.
path	VARCHAR	The location path of the element or attribute.

Returned type:
SMALLINT
Return codes:
returnedSmallint

Examples:

Scalar function example:

In the following example, the value of key in all sales orders is extracted as SMALLINT. The examples assume that you are using the DB2 UDB command shell, in which you do not need to type "DB2" at the beginning of each command.

```
CREATE TABLE t1(key INT);
INSERT INTO t1 values (
    DB2XML.extractSmallint(db2xml.xmlfile('dxx_install
     /samples/db2xml/xml/getstart.xml'),
    '/Order/Part[@color="black "]/key'));
SELECT * from t1;
```

Table function example:

In the following example, the value of key in all sales orders is extracted as SMALLINT. The examples assume that you are using the DB2 UDB command shell, in which you do not need to type "DB2" at the beginning of each command.

```
SELECT *
  FROM TABLE(
      DB2XML.extractSmallints(DB2XML.XMLFile('dxx_install
      /samples/db2xml/xml/getstart.xml'),
      '/Order/Part/key'))   AS X;
```

Related concepts:
- "Using indexes for XML column data" on page 75
- "UDTs and UDF names for XML Extender" on page 119
- "Types of XML Extender user-defined functions" on page 137

Related reference:
- "Extracting functions in XML Extender" on page 146
- "XML Extenders stored procedure return codes" on page 273

extractDouble() and extractDoubles()

Purpose:

Extracts the element content or attribute value from an XML document and returns the data as DOUBLE type.

Syntax:

Scalar function:

```
►►—extractDouble—(—xmlobj—,—path—)——————————————————————————————►◄
```

Table function:

```
►►—extractDoubles—(—xmlobj—,—path—)—————————————————————————————►◄
```

Parameters:

Table 35. extractDouble and extractDoubles function parameters

Parameter	Data type	Description
xmlobj	XMLVARCHAR, XMLFILE, or XMLCLOB	The column name.
path	VARCHAR	The location path of the element or attribute.

Returned Type:
DOUBLE
Return Codes:
returnedDouble
Examples: Scalar function example:
The following example automatically converts the price in an order from a DOUBLE type to a DECIMAL. The examples assume that you are using the DB2 command shell, in which you do not need to type "DB2" at the beginning of each command.

```
CREATE TABLE t1(price DECIMAL(9,2));
INSERT INTO t1 values (
    DB2XML.extractDouble(DB2XML.xmlfile('dxx_install
    /samples/db2xml/xml/getstart.xml'),
    '/Order/Part[@color="black "]/ExtendedPrice'));
SELECT * from t1;
```

Table function example:

In the following example, the value of ExtendedPrice in each part of the sales order is extracted as DOUBLE. The examples assume that you are using the DB2 UDB command shell, in which you do not need to type DB2 UDB at the beginning of each command.

```
SELECT CAST(RETURNEDDOUBLE AS DOUBLE)
  FROM TABLE(
      DB2XML.extractDoubles(DB2XML.XMLFile('dxx_install
       /samples/db2xml/xml/getstart.xml'),
      '/Order/Part/ExtendedPrice'))   AS X;
```

Related concepts:
- "UDTs and UDF names for XML Extender" on page 119

Related reference:
- "Extracting functions in XML Extender" on page 146

extractReal() and extractReals()

Purpose:

Extracts the element content or attribute value from an XML document and returns the data as REAL type.

Syntax:

Scalar function:

```
►►—extractReal—(—xmlobj—,—path—)——————————————————————————————►◄
```

Table function:

```
►►—extractReals—(—xmlobj—,—path—)—————————————————————————————►◄
```

Parameters:

Table 36. extractReal and extractReals function parameters

Parameter	Data type	Description
xmlobj	XMLVARCHAR, XMLFILE, or XMLCLOB	The column name.
path	VARCHAR	The location path of the element or attribute.

Returned type:
REAL
Return codes:
returnedReal
Examples:
Scalar function example:

In the following example, the value of ExtendedPrice is extracted as a REAL. The examples assume that you are using the DB2 UDB command shell, in which you do not need to type "DB2" at the beginning of each command.

```
CREATE TABLE t1(price DECIMAL(9,2));
INSERT INTO t1 values (
    DB2XML.extractReal(DB2XML.xmlfile('dxx_install
    /samples/db2xml/xml/getstart.xml'),
    '/Order/Part[@color="black"]/ExtendedPrice'));
SELECT * from t1;
```

Table function example:

In the following example, the value of ExtendedPrice is extracted as a REAL. The examples assume that you are using the DB2 UDB command shell, in which you do not need to type "DB2" at the beginning of each command.

```
SELECT CAST(RETURNEDREAL AS REAL)
  FROM TABLE(
      DB2XML.extractReals(DB2XML.XMLFile('dxx_install
      /samples/db2xml/xml/getstart.xml'),
      '/Order/Part/ExtendedPrice'))   AS X;
```

Related concepts:

- "UDTs and UDF names for XML Extender" on page 119
- "Types of XML Extender user-defined functions" on page 137

Related reference:

- "Extracting functions in XML Extender" on page 146
- "XML Extender UDF return codes" on page 273

extractChar() and extractChars()

Purpose:

Extracts the element content or attribute value from an XML document and returns the data as CHAR type.

Syntax:

Scalar function:

```
►►──extractChar──(──xmlobj──,──path──)────────────────────────────────►◄
```

Table function:

```
►►──extractChars──(──xmlobj──,──path──)───────────────────────────────►◄
```

Parameters:

Table 37. extractChar and extractChars function parameters

Parameter	Data type	Description
xmlobj	XMLVARCHAR, XMLFILE, or XMLCLOB	The column name.
path	VARCHAR	The location path of the element or attribute.

Returned type:
CHAR
Return codes:
returnedChar
Examples:
Scalar function example:

In the following example, the value of Name is extracted as CHAR. The examples assume that you are using the DB2 UDB command shell, in which you do not need to type "DB2" at the beginning of each command.

```
CREATE TABLE t1(name char(30));
INSERT INTO t1 values (
    DB2XML.extractChar(DB2XML.xmlfile('dxx_install
    /samples/db2xml/xml/getstart.xml'),
    '/Order/Customer/Name'));
SELECT * from t1;
```

Table function example:

In the following example, the value of Color is extracted as CHAR. The examples assume that you are using the DB2 UDB command shell, in which you do not need to type "DB2" at the beginning of each command.

```
SELECT *
  FROM TABLE(
      DB2XML.extractChars(DB2XML.XMLFile('dxx_install
       /samples/db2xml/xml/getstart.xml'),
      '/Order/Part/@color'))   AS X;
```

Related reference:

- “Extracting functions in XML Extender” on page 146
- “How to read syntax diagrams” on page x

extractVarchar() and extractVarchars()

Purpose:

Extracts the element content or attribute value from an XML document and returns the data as VARCHAR type.

Syntax:

Scalar function:

```
►►—extractVarchar—(—xmlobj—,—path—)——————————————————————————►◄
```

Table function:

```
►►—extractVarchars—(—xmlobj—,—path—)—————————————————————————►◄
```

Parameters:

Table 38. extractVarchar and extractVarchars function parameters

Parameter	Data type	Description
xmlobj	XMLVARCHAR, XMLFILE, or XMLCLOB	The column name.
path	VARCHAR	The location path of the element or attribute.

Returned type:
VARCHAR(4K)
Return codes:
returnedVarchar
Examples:
Scalar function example:

In a database with more than 1000 XML documents that are stored in the column ORDER in the SALES_TAB table, you might want to find all the customers who have ordered items that have an ExtendedPrice greater than 2500.00. The following SQL statement uses the extracting UDF in the SELECT clause:

```
SELECT extractVarchar(Order, '/Order/Customer/Name') from sales_order_view
   WHERE price > 2500.00
```

The examples assume that you are using the DB2 UDB command shell, in which you do not need to type “DB2” at the beginning of each command. The UDF extractVarchar() takes the column ORDER as the input and the location path `/Order/Customer/Name` as the select identifier. The UDF returns the names of the customers. With the WHERE clause, the extracting function evaluates only those orders with an ExtendedPrice greater than 2500.00.

Table function example:

In a database with more than 1000 XML documents that are stored in the column ORDER in the SALES_TAB table, you might want to find all the customers who have ordered items that have an ExtendedPrice greater than 2500.00. The following SQL statement uses the extracting UDF in the SELECT clause:

```
SELECT extractVarchar(Order, '/Order/Customer/Name') from sales_order_view
   WHERE price > 2500.00
```

The examples assume that you are using the DB2 UDB command shell, in which you do not need to type “DB2” at the beginning of each command. The UDF extractVarchar() takes the column ORDER as the input and the location path `/Order/Customer/Name` as the select identifier. The UDF returns the names of the customers. With the WHERE clause, the extracting function evaluates only those orders with an ExtendedPrice greater than 2500.00.

Scalar function example:

In the following example, the value of Name is extracted as VARCHAR. The examples assume that you are using the DB2 UDB command shell, in which you do not need to type “DB2” at the beginning of each command.

```
CREATE TABLE t1(name varchar(30));
INSERT INTO t1 values (
    DB2XML.extractVarchar(DB2XML.xmlfile('dxx_install
     /samples/db2xml/xml/getstart.xml'),
    '/Order/Customer/Name'));
SELECT * from t1;
```

Table function example:

In the following example, the value of Color is extracted as VARCHAR. The examples assume that you are using the DB2 UDB command shell, in which you do not need to type “DB2” at the beginning of each command.

```
SELECT*
  FROM TABLE(
      DB2XML.extractVarchars(DB2XML.XMLFile('dxx_install
      /samples/xml/getstart.xml'),
      '/Order/Part/@color'))   AS X;
```

Related concepts:

- “UDTs and UDF names for XML Extender” on page 119
- “Types of XML Extender user-defined functions” on page 137

Related reference:

- “Extracting functions in XML Extender” on page 146
- “XML Extender UDF return codes” on page 273

extractCLOB() and extractCLOBs()

Purpose:

Extracts a fragment of XML documents, with element and attribute markup and content of elements and attributes, including sub-elements. This function differs from the other extract functions, which return only the content of elements and attributes. The extractClob(s) functions are used to extract document fragments, whereas extractVarchar(s) and extractChar(s) are used to extract simple values.

Syntax:

Scalar function:

```
►►—extractCLOB—(—xmlobj—,—path—)——————————————————————————————►◄
```

Table function:

```
►►—extractCLOBs—(—xmlobj—,—path—)—————————————————————————————►◄
```

Parameters:

Table 39. extractCLOB and extractCLOBs function parameters

Parameter	Data type	Description
xmlobj	XMLVARCHAR, XMLFILE, or XMLCLOB	The column name.
path	VARCHAR	The location path of the element or attribute.

Returned type:
CLOB(10K)
Return codes:
returnedCLOB
Examples:
Scalar function example:

In this example, all name element content and tags are extracted from a purchase order. The examples assume that you are using the DB2 UDB command shell, in which you do not need to type “DB2” at the beginning of each command.

```
CREATE TABLE t1(name DB2XML.xmlclob);
INSERT INTO t1 values (
    DB2XML.extractClob(DB2XML.xmlfile('dxx_install
     /samples/db2xml/xml/getstart.xml'),
    '/Order/Customer/Name'));
SELECT * from t1;
```

Table function example:

In this example, all of the color attributes are extracted from a purchase order. The examples assume that you are using the DB2 UDB command shell, in which you do not need to type “DB2” at the beginning of each command.

```
SELECT *
  FROM TABLE(
      DB2XML.extractCLOBs(DB2XML.XMLFile('dxx_install
     /samples/db2xml/xml/getstart.xml'),
      '/Order/Part/@color'))   AS X;
```

Related concepts:

- “Types of XML Extender user-defined functions” on page 137

Related reference:

- “Extracting functions in XML Extender” on page 146

extractDate() and extractDates()

Purpose:

Extracts the element content or attribute value from an XML document and returns the data as DATE type. The date must be in the format: YYYY-MM-DD.

Syntax:

Scalar function:

```
►►──extractDate──(──xmlobj──,──path──)──────────────────────────────►◄
```

Table function:

```
►►──extractDates──(──xmlobj──,──path──)─────────────────────────────►◄
```

Parameters:

Table 40. extractDate and extractDates function parameters

Parameter	Data type	Description
xmlobj	XMLVARCHAR, XMLFILE, or XMLCLOB	The column name.
path	VARCHAR	The location path of the element or attribute.

Returned type:
DATE
Return codes:
returnedDate
Examples:
Scalar function example:

In the following example, the value of ShipDate is extracted as DATE. The examples assume that you are using the DB2 UDB command shell, in which you do not need to type “DB2” at the beginning of each command.

```
CREATE TABLE t1(shipdate DATE);
INSERT INTO t1 values (
    DB2XML.extractDate(DB2XML.xmlfile('dxx_install
    /samples/db2xml/xml/getstart.xml'),
    '/Order/Part[@color="red   "]/Shipment/ShipDate'));
SELECT * from t1;
```

Table function example:

In the following example, the value of ShipDate is extracted as DATE.

```
SELECT *
  FROM TABLE(
      DB2XML.extractDates(DB2XML.XMLFile('dxx_install
    /samples/db2xml/xml/getstart.xml'),
      '/Order/Part[@color="black "]/Shipment/ShipDate'))   AS X;
```

Related concepts:

- “Types of XML Extender user-defined functions” on page 137

Related reference:

- “Extracting functions in XML Extender” on page 146
- “XML Extender UDF return codes” on page 273

extractTime() and extractTimes()

Purpose:

Extracts the element content or attribute value from an XML document and returns the data as TIME type.

Syntax:

Scalar function:

```
►►──extractTime──(──xmlobj──,──path──)──────────────────────────────►◄
```

Table function:

```
►►──extractTimes──(──xmlobj──,──path──)─────────────────────────────►◄
```

Parameters:

Table 41. extractTime and extractTimes function parameters

Parameter	Data type	Description
xmlobj	XMLVARCHAR, XMLFILE, or XMLCLOB	The column name.
path	VARCHAR	The location path of the element or attribute.

Returned type:
TIME
Return codes:
returnedTime
Examples:
The examples assume that you are using the DB2 UDB command shell, in which you do not need to type “DB2” at the beginning of each command.

Scalar function example:

```
CREATE TABLE t1(testtime  TIME);
INSERT INTO t1 values (
    DB2XML.extractTime(DB2XML.XMLCLOB(
         '<stuff><data>11.12.13</data></stuff>'), '//data'));
SELECT * from t1;
```

Table function example:

```
select *
from table(
    DB2XML.extractTimes(DB2XML.XMLCLOB(
        '<stuff><data>01.02.03</data><data>11.12.13</data></stuff>'),
        '//data')) as x;
```

Related concepts:

- “UDTs and UDF names for XML Extender” on page 119
- “Types of XML Extender user-defined functions” on page 137

Related reference:
- “Extracting functions in XML Extender” on page 146

extractTimestamp() and extractTimestamps()

Purpose:

Extracts the element content or attribute value from an XML document and returns the data as TIMESTAMP type.

Syntax:

Scalar function:

```
►►—extractTimestamp—(—xmlobj—,—path—)——————————————————————————————►◄
```

Table function:

```
►►—extractTimestamps—(—xmlobj—,—path—)—————————————————————————————►◄
```

Parameters:

Table 42. extractTimestamp and extractTimestamps function parameters

Parameter	Data type	Description
xmlobj	XMLVARCHAR, XMLFILE, or XMLCLOB	The column name.
path	VARCHAR	The location path of the element or attribute.

Returned type:
TIMESTAMP
Return codes:
returnedTimestamp
Examples:
The examples assume that you are using the DB2 UDB command shell, in which you do not need to type “DB2” at the beginning of each command.

Scalar function example:

```
CREATE TABLE t1(testtimestamp  TIMESTAMP);
INSERT INTO t1 values (
    DB2XML.extractTimestamp(DB2XML.XMLCLOB(
        '<stuff><data>2003-11-11-11.12.13.888888</data></stuff>'),
        '//data'));
SELECT * from t1;
```

Table function example:

```
select * from
table(DB2XML.extractTimestamps(DB2XML.XMLClob(
    '<stuff><data>2003-11-11-11.12.13.888888
    </data><data>2003-12-22-11.12.13.888888</data></stuff>'),
    '//data')) as x;
```

XML Extender will automatically normalize timestamps extracted from XML documents to comply with the DB2 timestamp format if needed. Timestamps are normalized to the `yyyy-mm-dd-hh.mm.ss.nnnnnn` format or the `yyyy-mm-dd-hh mm.ss.nnnnnn` format. For example:

```
2003-1-11-11.12.13
```

will be normalized to:

```
2003-01-11-11.12.13.000000
```

Related concepts:
- "UDTs and UDF names for XML Extender" on page 119
- "Types of XML Extender user-defined functions" on page 137

Related reference:
- "Extracting functions in XML Extender" on page 146
- "XML Extender UDF return codes" on page 273

Update functions in XML Extender

The Update() function updates a specified element or attribute value in one or more XML documents stored in the XML column. You can also use the default casting functions to convert an SQL base type to the XML UDT.

Purpose

Takes the column name of an XML UDT, a location path, and a string of the update value and returns an XML UDT that is the same as the first input parameter. With the Update() function, you can specify the element or attribute that is to be updated.

Syntax

```
►►──Update──(──xmlobj──,──path──,──value──)──────────────────────────────►◄
```

Parameters

Table 43. The UDF Update parameters

Parameter	Data type	Description
xmlobj	XMLVARCHAR, XMLCLOB as LOCATOR	The column name.
path	VARCHAR	The location path of the element or attribute.
value	VARCHAR	The update string. **Restriction:** The Update function does not have an option to disable output escaping; the output of an extractClob (which is a tagged fragment) cannot be inserted using this function. Use textual values only.

Restriction: Note that the Update UDF supports location paths that have predicates with attributes, but not elements. For example, the following predicate is supported:

```
'/Order/Part[@color="black "]/ExtendedPrice'
```

The following predicate is not supported:

```
'/Order/Part/Shipment/[Shipdate < "11/25/00"]'
```

Return type

Data type	Return type
XMLVARCHAR	XMLVARCHAR
XMLCLOB as LOCATOR	XMLCLOB

Example

The following example updates the purchase order handled by the salesperson Sriram Srinivasan.

```
UPDATE sales_tab
   set order = db2xml.update(order, '/Order/Customer/Name', 'IBM')
   WHERE sales_person = 'Sriram Srinivasan'
```

In this example, the content of `/Order/Customer/Name` is updated to `IBM`.

Usage

When you use the Update function to change a value in one or more XML documents, it replaces the XML documents within the XML column. Based on output from the XML parser, some parts of the original document are preserved, while others are lost or changed. The following sections describe how the document is processed and provide examples of how the documents look before and after updates.

How the Update() function processes the XML document

When the Update() function replaces XML documents, it must reconstruct the document based on the XML parser output. Table 44 on page 160 describes how the parts of the document are handled, with examples.

Table 44. Update function rules

Item or node type	XML document code example	Status after update
XML declaration	`<?xml  version='1.0'` `encoding='utf-8'` `standalone='yes' >`	The XML declaration is preserved: • Version information is preserved. • Encoding declaration is preserved and appears when specified in the original document. • Standalone declaration is preserved and appears when specified in the original document. • After update, single quotation marks are used to delineate values.
DOCTYPE Declaration	`<!DOCTYPE books SYSTEM` `"http://dtds.org/books.dtd" >` `<!DOCTYPE books PUBLIC` `"local.books.dtd"  "http://dtds.org/books.dtd" >` `<!DOCTYPE books>` `-Any of` `<!DOCTYPE books` `( S ExternalID ) ?` `[ internal-dtd-subset ] >` `-Such as` `<!DOCTYPE books` `[ <!ENTITY mydog "Spot"> ] >?` `[ internal-dtd-subset ] >`	The document type declaration is preserved: • Root element name is supported. • Public and system ExternalIDs are preserved and appear when specified in the original document. • Internal DTD subset is *not* preserved. Entities are replaced; defaults for attributes are processed and appear in the output documents. • After the update, double quotation marks are used to delineate public and system URI values. • The current XML4c parser does not report an XML declaration that does not contain an ExternalID or internal DTD subset. After the update, the DOCTYPE declaration would be missing in this case.
Processing Instructions	`<?xml-stylesheet` `title="compact"` `href="datatypes1.xsl"` `type="text/xsl"?>`	Processing instructions are preserved.
Comments	`<!-- comment -->`	Comments inside the root element are preserved. Comments outside the root element are discarded.

Table 44. Update function rules (continued)

Item or node type	XML document code example	Status after update

Elements	`<books>`
	`content`
	`</books>`
		Elements are preserved.

Attributes	`id='1' date="01/02/2003"`	Attributes of elements are preserved. • After update, double quotation marks are used to delineate values. • Data within attributes is lost. • Entities are replaced.

Text Nodes	`This chapter is about`
	`my dog &mydog;.`
		Text nodes (element content) are preserved.
		• Data within text nodes is lost.
		• Entities are replaced.

Multiple occurrence

When a location path is provided in the Update() UDF, the content of every element or attribute with a matching path is updated with the supplied value. This means that if a document has multiple occurring location paths, the Update() function replaces the existing values with the value provided in the *value* parameter.

You can specify a predicate in the *path* parameter to provide distinct locations paths to prevent unintentional updates. The Update() UDF supports location paths that have predicates with attributes, but not elements.

Examples

The following examples show instances of an XML document before and after an update.

Table 45. XML documents before and after an update

Example 1:

Before:

Table 45. XML documents before and after an update (continued)

```
<?xml version='1.0'   encoding='utf-8'    standalone="yes"?>
<!DOCTYPE book PUBLIC "public.dtd" "system.dtd">
<?pitarget option1='value1' option2='value2'?>
<!-- comment -->
<book>
  <chapter id="1" date='07/01/1997'>
    <!-- first section -->
    <section>This is a section in Chapter
       One.</section>
  </chapter>
  <chapter id="2" date="01/02/1997">
    <section>This is a section in Chapter
       Two.</section>
    <footnote>A footnote in Chapter Two is
        here.</footnote>
  </chapter>
  <price date="12/22/1998" time="11.12.13"
       timestamp="1998-12-22-11.12.13.888888">
       38.281</price>
</book>
```

- Contains white space in the XML declaration
- Specifies a processing instruction
- Contains a comment outside of the root node
- Specifies PUBLIC ExternalID
- Contains a comment inside of root note

After:

```
<?xml version='1.0' encoding='utf-8' standalone='yes'?>
<!DOCTYPE book PUBLIC "public.dtd" "system.dtd">
<?pitarget option1='value1' option2='value2'?>
<book>
  <chapter id="1" date="07/01/2003">
        <!-- first section -->
        <section>This is a section in Chapter
         One.</section>
  </chapter>
  <chapter id="2" date="01/02/2003">
        <section>This is a section in Chapter
         Two.</section>
        <footnote>A footnote in Chapter Two
         is here.</footnote>
  </chapter>
  <price date="12/22/2003" time="11.12.13"
       timestamp="2003-12-22-11.12.13.888888">
       60.02</price>
</book>
```

- White space inside of markup is eliminated
- Processing instruction is preserved
- Comment outside of the root node is not preserved
- PUBLIC ExternalID is preserved
- Comment inside of root node is preserved
- Changed value is the value of the <price> element

Example 2:

Before:

```
<?xml version='1.0'     ?>
<!DOCTYPE book>
<!-- comment -->
<book>
  ...
</book>
```

Contains DOCTYPE declaration without an ExternalID or an internal DTD subset. Not supported.

After:

Table 45. XML documents before and after an update (continued)

`<?xml version='1.0'?>`
`<book>`
`  ...`
`</book>`
	DOCTYPE declaration is not reported by the XML parser and not preserved.

Example 3:	

Before:
`<?xml version='1.0'     ?>`
`<!DOCTYPE book [ <!ENTITY myDog "Spot"> ]>`
`<!-- comment -->`
`<book>`
`  <chapter id="1" date='07/01/1997'>`
`       <!-- first section -->`
`       <section>This is a section in Chapter`
`         One about my dog &;myDog;.</section>`
`       ...`
`  </chapter>`
`  ...`
`</book>`
	• Contains white space in markup
	• Specifies internal DTD subset
	• Specifies entity in text node

After:
`<?xml version='1.0'?>`
`<!DOCTYPE book>`
`<book>`
`  <chapter id="1" date="07/01/1997">`
`       <!-- first section -->`
`       <section>This is a section in Chapter`
`         One about my dog Spot.</section>`
`          ...`
`  </chapter>`
`  ...`
`</book>`
	• White space in markup is eliminated
	• Internal DTD subset is not preserved
	• Entity in text node is resolved and replaced

Validation functions

DB2 XML Extender offers two user defined functions (UDFs) that validate XML documents against either an XML schema or a DTD.

An element in an XML document is valid according to a given schema if the associated element type rules are satisfied. If all elements are valid, the whole document is valid. With a DTD, however, there is no way to require a specific root element. The validation functions return 1 if the document is valid or they return 0 and write an error message in the trace file if the document is invalid. The functions are:

db2xml.svalidate:
Validates an XML document instance against the specified schema.

db2xml.dvalidate:
Validates an XML document instance against the specified DTD.

SVALIDATE() function

This function validates an XML document against a specified schema (or the one named in the XML document) and returns 1 if the document is valid or 0 if not. This function assumes that an XML document and a schema exist on the file system or as a CLOB in DB2.

Before you run the SVALIDATE function, ensure that XML Extender is enabled with your server by running the following command:

```
dxxadm enable_server -a subsystem-name wlm environment wlm-name1
```

If the XML document fails the validation, an error message is written to the XML Extender trace file. Enable the trace before executing the DVALIDATE command. See “Starting the trace for XML Extender” on page 271 for information on enabling the trace.

Syntax

```
►►──SVALIDATE──(──xmlobj──┬──────────────┬──)──────────────────────────────►◄
                          └─,──schemadoc─┘
```

Parameters

Table 46. The SVALIDATE parameters

Parameter	Data type	Description
xmlobj	VARCHAR(256)	File path of the XML document to be verified.
	CLOB(2G)	XML column that contains the document to be verified.
schemadoc	VARCHAR(256)	File path of the schema document.
	CLOB(2G)	XML column that contains the schema.

Examples

Example 1: This example validates an XML document using the specified schema, and both the document and schema are stored in DB2 UDB tables.

```
db2 select db2xml.svalidate(doc,schema) from equiplogs where id=1
```

DVALIDATE() function

This function validates an XML document against a specified DTD (or the one named in the XML document) and returns 1 if the document is valid or 0 if not. This function assumes that an XML document and a DTD exist on the file system or as a CLOB in DB2.

Before you can execute the DVALIDATE function, ensure that XML Extender is enabled with your server.

If the XML document fails the validation, an error message is written to the XML Extender trace file. Enable the trace before executing the SVALIDATE command. See “Starting the trace for XML Extender” on page 271 for information on enabling the trace.

Syntax

```
►►──DVALIDATE──(──xmlobj──┬─────────────┬──)─────────────────────────────►◄
                          └─,──dtddoc───┘
```

Parameters

Table 47. The DVALIDATE parameters

Parameter	Data type	Description
xmlobj	VARCHAR(256)	File path of the XML document to be verified.
	CLOB(2G)	XML column that contains the document to be verified.
dtddoc	VARCHAR(256)	File path of the DTD document.
	CLOB(2G)	XML column that contains the DTD, which is either from the DTD_REF table or from a regular table.

Related reference:

- "Starting the trace for XML Extender" on page 271

Chapter 9. Document access definition (DAD) files

Creating a DAD file for XML columns

This task is part of the larger task of defining and enabling an XML column.

See the XML Extender Web site at www.ibm.com/software/data/db2/extenders/xmlext/downloads.html for the most recent information about DAD files.

To access your XML data and enable columns for XML data in an XML table, you need to define a document access definition (DAD) file. This file defines the attributes and key elements of your data that need to be searched within the column. For XML columns, the DAD file primarily specifies how documents stored within it are to be indexed. The DAD file also specifies a DTD or schema to use for validating documents that are inserted into the XML column. DAD files are stored as a CLOB data type, and their size limit is 100 KB.

Prerequisites:

Before you create the DAD file, you need to:

- Decide which elements or attributes you expect to use often in your search. The elements or attributes that you specify are extracted into the side tables for fast searches by the XML Extender.
- Define the location path to represent each element or attribute indexed in a side table. You must also specify the type of data that you want the element or attribute to be converted to.

Procedure:

To create a DAD file:

1. Create a new document in a text editor and type the following syntax:

   ```
   <?XML version="1.0"?>
   <!DOCTYPE DAD SYSTEM <"path/dtd/dad.dtd">.
   ```

   "path/dtd/dad.dtd " is the path and file name of the DTD for the DAD file. A DTD is provided in `dxx_install\samples\db2xml\dtd`
2. Insert DAD tags after the lines from step 1.

   ```
   <DAD>
   </DAD>
   ```

   This element will contain all the other elements.
3. Specify validation for the document and the column:
   - If you want to validate your entire XML document against a DTD or schema before it is inserted into the database:
     – Insert the appropriate tag to specify how you want to validate the document:

     ```
     <dtdid>path/dtd_name.dtd</dtdid>
     ```

     – Insert the following tag to validate the document using a schema:

     ```
     <schemabindings>
     <nonamespacelocation location="path/schema_name.xsd"/>
     </schemabindings>
     ```

| – Validate the column by inserting the following tag:

```
<validation>YES</validation>
```

- If you don’t want to validate the document, use the following tag:

```
<validation>NO</validation>
```

4. Insert `<Xcolumn> </Xcolumn>` tags to specify that you are using XML columns as the access and storage method for your XML data.
5. Specify side tables. For each side table that you want to create:
   a. Specify a <table>`</table>` tag. For example:

   ```
   <table name="person_names">
   </table>
   ```

   b. Inside the table tags, insert a `<column>` tag for each column that you want the side table to contain. Each column has four attributes: name, type, path and, multi_occurrence.

   Example:

   ```
   <table name="person_names">>
   <column name ="fname"
           type="varchar(50)"
           path="/person/firstName"
           multi_occurrence="NO"/>
   <column name ="lname"
           type="varchar(50)"
           path="/person/lastName"
           multi_occurrence="NO"/>
   </table>
   ```

   Where:

   name Specifies the name of the column that is created in the side table.

   type Indicates the SQL data type in the side table for each indexed element or attribute

   path Specifies the location path in the XML document for each element or attribute to be indexed

   multi_occurrence
   Indicates whether the element or attribute referred to by the path attribute can occur more than once in the XML document. The possible values for **multi_occurrence** are **YES** or **NO**. If the value is **NO**, then multiple columns can be specified per table. If the value is **YES**, you can specify only one column in the side table.
6. Save your file with a DAD extension.

The following example shows a complete DAD file:

```
<?xml version="1.0"?>
<!DOCTYPE DAD SYSTEM "c:\dxx_installsamples\db2xml\dtd\dad.dtd">
<DAD>
<dtid>C:\SG246130\code\person.dtd</dtdid>
<validation>YES</validation>
<Xcolumn>
  <table name="person_names">
   <column name="fname"
     type="varchar(50)"
     path="/person/firstName"
     multi_occurrence="NO"/>
   <column name="lname"
     type="varchar(50)"
     path="/person/lastName"
     multi_occurrence="NO"/>
```

```
</table>
<table name="person_phone_number">
   <column name="pnumber"
     type="varchar(20)"
     path="/person/phone/number"
     multi_occurrence="YES"/>
</table>
<table name="person_phone_number">
   <column name="pnumber"
     type="varchar(20)"
     path="/person/phone/number"
     multi_occurrence="YES"/>
</table>
<table name="pesron_phone_type">
   <column name="ptype"
     type="varchar(20)"
     path="/person/phone/type"
     multi_occurrence="YES"/>
</table>
<Xcolumn>
</DAD>
```

Now that you created a DAD file, the next step to defining and enabling an XML column is to create the table in which your XML documents will be stored.

Related concepts:

- "XML collections as a storage and access method" on page 91
- "DAD files for XML collections" on page 169
- "Dad Checker" on page 183

Related tasks:

- "Using the DAD checker" on page 184

DAD files for XML collections

For XML collections, the DAD file maps the structure of the XML document to the DB2® tables from which you compose the document. You can also decompose documents to the DB2 UDB tables using the DAD file.

For example, if you have an element called <Tax> in your XML document, you need to map <Tax> to a column called TAX. You use the DAD file to define the relationship between the XML data and the relational data.

You must specify the DAD file either while enabling a collection, or when you are using the DAD file in stored procedures for XML collections. The DAD is an XML-formatted document, residing at the client. If you choose to validate XML documents with a DTD, the DAD file can be associated with that DTD. When used as the input parameter of the XML Extender stored procedures, the DAD file has a data type of CLOB. This file can be up to 100 KB.

To specify the XML collection access and storage method, use the <Xcollection> tag in your DAD file.

<Xcollection>
: Specifies that the XML data is either to be decomposed from XML documents into a collection of relational tables, or to be composed into XML documents from a collection of relational tables.

An XML collection is a set of relational tables that contains XML data. Applications can enable an XML collection of any user tables. These user tables can be tables of existing business data or tables that XML Extender recently created.

The DAD file defines the XML document tree structure, using the following kinds of nodes:

root_node
Specifies the root element of the document.

element_node
Identifies an element, which can be the root element or a child element.

text_node
Represents the CDATA text of an element.

attribute_node
Represents an attribute of an element.

Figure 14 shows a fragment of the mapping that is used in a DAD file. The nodes map the XML document content to table columns in a relational table.

```
<?xml version="1.0"?>
<!DOCTYPE DAD SYSTEM ""c:\dxx\samples\db2xml\dtd\dad.dtd">
<DAD>
  ...
<Xcollection>
<SQL_stmt>
       ...
</SQL_stmt>
<prolog>?xml version="1.0"?</prolog>
<doctype>!DOCTYPE Order SYSTEM
                  ""c:\dxx\samples\db2xml\dtd\getstart.dtd""</doctype>
<root_node>
 <element_node name="Order">      --> Identifies the element <Order>
  <attribute_node name="key">     --> Identifies the attribute "key"
   <column name="order_key"/>     --> Defines the name of the column,
                                      "order_key", to which the
                                      element and attribute are
                                      mapped
  </attribute_node>
  <element_node name="Customer">  --> Identifies a child element of
                                      <Order> as <Customer>
   <text_node>                    --> Specifies the CDATA text for
                                      the element <Customer>
    <column name="customer">      --> Defines the name of the column,
                                      "customer", to which the child
                                      element is mapped
   </text_node>
  </element_node>
       ...
 </element_node>

      ...
</root_node>
</Xcollection>
</DAD>
```

Figure 14. Node definitions for the XML document as mapped to the XML collection table

In this example, the first two columns have elements and attributes mapped to them.

The XML Extender also supports processing instructions for stylesheets, using the <stylesheet> element. It must be inside the root node of the DAD file, with the doctype and prolog defined for the XML document. For example:

```
<Xcollection>
...
<prolog>...</prolog>
<doctype>...</doctype>
<stylesheet>?xml-stylesheet type="text/css" href="order.css"?</stylesheet>
<root_node>...</root_node>
...

</Xcollection>
```

Use any text editor to create and update a DAD file.

Related concepts:

- "Mapping schemes for XML collections" on page 105

SQL composition

You can compose XML documents using columns with the same name. Selected columns with the same name, even if from diverse tables, must be identified by a unique alias so that every variable in the select clause of the SQL statement is different. The following example shows how you would give unique aliases to columns that have the same names.

```
<SQL_stmt>select o.order_key as oorder_key,
                 key customer_name, customer_email,
                 p.part_key p.order_key as porder_key,
                 color, qty, price, tax, ship_id, date, mode
            from order_tab o.part_tab p
            order by order_key, part_key</SQL_stmt>
```

You can also compose XML documents using columns with generated random values. If an SQL statement in a DAD file has a random value, you must give the random value function an alias to use it in the ORDER BY clause. This requirement is necessary because the value is not associated with any column in a given table. See the alias for generate_unique at the end of the ORDER BY clause in the following example.

```
<SQL_stmt>select o.order_key, customer_name,customer_email,
                 p.part_key,color,qty,price,tax,ship_id,
                 date, mode
          from order_tab o,part_tab p,
               table(select substr(char(timestamp(generate_unique())),16)
as ship_id, date, mode,
                           part_key
                    from ship_tab) s
          where o.order_key=1 and p.price>2000 and
                o.order_key=o.order_key and s.part_key
          order by order_key, part_key,ship_id</SQL_stmt>
```

RDB node composition

The following restrictions apply to RDB node composition:

- The condition associated with any non-root_node RDB node DAD file must compare against a literal.
- Each equality in the condition associated with a top-level RDB_node specifies the join relationship between columns of two tables and is applied separately from the other equalities. That is, all the predicates connected by AND do not apply simultaneously for a single join condition; they simulate an outer join when the

document is composed. The parent-child relationship between each pair of tables is determined by their relative nesting in the DAD file. For example:

```
<condition>order_tab.order_key=part_tab.order_key AND
part_tab.part_key=ship_tab.part_key</condition>
```

Composition from rows that have null values

You can use columns that have null values to compose XML documents.

The following example illustrates how you can generate an XML document form a table *MyTable* which has a row containing a null value in column *Col 1*. The DAD used in the example is *nullcol.dad*.

```
<?xml version="1.0"?>
<!DOCTYPE DAD SYSTEM "c:\dxx\dtd\dad.dtd">
<DAD>
<validation>NO validation>NO>
<Xcollection>
<SQL_stmt>SELECT 1 as X, Col1 FROM MyTable order by X, Col1<\SQL_stmt>
<prolog>?xml version="1.0"?prolog>?xml version="1.0"?>
<doctype>!DOCTYPE Order SYSTEM "e:\t3xml\x.dtd">
<root_node>
<element_node name="MyColumn">
<element_node name="Column1" multi_occurrence="YES">
  <text_node>
  <column name="Col1"/>
  </text_node>
 </element_node>
</element_node>
</roott_node>
</Xcollection>
</DAD>

MyTable
___________
| Col 1 |
|__________|
| 1 |
|__________|
| 3 |
|__________|
| - |
|__________|
```

Run tests2x mydb nullcol.dad result_tab or use dxxGenXML to produce the following document: Note that the third Column1 element represents a null value.

```
<?xml version="1.0"?>
<!DOCTYPE Order SYSTEM "e:\t3xml\x.dtd">
<MyColumn>
 <Column1>1</Column1>
 <Column1>3</Column1>
 <Column1></Column1>
</MyColumn>
```

- The condition associated with any non-root_node RDB node DAD file must compare against a literal.
- The condition associated with any lower level RDB node in the DAD must compare against a literal.
- The condition associated with a root_node describes the relationship between the tables involved in the RDB node composition. An example is a primary foreign key relationship.

- Each equality in the condition associated with a top-level RDB_node specifies the join relationship between columns of two tables and is applied separately from the other equalities. That is, all the predicates connected by AND do not apply simultaneously for a single join condition, they simulate an outer join when the document is composed. The parent-child relationship between each pair of tables is determined by their relative nesting in the DAD file. For example:

```
<condition>order_tab.order_key=part_tab.order_key AND
part_tab.part_key=ship_tab.part_key</condition>
```

DTD for the DAD file

This topic describes the document type declarations (DTD) for the document access definition (DAD) file. The DAD file itself is a tree-structured XML document and requires a DTD. The DTD file name is `dad.dtd`. The following example shows the DTD for the DAD file.

```
<?xml encoding="US-ASCII"?>

| <!ELEMENT DAD ((schemabindings | dtdid)?, validation,
| (Xcolumn | Xcollection))>
  <!ELEMENT dtdid (#PCDATA)>
| <!ELEMENT schemabindings (nonamespacelocation)>
| <!ELEMENT nonamespacelocation (empty)>
| <!ATTLIST nonamespacelocation location CDATA #REQUIRED>
  <!ELEMENT validation (#PCDATA)>
  <!ELEMENT Xcolumn (table+)>
  <!ELEMENT table (column+)>
  <!ATTLIST table name CDATA #REQUIRED
                              key CDATA #IMPLIED
                              orderBy CDATA #IMPLIED>
  <!ELEMENT column EMPTY>
  <!ATTLIST column
                     name CDATA #REQUIRED
                     type CDATA #IMPLIED
                     path CDATA #IMPLIED
                      multi_occurrence CDATA #IMPLIED>
  <!ELEMENT Xcollection (SQL_stmt?, prolog, doctype, root_node)>
  <!ELEMENT SQL_stmt (#PCDATA)>
  <!ELEMENT prolog (#PCDATA)>
  <!ELEMENT doctype (#PCDATA | RDB_node)*>
  <!ELEMENT root_node (element_node)>
  <!ELEMENT element_node (RDB_node*,
                                        attribute_node*,
                                        text_node?,
                                        element_node*,
                                        namespace_node*,
                                        process_instruction_node*,
                                        comment_node*)>
  <!ATTLIST element_node
                    name CDATA #REQUIRED
                    ID CDATA #IMPLIED
                    multi_occurrence CDATA "NO"
                    BASE_URI CDATA #IMPLIED>
  <!ELEMENT attribute_node (column | RDB_node)>
  <!ATTLIST attribute_node
                    name CDATA #REQUIRED>
  <!ELEMENT text_node (column | RDB_node)>
  <!ELEMENT RDB_node (table+, column?, condition?)>
  <!ELEMENT condition (#PCDATA)>
  <!ELEMENT comment_node (#PCDATA)>
  <!ELEMENT process_instruction_node (#PCDATA)>
```

The DAD file has four major elements:

- DTDID
- validation
- Xcolumn
- Xcollection

Xcolumn and Xcollection have child element and attributes that aid in the mapping of XML data to relational tables in DB2. The following list describes the major elements and their child elements and attributes. Syntax examples are taken from the previous example.

DTDID element

DTDs that are provided to XML Extender are stored in the DTD_REF table. Each DTD is identified by a unique ID that is provided in the `DTDID` tag of the DAD file. The `DTDID` points to the DTD that validates the XML documents, or guides the mapping between XML collection tables and XML documents. For XML collections, this element is required only for validating input and output XML documents. For XML columns, this element is needed only to validate input XML documents. The `DTDID` must be the same as the SYSTEM ID specified in the `doctype` of the XML documents.

Syntax: `<!ELEMENT dtdid (#PCDATA)>`

validation element

Indicates whether the XML document is to be validated with the DTD for the DAD. If YES is specified, then the `DTDID` must also be specified.

Syntax: `<!ELEMENT validation(#PCDATA)>`

Xcolumn element

Defines the indexing scheme for an XML column. It is composed of zero or more tables.

Syntax: `<!ELEMENT Xcolumn (table*)>``Xcolumn` has one child element, `table`.

table element

Defines one or more relational tables created for indexing elements or attributes of documents stored in an XML column.

Syntax:

```
<!ELEMENT table (column+)>
 <!ATTLIST table name CDATA #REQUIRED
       key CDATA #IMPLIED
       orderBy CDATA #IMPLIED>
```

The `table` element has one mandatory and two implied attributes:

name attribute

Specifies the name of the side table.

key attribute

The primary single key of the table.

orderBy attribute

The names of the columns that determine the sequence order of multiple-occurring element text or attribute values when generating XML documents.

The table element has one child element:

column element

Maps an attribute of a CDATA node from the input XML document to a column in the table.

Syntax:

```
<!ATTLIST column
                     name CDATA #REQUIRED
                     type  CDATA #IMPLIED
                     path  CDATA #IMPLIED
                     multi_occurrence CDATA #IMPLIED>
```

The `column` element has the following attributes:

name attribute

Specifies the name of the column. It is the alias name of the location path that identifies an element or attribute.

type attribute

Defines the data type of the column. It can be any SQL data type.

path attribute

Shows the location path of an XML element or attribute and must be the simple location path as specified in Table 3.1.a.

multi_occurrence attribute

Specifies whether this element or attribute can occur more than once in an XML document. Values can be YES or NO.

Xcollection

Defines the mapping between XML documents and an XML collection of relational tables.

Syntax:

```
<!ELEMENT Xcollection(SQL_stmt?, prolog, doctype, root_node)>
```

`Xcollection` has the following child elements:

SQL_stmt

Specifies the SQL statement that XML Extender uses to define the collection. Specifically, the statement selects XML data from the XML collection tables, and uses the data to generate the XML documents in the collection. The value of this element must be a valid SQL statement. It is only used for composition, and only a single `SQL_stmt` is allowed.

Syntax: `<!ELEMENT SQL_stmt  #PCDATA >`

prolog

The text for the XML prolog. The same prolog is supplied to all documents in the entire collection. The value of `prolog` is fixed.

Syntax: `<!ELEMENT prolog  #PCDATA>`

doctype

Defines the text for the XML document type definition.

Syntax:

```
<!ELEMENT doctype (#PCDATA | RDB_node)*>
```

`doctype` is used to specify the DOCTYPE of the resulting document. Define an explicit value. This value is supplied to all documents in the entire collection.

`doctype` has one child element:

root_node
: Defines the virtual root node. `root_node` must have one required child element, `element_node`, which can be used only once. The `element_node` under the `root_node` is actually the `root_node` of the XML document.

  Syntax: `<!ELEMENT root_node(element_node)>`

RDB_node
: Defines the DB2 UDB table where the content of an XML element or value of an XML attribute is to be stored or from where it will be retrieved. rdb_node is a child element of element_node, text_node, and attribute_node and has the following child elements:

  table Specifies the table in which the element or attribute content is stored.

  column
  Specifies the column in which the element or attribute content is stored.

  condition
  Specifies a condition for the column. Optional.

element_node
: Represents an XML element. It must be defined in the DAD specified for the collection. For the `RDB_node` mapping, the root `element_node` must have an `RDB_node` to specify all tables containing XML data for itself and all of its child nodes. It can have zero or more `attribute_nodes` and child `element_nodes`, as well as zero or one `text_node`. For elements other than the root element no RDB_node is needed.

  Syntax:

  An `element_node` is defined by the following child elements:

  RDB_node
  (Optional) Specifies tables, column, and conditions for XML data. The RDB_node for an element needs to be defined only for the RDB_node mapping. In this case, one or more tables must be specified. The column is not needed because the element content is specified by its text_node. The condition is optional, depending on the DTD and query condition.

  child nodes
  Optional: An `element_node` can also have the following child nodes:

  element_node
  Represents child elements of the current XML element.

  attribute_node
  Represents attributes of the current XML element.

  text_node
  Represents the CDATA text of the current XML element.

attribute_node

Represents an XML attribute. It is the node that defines the mapping between an XML attribute and the column data in a relational table.

Syntax:

The `attribute_node` must have definitions for a `name` attribute, and either a `column` or a `RDB_node` child element. `attribute_node` has the following attribute:

name The name of the attribute.

`attribute_node` has the following child elements:

column

Used for the SQL mapping. The column must be specified in the SELECT clause of `SQL_stmt`.

RDB_node

Used for the RDB_node mapping. The node defines the mapping between this attribute and the column data in the relational table The table and column must be specified. The condition is optional.

text_node

Represents the text content of an XML element. It is the node that defines the mapping between an XML element content and the column data in a relational table.

Syntax: It must be defined by a `column` or an `RDB_node` child element:

column

Needed for the SQL mapping. In this case, the column must be in the SELECT clause of `SQL_stmt`.

RDB_node

Needed for the RDB_node mapping. The node defines the mapping between this text content and the column data in the relational table. The `table` and `column` must be specified. The condition is optional.

Related concepts:

- "DAD files for XML collections" on page 169

Related tasks:

- "Dynamically overriding values in the DAD file" on page 177

Dynamically overriding values in the DAD file

Procedure:

For dynamic queries you can use two optional parameters to override conditions in the DAD file: *override* and *overrideType*. Based on the input from *overrideType*, the application can override the <SQL_stmt> tag values for SQL mapping or the conditions in RDB_nodes for RDB_node mapping in the DAD.

These parameters have the following values and rules:

overrideType
This parameter is a required input parameter (IN) that flags the type of the *override* parameter. The *overrideType* parameter has the following values:

NO_OVERRIDE
Specifies not to override a condition in the DAD file.

SQL_OVERRIDE
Specifies to override a condition in the DAD file with an SQL statement.

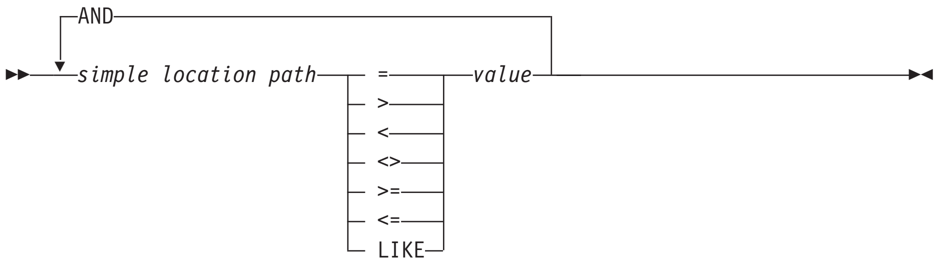
XML_OVERRIDE
Specifies to override a condition in the DAD file with an XPath-based condition.

override
This parameter is an optional input parameter (IN) that specifies the override condition for the DAD file. The syntax of the input value corresponds to the value specified on the *overrideType* parameter:

- If you specify NO_OVERRIDE, the input value is a NULL string.
- If you specify SQL_OVERRIDE, the input value is a valid SQL statement.

  If you use SQL_OVERRIDE as an SQL statement, you must use the SQL mapping scheme in the DAD file. The input SQL statement overrides the SQL statement specified by the <SQL_stmt> element in the DAD file.
- If you specify XML_OVERRIDE, the input value is a string that contains one or more expressions.

  If you use XML_OVERRIDE and an expression, you must use the RDB_node mapping scheme in the DAD file. The input XML expression overrides the RDB_node condition specified in the DAD file. The expression uses the following syntax:



This syntax has the following components:

simple location path
Specifies a simple location path, using syntax defined by XPath..

operators
The SQL operators shown in the syntax diagram can have a space to separate the operator from the other parts of the expression.

Spaces around the operators are optional. Spaces are mandatory around the LIKE operator.

value
A numeric value or a string enclosed in single quotation marks.

AND
And is treated as a logical operator on the same location path. If a simple location path is specified more than once in the override string, then all the predicates for that simple location path are applied simultaneously.

If you specify XML_OVERRIDE, the condition for the RDB_node in the text_node or attribute_node that matches the simple location path is overridden by the specified expression.

XML_OVERRIDE is not completely XPath compliant. The simple location path is used only to identify the element or attribute that is mapped to a column.

The following examples use SQL_OVERRIDE and XML_OVERRIDE to show dynamic override.

Example 1: A stored procedure using SQL_OVERRIDE. In this example, the <xcollection> element in the DAD file must have an <SQL_stmt> element. The *override* parameter overrides the value of <SQL_stmt>, by changing the price to be greater than 50.00, and the date to be greater than 1998-12-01.

```
#include "dxx.h"
#include "dxxrc.h"

EXEC SQL INCLUDE SQLCA;
EXEC SQL BEGIN DECLARE SECTION;
char    collectionName[32]; /* name of an XML collection */
char    result_tab[32];     /* name of the result table */
char    result_colname[32]; /* name of the result column */
char    valid_colname[32];  /* name of the valid column, will set to NULL*/
char    override[512];      /* override */
short   overrideType;       /* defined in dxx.h */
short   max_row;            /* maximum number of rows */
short   num_row;            /* actual number of rows */
long    returnCode;         /* return error code */
char    returnMsg[1024];    /* error message text */
short   collectionName_ind;
short   rtab_ind;
short   rcol_ind;
short   vcol_ind;
short   ovtype_ind;
short   ov_ind;
short   maxrow_ind;+
short   numrow_ind;
short   returnCode_ind;
short   returnMsg_ind;
EXEC SQL END DECLARE SECTION;
float price_value;

/* create table */
EXEC SQL CREATE TABLE xml_order_tab (xmlorder XMLVarchar);

/* initial host variable and indicators */
strcpy(collection, "sales_ord");
strcpy(result_tab,"xml_order_tab");
strcpy(result_col,"xmlorder");
valid_colname[0] = '\0';

/* get the price_value from some place, such as from data */
price_value = 1000.00        /* for example */

/* specify the override */
sprintf(override,
  " SELECT o.order_key, customer, p.part_key,
    quatity, price, tax, ship_id, date, mode
  FROM order_tab o, part_tab p,
     table(select db2xml.generate_unique()
     as ship_id, date, mode from ship_tab) s
 WHERE p.price > %d and s.date >'1996-06_01' AND
     p.order_key = o.order_key and s.part_key = p.part_key",
     price_value);
```

```
overrideType = SQL_OVERRIDE;
max_row = 0;
num_row = 0;
returnCode = 0;
msg_txt[0] = '\0';
collectionName_ind = 0;
rtab_ind = 0;
rcol_ind = 0;
vcol_ind = -1;
ov_ind = 0;
ovtype_ind = 0;
maxrow_ind = 0;
numrow_ind = -1;
returnCode_ind = -1;
returnMsg_ind = -1;

/* Call the store procedure */
EXEC SQL CALL "DB2XML.DXXRETRIEVEXML" (:collectionName:collectionName_ind,
                                  :result_tab:rtab_ind,
                                  :result_colname:rcol_ind,
                                  :valid_colname:vcol_ind,
                                  :overrideType:ovtype_ind,:override:ov_ind,
                                  :max_row:maxrow_ind,:num_row:numrow_ind,
                                  :returnCode:returnCode_ind,
            :returnMsg:returnMsg_ind);

if (SQLCODE < 0) {
    EXEC SQL ROLLBACK;
  else
    EXEC SQL COMMIT;
}
```

Example 2: A stored procedure using XML_OVERRIDE. In this example, the <collection> element in the DAD file has an RDB_node for the root element_node. The *override* value is XML-content based. The XML Extender converts the simple location path to the mapped DB2 UDB column.

```
#include "dxx.h"
#include "dxxrc.h"

EXEC SQL INCLUDE SQLCA;
EXEC SQL BEGIN DECLARE SECTION;
char    collectionName[32]; /* name of an XML collection */
char    result_tab[32];     /* name of the result table */
char    result_colname[32]; /* name of the result column */
char    valid_colname[32];  /* name of the valid column, will set to NULL*/
char    override[256];      /* override, SQL_stmt*/
short   overrideType;       /* defined in dxx.h */
short   max_row;            /* maximum number of rows */
short   num_row;            /* actual number of rows */
long    returnCode;         /* return error code */
char    returnMsg[1024];    /* error message text */
short   collectionName_ind;
short   rtab_ind;
short   rcol_ind;
short   vcol_ind;
short   ovtype_ind;
short   ov_ind;
short   maxrow_ind;
short   numrow_ind;
short   returnCode_ind;
short   returnMsg_ind;
EXEC SQL END DECLARE SECTION;

/* create table */
EXEC SQL CREATE TABLE xml_order_tab (xmlorder XMLVarchar);
```

```
/* initial host variable and indicators */
strcpy(collection, "sales_ord");
strcpy(result_tab,"xml_order_tab");
strcpy(result_col,"xmlorder");
valid_colname[0] = '\0';
sprintf(override,"%s %s",
           "/Order/Part Price > 50.00 AND ",
           "/Order/Part/Shipment/ShipDate > '1998-12-01'");
overrideType = XML_OVERRIDE;
max_row = 500;
num_row = 0;
returnCode = 0;
msg_txt[0] = '\0';
collectionName_ind = 0;
rtab_ind = 0;
rcol_ind = 0;
vcol_ind = -1;
ov_ind = 0;
ovtype_ind = 0;
maxrow_ind = 0;
numrow_ind = -1;
returnCode_ind = -1;
returnMsg_ind = -1;

/* Call the store procedure */
EXEC SQL CALL "DB2XML.DXXRETRIEVE"
          (:collectionName:collectionName_ind,
           :result_tab:rtab_ind,
           :result_colname:rcol_ind,
           :valid_colname:vcol_ind,
            :overrideType:ovtype_ind,:override:ov_ind,
           :max_row:maxrow_ind,:num_row:numrow_ind,
           :returnCode:returnCode_ind,:returnMsg:returnMsg_ind);

if (SQLCODE < 0) {
    EXEC SQL ROLLBACK;
  else
    EXEC SQL COMMIT;
}
```

Multiple Overrides

XML Extender supports multiple overrides on the same path. All overrides specified to the RDB node will be accepted.

You can specify multiple XML overrides on the same location path to refine set conditions in your search. In the following example, an XML document is composed from the two tables using the test.dad file.

Table 48. Department Table

Department Number	Department Name
10	Engineering
20	Operations
30	Marketing

Table 49. Employee Table

Employee Number	Department Number	Salary
123	10	$98,000.00
456	10	$87,000.00

Table 49. Employee Table (continued)

Employee Number	Department Number	Salary
111	20	$65,000.00
222	20	$71,000.00
333	20	$66,000.00
500	30	$55,000.00

The DAD file `test.dad` illustrated below contains a condition comparing the variable *deptno* with the value 10. To expand the search to greater than 10 and less than 30, you must override this condition. You must set the override parameter when calling dXXGenXML as follows:

```
/ABC.com/Department>10 AND /ABC.com/Department<30

<?xml version="1.0"?>
<!DOCTYPE DAD SYSTEM "C:\dxx_xml\test\dtd\dad.dtd">
<DAD>
<dtdid>E:\dtd\lineItem.dtd</dtdid>
<validation>NO</validation>
<Xcollection>
<porlog>?xmol version="1.0"?</prolog>
<doctype>!DOCTYPE Order SYSTEM "C:\dxx_xml\test\dtd\LineItem.dtd"</doctype>
<root_node>
<element_node name="ABC.com">
<TDB_node>
<table name="dept" key="deptno"/>
<table name="empl" key="emplno"/>
<condition>dept deptno=empl.deptno</condition>
</RDB_node>

<element_node name="Department" multi_occurrence="YES">
<text_node>
<RDB_node>
<table name="dept"/>
<column name="deptno">
<condition>deptno=10</condition><RDB_node></RDB_node><text_node></text_node>
<element_node name="Employees" multi_occurrence="YES">

<text_node>

<RDB_node>

<table name="dept"><column name="deptnot"><condition>deptno=10</condition>
</table></RDB_node></text_node>
<element_node name="Employees" multi_occurence="YES">

<element_node name="EmployeeNo">

<text_node>

<RDB_node>

<table name="empl"><column name="emplno"><condition>emplno<500</condition>
</table></RDB_node></text_node></element_node>
<element_node name="Salary">

<text_node>

<RDB_node>

<table name="empl"><column name="salary"><condition>salary>5000.00</condition>
</table></RDB_node></text_node></element_node></element_node></element_node>
```

To compose an XML document without an override, enter tests2x mydb test.dad result_tab or you can invoke dxxGenXML without setting an override. This will generate a document similar to this:

```
<?xml version="1.0">
<!DOCTYPE Order SYSTEM "C:\dxx_xml\test\dtd\LineItem.dtd">
<ABC.com>
<Department>10
<Employees>
<EmployeeNo>123</EmployeeNO>
<Salary>98,000.00</Salary>
</Employees>
<Employees>
<EmployeeNo>456</EmployeeNo>
<Salary>87,000.00</Salary>
</Employees>
</Department>
</ABC.COM>
```

To override the DAD file you can invoke dxxGenXML as mentioned above, or you can run the test2x program with the specified conditions:

tests2x mydb test.dad result_tab -o 2 ″/ABC.com/Department>10 AND /ABC.com/Department<30″

```
<?xml version="1.0">
<!DOCTYPE Order SYSTEM "C:\dxx_xml\test\dtd\LineItem.dtd">
<ABC.com>
<Department>20
<Employees>
<EmployeeNo>111</EmployeeNo>
<Salary>65,000.00</Salary>
</Employees>
<EmployeeNo>222</EmployeeNo>
<Salary>71,000.00</Salary>
</Employees>
<Employees>
<EmployeeNo>333</EmployeeNo>
<Salary>66,000.00</Salary>
</Employees>
</Department>
</ABC.com>
```

Related concepts:

- “DAD files for XML collections” on page 169
- “Dad Checker” on page 183

Related tasks:

- “Creating a DAD file for XML columns” on page 167
- “Using the DAD checker” on page 184

Related reference:

- “DTD for the DAD file” on page 173

Dad Checker

The DAD checker can be used to verify the validity of DAD files that use the XML collection storage method. In each DAD file a mapping scheme that specifies the relationship between the tables and the structure of the XML document is specified.

Much like document type descriptions (DTDs) are used to validate the syntax of XML documents, the DAD checker is used to ensure that a DAD file is semantically correct. This validation can take place without connecting to a database. Use of the DAD checker can help minimize the number of errors that occur when submitting the file to the XML Extender for processing. The DAD checker is a Java™ application that is called from the command line. When invoked, it produces a set of two output files that contain errors, warnings, and success indicators. The two files are equivalent; one is a plain text file that you use to check for errors or warnings; the other is an XML file, `errorsOutput.xml`, which communicates the results of the DAD checker application to other applications. The name of the output text file is user-defined. If no name is specified, the standard output is used.

Related concepts:
- "DAD files for XML collections" on page 169

Related tasks:
- "Dynamically overriding values in the DAD file" on page 177
- "Creating a DAD file for XML columns" on page 167
- "Using the DAD checker" on page 184

Using the DAD checker

Prerequisites:

You must have a JRE or JDK Version 1.3.1 or later installed on your system.

Procedure:

To use the DAD checker:
1. Download the DADChecker.zip file, and extract all files into a directory of your choice.
2. From a command line change to the `/bin` subdirectory in the directory where you installed the DAD checker.
3. Set the classpath by running the setCP.bat file, located in the `/bin` directory.
4. Run the following command:
```
java dadchecker.Check_dad_xml [-dad | -xml] [-all][-tag tagname]
[-out outputFile] fileToCheck
```
   Where:

   -dad
      indicates that the file that is to be checked is a DAD file. This is the default option.

   -xml
      indicates that the file that is to be checked is an XML document rather than a DAD file. For large XML documents, the Java Virtual Machine might run out of memory, which produces a java.lang. OutOfMemoryError exception. In such cases, the -Xmx option can be used to allocate more memory to the Java Virtual Machine. See the JDK documentation for details.

   -all
      indicates that the output will show all occurrences of tags that are in error.

-tag
: indicates that only the duplicate tags whose name attribute values are *tagname* are displayed. For XML documents, only the duplicate tags whose name are tagname are displayed.

-out
: *outputFile* specifies the output text file name. If omitted, the standard output is used. A second output file, `errorsOutput.xml` is also created in the same directory as the DAD file. This file is always generated and contains in XML form the same information as the output text file except the parser warnings and errors.

To display command-line options, type `java dadchecker.Check_dad_xml help`.

To display version information, type `java dadchecker.Check_dad_xml version`.

Sample files for Dad Checker:

The following sample files can be found in the `samples` directory:

bad_dad.dad
: sample DAD file that demonstrates all possible semantic errors.

bad_dad.chk
: output text file that is generated by the DAD checker for bad_dad.dad.

bad_dad.chk
: output text file that is generated by the DAD checker for bad_dad.dad.

errorsOutput.xml
: output XML file that is generated by the DAD checker for bad_dad.dad.

dup.xsl
: XSL stylesheet used for transforming the errorsOutput.xml file into an HTML file that shows only the duplicate tags.

dups.html
: generated HTML file that shows only the duplicate tags contained in bad_dad.dad.

Errors and warnings in the output text file:

Errors and warnings are indicated by tag occurrence. Two tags are considered as occurrences of the same tag if:

- Their name attributes have the same value.
- They have the same number of ancestors.
- The name attributes of their corresponding ancestor tags have the same value.

Occurrences of the same tag could potentially have different children tags.

Tag occurrences that do not conform to the DAD semantic rules are indicated in the output text file in the following way:

- All ancestor tags and their attributes are displayed in sequence.
- The tag that is in error is displayed, preceded by a number indicating its depth in the XML tree. The tag name is followed by a list of line numbers where all occurrences of the tag appear in the DAD file. You can display each error occurrence separately by using the *-all* command line option.

- The direct children tags of the first tag occurrence are displayed. For those children tags that specify a data mapping, the data mapping tags are also displayed. You can use the *-all* command line option to display each error occurrence separately.

Sample of an error report for DAD Checker:

In this example, the element_node tag whose name attribute has the value ″Password″ is in error. There are two occurrences of this tag in the DAD file, one on line 49, and one on line 75. The tag in error can be isolated from the list of ancestor and children tags by locating the tag's depth indicator (in this example 4). The list of ancestor and children tags help establish the context in which the error occurred.

```
<DAD>
 <Xcollection>
  <root_node>
   <element_node name="Advertiser" multi_occurrence="YES">
4   <element_node name="Password"> line(s): 49 75
     <element_node name="Pswd1">
     <element_node name="Pswd2">
```

If you had used the all option, the output text file would look like this:

```
<DAD>
 <Xcollection>
  <root_node>
   <element_node name="Advertiser" multi_occurrence="YES">
4   <element_node name="Password">  line: 49
     <element_node name="Pswd1">
      <element_node name="Pswd2">


<DAD>
 <Xcollection>
  <root_node>
   <element_node name="Advertiser" multi_occurrence="YES">
4   <element_node name="Password">  line: 75
    <element_node name="Pswd1">
    <element_node name="Pswd3">
```

In this example, two occurrences have identical ancestors and name attribute values, but different children elements.

Checks performed by the DAD checker

When you invoke the DAD checker you receive the following message:

```
Checking DAD document: file_path
```

where *file_path* is the path to the DAD file being validated.

The DAD checker performs the following validation checks:

1. Well-formedness checking and DTD validation.
2. Duplicate <attribute_node> and leaf <element_node> detection (RDB_node mapping).
3. Missing type attribute detection.
4. Missing table declaration detection.
5. Missing <text_node> or <attribute_node> detection.
6. <attribute_node> and <element_node> mapping order check.
7. Data mapping consistency check for tags with identical name attribute values.

8. Multi_occurrence attribute value checking for parent <element_node> with mapped children (RDB_node mapping).
9. Attribute and element potential naming conflict check (XML documents).

These validation checks are described in the following sections.

Well-formedness and DTD validation

DAD files must be validated against the DAD DTD, which is located in ″c:\dxx_installsamples\db2xml\dtd\dad.dtd″ If the DAD file is not well-formed or if the DTD cannot be found, a fatal error occurs that causes the DAD checker to terminate, and is indicated in the output text file. For example:

```
org.xml.sax.SAXException: Stopping after fatal error,
line 1, col 22. The XML declaration must end with "?>".
```

Validation errors and warnings are also reported in the output text file, but do not cause the DAD checker to terminate. The following example is a fragment of an output text file showing two possible validation errors that can be encountered while parsing the DAD file:

```
 ** The document is not valid against the DTD, line 5, col 15. Element type
     "XCollection" must be declared

** The document is not valid against the DTD, line 578, col 21. The content of
      element type "text_node" must match "(column|RDB_node)".
```

Duplicate <attribute_node> and leaf <element_node> detection (RDB_node mapping)

This check is relevant only to DAD files that use RDB_node mapping.

Two elements are considered to be duplicates if two or more <attribute_node> or <element_node> tags have the same value in their name attribute and they have the same ancestor.

Two or more tags are considered to have the same ancestors if the name attributes of their corresponding ancestor tags have the same value.

A leaf <element_node> is an element_node that is used to map a tag that has no children in the XML document tree. Therefore, leaf <element_node> tags must have one text node tag as one of their direct children. No other <element_node> tags can have text node tags as direct children.

This conflict might arise either between two or more leaf <element_node> tags, between two or more <attribute_node> tags, or between leaf <element_node> tags and <attribute_node> tags.

Examples:

Example 1:

Leaf <element_node> conflict:

```
<element_node name = "A1">
  <element_node name = "B">
    <element_node name = "C">
       <text_node
          ....
<element_node name = "A2">
  <element_node name = "B">
```

```
   <element_node name = "C">
      <text_node>
       ....
</element_node>
```

In this example, <element_node name = ″C″> is duplicated, because it is mapped through two different paths: \A1\B\C and \A2\B\C. Note that <element_node name=″B″> is not considered to be duplicated, because it is a non-leaf <element_node>.

Example 2:

This example shows an <attribute node> conflict.

```
<element_node name = "A1">
    <attribute_node name = "B">
                  ....
<element_node name = "A2">
    <attribute_node name = "B">
 /element_node>               ....
<
```

In this example, <attribute_node name = ″B″> is duplicated, because it is mapped through two different paths: \A1\B and \A2\B.

Example 3:

This example shows a leaf <element_node> and <attribute_node> conflict.

```
<element_node name = "A">
    <element_node name = "B">
         <text_node>
            ....
     </element_node>
</element_node>
           ....
<attribute_node name = "B">
           ....
<attribute_node name = "A">
           ....
```

In this example, <element_node name = ″B″> conflicts with <attribute_node name = ″B″>. Note that <element_node name = ″A″> and <attribute_node name = ″A″> do not conflict, because <element_node name = ″A″> is not a leaf <element_node>.

If conflicts occur, the XML document DTD must be revised to eliminate the conflicts. The XML document and the DAD file also need to be revised to reflect the DTD changes.

Example 4:

```
7 duplicate naming conflicts were found
A total of 16 tags are in error (cumulate occurrences of these tags: 20)

The following tags are duplicates:

<DAD>
  <Xcollection>
   <root_node>
     <element_node name="Advertiser" multi_occurrence="YES">
 4       <element_node name="Country">  line(s): 127 135
        <text_node>
        <RDB_node>
         <table name="advertiser">
         <column type="VARCHAR(63)" name="country">

------------
<DAD>
<Xcollection>
  <root_node>
    <element_node name="Advertiser" multi_occurrence="YES">
     <element_node name="Campaign" multi_occurrence="YES">
      <element_node name="Target" multi_occurrence="YES">
       <element_node name="Location" multi_occurrence="YES">
 7         <element_node name="Country">  line(s): 460
            <text_node>
             <RDB_node>
               <table name="target_location">
               <column type="VARCHAR(63)" name="country">
-----------------------------------------------------------
```

Tags that are in error are grouped by naming conflict. The groups are separated by lines, and the tags are separated by short lines. You can also display all the error occurrences by using the *all* command line option.

If there are no duplicates in the DAD file, the following message is written in the output text file:

```
No duplicated tags were found.
```

Missing type attribute detection

When using a DAD file to enable a collection or for decomposition, the type attribute must be specified for each <column> tag. For example:

```
<column name="email" type="varchar(20)">
```

The enable_collection command uses the column type specifications to create the tables in the collection if the tables do not exist. If the tables do exist, the type specified in the DAD must match the actual column type in the database.

Example:

The following example is a fragment of an output text file showing <column> tags that do not have the type attribute:

```
If this DAD is to be used for decomposition or for enabling a collection,
the type attributes are missing for the following <column> tag(s):
<DAD>
  <Xcollection>
   <root_node>
     <element_node name="Advertiser" multi_occurrence="YES">
      <element_node name="Address">
       <text_node>
         <RDB_node>
7           <column name="address">  line: 86
```

If no type attributes are missing, the following message is written in the output text file:

```
No type attributes are missing for <column> tags.
```

Missing table declaration detection

The first <RDB_node> tag in the DAD file must enclose the table declaration, including all <table> tags which declare the relational tables that are used for data mapping. This tag must be enclosed in the first <element_node> tag. All subsequent <RDB_node> tags must be enclosed in a <text_node> tag.

An error is also added to the output file if the first encountered <RDB_node> tag contains a <column> tag. This error indicates either that the table declaration is missing, or that the table declaration wrongly contains a <column> tag.

Missing <text_node> or <attribute_node> detection

Each <RDB_node> tag other than the first one, which is used for the table declaration, must be enclosed in an <attribute_node> or a <text_node> tag.

Examples:

Example 1:

```
<element_node name ="amount">
<text_node>
<RDB_node>
<table name="fakebank.payments"/>
<column name="amount" type="decimal(8,2)"/>
</RDB_node>
</element_node>
```

Example 2:

The following example is a fragment of an output text file showing a missing <text_node> or <attribute_node> tag:

```
<DAD>
  <Xcollection>
   <root_node>
     <element_node name="Advertiser" multi_occurrence="YES">
      <element_node name="PostalCode">
5         <RDB_node>  line: 107
           <table name="advertiser">
            <column type="VARCHAR(10)" name="postal_code">
```

Check for <attribute_node> and <element_node> mapping order

This check is required for FixPak 3 and earlier. The <attribute_node> tags need to be mapped to a table before any <element_node> tags are mapped to the table.

Example:

The following example shows tags that need to be mapped to a table.

```
<element_node name="payment-request"
multi_occurrence="YES">
     <element_node name="payment-request-id">
        <text_node>
           <RDB_node>
             <table name="fakebank.payments"/>
             <column name="statement_id" type="varchar(30)"/>
                  ....
      <element_node name="bank-customer-info">
        <element_node name="account">
          <attribute_node name="type">
            <text_node>
              <RDB_node>
                 <table name="fakebank.payments"/>
                 <column name="payor_account" type="char(6)"/
```

In this example, <attribute_node name=″type″> is mapped to the same table (fakebank.payments) as <element_node name = ″payment-request-id″>. The mapping of the <attribute_node> must precede the mapping of the <element_node>.

Data mapping consistency check for tags with identical name attribute values

Within the DAD file, all <element_node> tags and all <attribute_node> tags that are mapped and, identified by distinct name attribute values should be mapped only once. If two or more occurrences of an <element_node> tag or <attribute_node> tag are mapped to different columns, their name attributes should be assigned different values.

Example:

Example 1: In this example, the second occurrence of the <element_node name="type"> tag has a different mapping than the first occurrence. Duplicate <attribute_node> and duplicate leaf <element_node> tags are not displayed as a result of this check.

```
<element_node name="bank-customer-info">
   <element_node name="account">
      <element_node name="type">
         <text_node>
            <RDB_node>
              <table name="fakebank.payments"/>
              <column name="payor_account" type="char(20)
            </RDB_node>
         </text_node>
      </element_node>
      <element_node>
<element_node>
<element_node name="bank-customer-info">
    <element_node name="account">
      <element_node name="type">
         <text_node>
           <RDB_node>
              <table name="fakebank.payments"/>
              <column name="payto_account" type="char(20)"/>
           </RDB_node>
         </text_node>
       </element_node>
</element_node>
<element_node>
```

You can fix this error by creating a new element to use with the second mapping. You also need to change the DTD, the XML document, and the DAD file.

Example 2: This example is a fragment of an output text file that indicates <element_node> tags that have the same names and ancestors, but not the same mappings.

```
<DAD>
  <Xcollection>
   <root_node>
    <element_node name="Advertiser" multi_occurrence="YES">
4      <element_node name="PostalCode">  line(s): 127
       <text_node>
       <RDB_node>
       <table name="advertiser">
        <column type="VARCHAR(10)" name="postal_code">
----------------
<DAD>
  <Xcollection>
    <root_node>
      <element_node name="Advertiser" multi_occurrence="YES">
4         <element_node name="PostalCode">  line(s): 135 143
          <text_node>
```

```
           <RDB_node>
             <table name="advertiser">
              <column type="VARCHAR(10)" name="postal_code2">
```

In this example, one occurrence of the <element_node name=″PostalCode″> on line 127 is mapped to the 'postal_code' column, and two other occurrences of the same tag, on lines 135 and 143, are mapped to the 'postal_code2' column.

Multi_occurrence attribute value checking for parent <element_node> with mapped children

This check is relevant only to DAD files that use RDB-node mapping.

The default value for the multi_occurrence attribute is NO. The multi_occurrence attribute should be assigned the value YES for each <element_node> tag that has as direct children an <attribute_node> tag or two or more <element_node> tags meeting one or two of the following criteria:

- The <element_node> is mapped (it has a <text_node> as its direct child).
- The <element_node> has at least one <attribute_node> as a direct child.

Example:

Example 1: In the following example, payment-request-id and amount are mapped to a DB2 UDB table. Sender has an <attribute_node> as a direct child. Payment-request-id, amount and sender are all direct children of payment-request:

```
<element_node name="payment-request" multi_occurrence="YES">
  <element_node name="payment-request-id">
     <text_node>
        <RDB_node>
           <table name="fakebank.payments"/>
            <column name="statement_id" type="varchar(30)"/>
        </RDB_node>
      </text_node>
  </element_node>
 <element_node name ="amount">
      <text_node>
        <RDB_node>
          <table name="fakebank.payments"/>
           <column name="amount" type="decimal(8,2)"/>
        </RDB_node>
      </text_node>
  </element_node>
  <element_node name ="sender">
     <attribute_node name ="ID">
         <RDB_node>
            <table name="fakebank.payments"/>
            <column name="sender_ID" type="decimal(8,2)"/>
          </RDB_node>
      </attribute_node>
  </element_node>
  </element_node>
```

The DAD checker indicates all <element_node> tags whose multi_occurrence attributes are set to NO.

Example 2: The following example is a fragment of an output text file suggesting <element_node> tags whose multi_occurrence attributes should be set to YES.

```
<DAD>
 <Xcollection>
   <root_node>
```

```
     <element_node name="Advertiser" multi_occurrence="YES">
4       <element_node name="Password">  line(s): 49 75
        <element_node name="Pswd1">
        <element_node name="Pswd2">
```

Attribute and element naming conflict

In XML documents, elements with the same name can appear in different contexts, such as having different ancestor elements. Attributes and elements can have identical names.

The DAD checker can be used to check XML documents for naming conflicts. If more than one of the conflicting elements or attributes needs to be mapped, then naming changes should be made to the document and the DTD.

It is best to check the XML document before the DAD file is created. The DAD checker does not validate the XML document against its DTD.

Example:

The following example is a fragment of an XML document where naming conflicts occur:

```
<A1>
  <B>
     <C>
          ....
<A2>
   <B>
      <C>
          ....
<D C="attValue">
.....

If the <C> element and the C attribute are to be mapped, then the resulting
DAD file would have the following duplicate conflicts:
<element_node name = "A1">
    <element_node name = "B">
       <element_node name = "C">
          <text_node>
            .....
<element_node name = "A2">
    <element_node name = "B">
       <element_node name = "C">
          <text_node>
            ....
      <element_node name = "D">
         <attribute_node name = "C">
          ....
</element_node>
```

The two <element_node name = ″C″> tags and the <attribute_node name = ″C″> tag are duplicates in the DAD.

Chapter 10. XML Extender stored procedures

XML Extender stored procedures

The XML Extender provides stored procedures for administration and management of XML columns and collections. These stored procedures can be called from the DB2 client. The client interface can be embedded in SQL, ODBC, or JDBC. See the section on stored procedures in the *DB2 UDB for OS/390 Administration Guide* for details about how to call stored procedures.

The stored procedures use the schema DB2XML, which is the schema name of the XML Extender.

The XML Extender provides three types of stored procedures:

Administration stored procedures
assist users in completing administrative tasks

Composition stored procedures
generate XML documents using data in existing database tables

Decomposition stored procedures
break down or shred incoming XML documents and store data in new or existing database tables

Ensure that you include the XML Extender external header files in the program that calls stored procedures. The header files are located in the ″*$dxx_install$*\dxx\samples\db2xml\include″ directory, where *$dxx_install$* is the directory where you installed DB2 XML Extender. The header files are:

dxx.h	The XML Extender defined constant and data types
dxxrc.h	The XML Extender return code

The syntax for including these header files is:

```
#include "dxx.h"
#include "dxxrc.h"
```

Make sure that the path of the include files is specified in your makefile with the compilation option.

XML Extender administration stored procedures

These stored procedures are used for administration tasks, such as enabling or disabling an XML column or collection. They are called by the XML Extender administration wizard and the administration command **dxxadm**.

- dxxEnableDB()
- dxxDisableDB()
- dxxEnableColumn()
- dxxDisableColumn()
- dxxEnableCollection()
- dxxDisableCollection()

dxxEnableDB() stored procedure

Purpose:

Enables the database server. When the database server is enabled, the XML Extender creates the following objects:

- The XML Extender user-defined types (UDTs)
- The XML Extender user-defined functions (UDFs)
- The XML Extender stored procedures
- The XML Extender DTD repository table, DTD_REF, which stores DTDs and information about each DTD.
- The XML Extender usage table, XML_USAGE, which stores common information for each column that is enabled for XML and for each collection.

Syntax:

```
dxxEnableDB(long           varchar (64)   wlmNames      /* input */
          varchar (18)   extSecurity   /* input */
          returnCode,         /* output */
                   varchar(1024)  returnMsg)    /* output */
```

Parameters:

Table 50. dxxEnableSRV() parameters

Parameter	Description	IN/OUT parameter
returnCode	The return code from the stored procedure.	OUT
returnMsg	The message text that is returned in case of error.	OUT
wlmNames	The names of the WLM environments.	IN
extSecurity	The external security option; values can be DB2 UDB (default), USER, or DEFINER	IN

Related concepts:

- "XML Extender administration stored procedures" on page 195
- Chapter 13, "XML Extender administration support tables," on page 269

Related tasks:

- "Calling XML Extender composition stored procedures" on page 201

dxxDisableDB() stored procedure

Purpose:

Disables the database server. When the XML Extender disables the database server, it drops the following objects:

- The XML Extender user-defined types (UDTs).
- The XML Extender user-defined functions (UDFs).
- The XML Extender DTD repository table, DTD_REF, which stores DTDs and information about each DTD.

- The XML Extender usage table, XML_USAGE, which stores common information for each column that is enabled for XML and for each collection.

Important: You must disable all XML columns before attempting to disable a database server. The XML Extender cannot disable a database server that contains tables with columns or collections that are enabled for XML.

Syntax:

```
dxxDisableDB(
                  long          returnCode,   /* output */
                  varchar(1024) returnMsg)    /* output */
```

Parameters:

Table 51. dxxDisableDB() parameters

Parameter	Description	IN/OUT parameter
returnCode	The return code from the stored procedure.	OUT
returnMsg	The message text that is returned in case of error.	OUT

Related concepts:

- “XML Extender administration stored procedures” on page 195
- Chapter 13, “XML Extender administration support tables,” on page 269

Related tasks:

- “Calling XML Extender composition stored procedures” on page 201

Related reference:

- “How to read syntax diagrams” on page x

dxxEnableColumn() stored procedure

Purpose:

Enables an XML column. When enabling a column, the XML Extender completes the following tasks:

- Determines whether the XML table has a primary key; if not, the XML Extender alters the XML table and adds a column called DXXROOT_ID.
- Creates side tables that are specified in the DAD file with a column containing a unique identifier for each row in the XML table. This column is either the root_id that is specified by the user, or it is the DXXROOT_ID that was named by the XML Extender.
- Creates a default view for the XML table and its side tables, optionally using a name you specify.

Syntax:

```
DB2XML.dxxEnableColumn(char(tbName) tbName,      /* input */
                char(colName) colName,     /* input */
                CLOB(100K)     DAD,         /* input */
                char(tablespace) tablespace,  /* input */
                char(defaultView) defaultView, /* input */
```

```
                    char(rootID) rootID,      /* input */
                    long          returnCode,  /* output */
                    varchar(1024)  returnMsg)   /* output */
```

Parameters:

Table 52. dxxEnableColumn() parameters

Parameter	Description	IN/OUT parameter
tbName	The name of the table containing the XML column.	IN
colName	The name of the XML column.	IN
DAD	A CLOB containing the DAD file.	IN
tablespace	The table space that contains the side tables other than the default table space. If not specified, the default table space is used.	IN
defaultView	The name of the default view joining the application table and side tables.	IN
rootID	The name of the single primary key in the application table that is to be used as the root ID for the side table.	IN
returnCode	The return code from the stored procedure.	OUT
returnMsg	The message text that is returned in case of error.	OUT

Related concepts:

- "XML columns as a storage and access method" on page 73
- "XML Extender administration stored procedures" on page 195

Related tasks:

- "Calling XML Extender composition stored procedures" on page 201

Related reference:

- "How to read syntax diagrams" on page x
- Appendix C, "XML Extender limits," on page 311

dxxDisableColumn() stored procedure

Purpose:

Disables the XML-enabled column. When an XML column is disabled, it can no longer contain XML data types.

Syntax:

```
DB2XML.dxxDisableColumn(char(tbName) tbName,      /* input */
                 char(colName) colName,     /* input */
                 long           returnCode,  /* output */
                 varchar(1024)  returnMsg)   /* output */
```

Parameters:

Table 53. dxxDisableColumn() parameters

Parameter	Description	IN/OUT parameter
tbName	The name of the table containing the XML column.	IN
colName	The name of the XML column.	IN
returnCode	The return code from the stored procedure.	OUT
returnMsg	The message text that is returned in case of error.	OUT

Related reference:

- Appendix C, "XML Extender limits," on page 311

dxxEnableCollection() stored procedure

Purpose:

Enables an XML collection that is associated with an application table.

Syntax:

```
dxxEnableCollection(char() dbName,      /* input */
                    char(colName) colName,     /* input */
                    CLOB(100K)     DAD,         /* input */
                    char(tablespace) tablespace,  /* input */
  long           returnCode,  /* output */
                    varchar(1024)  returnMsg)   /* output */
```

Parameters:

Table 54. dxxEnableCollection() parameters

Parameter	Description	IN/OUT parameter
dbName	The database name.	IN
colName	The name of the XML collection.	IN
DAD	A CLOB containing the DAD file.	IN
tablespace	The table space that contains the side tables other than the default table space. If not specified, the default table space is used.	IN
returnCode	The return code from the stored procedure.	OUT
returnMsg	The message text that is returned in case of error.	OUT

Related concepts:

- "XML collections as a storage and access method" on page 91
- "XML Extender administration stored procedures" on page 195

Related tasks:

- "Calling XML Extender composition stored procedures" on page 201

Related reference:

- "How to read syntax diagrams" on page x
- Appendix C, "XML Extender limits," on page 311

dxxDisableCollection() stored procedure

Purpose:

Disables an XML-enabled collection, removing markers that identify tables and columns as part of a collection.

Syntax:

```
dxxDisableCollection(char(dbName) dbName,      /* input */
                     char(colName) colName,     /* input */
                     long          returnCode,  /* output */
                     varchar(1024)  returnMsg)   /* output */
```

Parameters:

Table 55. dxxDisableCollection() parameters

Parameter	Description	IN/OUT parameter
dbName	The database name.	IN
colName	The name of the XML collection.	IN
returnCode	The return code from the stored procedure.	OUT
returnMsg	The message text that is returned in case of error.	OUT

Related reference:

- Appendix C, "XML Extender limits," on page 311

XML Extender composition stored procedures

The composition stored procedures dxxGenXML(), dxxRetrieveXML(), dxxGenXMLCLOB(), and dxxRetrieveXMLCLOB() are used to generate XML documents using data in existing database tables. The dxxGenXML() stored procedure takes a DAD file as input; it does not require an enabled XML collection. The dxxRetrieveXML() stored procedure takes an enabled XML collection name as input.

The following performance enhancements have been made for composition stored procedures.

- On iSeries and zSeries operating systems, the length of the override parameter has been increased to 16KB.
- The requirement for an intermediate result table has been removed.
- By using these stored procedures:
  – You reduce the instruction path length because there is no need to create result tables.
  – You simplify your programming.
- Use the stored procedures that require an intermediate result table if you want to produce more than one document.

- The user-defined functions for XML column have been enhanced for performance
- The DB2 UDB XML Extender user-defined functions will now keep small (512KB) XML documents in memory while processing them. This reduces input/output activity and the contention for the disk that is used for temporary files.
- The definition of the DB2 UDB XML Extender scalar (non-table) user-defined functions has been changed so that they can run in parallel. This change provides significant performance improvements in the execution of queries that refer to the user-defined functions more than once. You must run the migration script program to get the parallel capability for the scalar UDFs. If you already have columns enabled using the scalar UDFs, you must disable all your columns, run the migration script and then re-enable the columns.

Calling XML Extender composition stored procedures

You can use XML Extender in different operating systems from a single client application, by writing the stored procedure names in both uppercase and lowercase. To call the stored procedures in this way, use the `result_colname` and `valid_colname` versions of the composition stored procedures. Using this method gives you the following benefits:

- You can use these stored procedures in all DB2 Universal Database environments because you can include many columns in the result table. The versions of the stored procedures that do not support `result_colname` and `valid_colname` require exactly one column in the result table.
- You can use a declared temporary table as your result table. Your temporary table is identified by a schema that is set to ″session″. Declared temporary tables enable you to support multi-user client environments.

Use uppercase when you call the DB2 XML Extender stored procedures to access the stored procedures consistently across platforms.

Prerequisites:

Run the DXXGPREP JCL job before working with stored procedures to initialize XML Extender.

Procedure:

Call XML Extender using the following syntax:

```
CALL DB2XML.function_entry_point
```

Where:

function_entry_point
: Specifies the name of the function.

In the CALL statement, the arguments that are passed to the stored procedure must be host variables, not constants or expressions. The host variables can have null indicators.

See samples for calling stored procedures in the `dxx_install/samples/db2xml/c` and `dxx_install/samples/db2xml/cli` directories. In the `dxx_install/samples/db2xml/c` directory, SQX code files are provided to call XML collection stored procedures using embedded SQL. In the `dxx_install/samples/db2xml/cli` directory, the sample files show how to call stored procedures using the Call Level Interface (CLI).

Increasing the CLOB limit for stored procedures

The default limit for CLOB parameters when passed to a stored procedure is 1 MB. You can increase the limit.

Procedure:

To increase the CLOB limit:

1. Drop each stored procedure. For example:

```
db2  "drop procedure DB2XML.dxxShredXML restrict"
```

2. Create a new procedure with the increased CLOB limit. For example:

```
| db2  "create procedure DB2XML!dxxShredXML(in    dadBuf     clob(100K),
|                                          in    XMLObj     clob(10M),
|                                          out   returnCode integer,
|                                          out   returnMsg  varchar(1024)
|                                          )
|       external name 'DB2XML.dxxShredXML_STP'
|       language C
|       parameter style SQL
|       not deterministic
|       fenced
|       null call"
```

Stored Procedures that return CLOBS

If you have CLOB files that are larger than 1 MB, XML Extender provides a command file to redefine the stored procedure parameter. Download the `crtgexc.zip` from the DB2 XML Extender Web site. This ZIP file contains the following programs:

crtgenxc.zox.jci and crtgenxc.zos.cmd

For use with XML Extender for OS/390 V7, APAR PQ58249 and later.

To specify the CLOB length: Open the file in an editor and modify the *resultDoc* parameter shown in the following example:

```
out resultDoc clob(clob_size),
```

If more than one document is generated, the stored procedure returns the first document.

Size recommendation: The size limit of the *resultDoc* parameter depends on your system setup. Be aware that the amount specified in this parameter is the amount allocated by JDBC, regardless of the size of the document. The size should accommodate your largest XML files, but should not exceed 1.5 gigabytes.

To run the command file, modify the JCL or CMD file contents. Submit the JCL or run the CMD from the USS.

dxxGenXML() stored procedure

Purpose:

Constructs XML documents using data that is stored in the XML collection tables that are specified by the <Xcollection> in the DAD file and inserts each XML document as a row into the result table. You can also open a cursor on the result table and fetch the result set.

To provide flexibility, dxxGenXML() also lets the user specify the maximum number of rows to be generated in the result table. This decreases the amount of time the application must wait for the results during any trial process. The stored procedure returns the number of actual rows in the table and any error information, including error codes and error messages.

To support dynamic query, dxxGenXML() takes an input parameter, *override*. Based on the input *overrideType*, the application can override the SQL_stmt for SQL mapping or the conditions in RDB_node for RDB_node mapping in the DAD file. The input parameter *overrideType* is used to clarify the type of the *override*.

Syntax:

```
dxxGenXML(CLOB(100K)     DAD,       /* input */
          char(resultTabName32) resultTabName, /* input */
          char resultColName, char resultValidCol /* input */

     char(30)       valid_column, /* input */
    integer        overrideType  /* input */
          varchar(1024)  override,     /* input */
      integer        maxRows,      /* input */
          integer        numRows,      /* output */
          long           returnCode,   /* output */
          varchar(1024)  returnMsg)    /* output */
```

Where the varchar_value is 32672 for Windows and UNIX, and 16366 for iSeries and z/OS.

Parameters:

Table 56. dxxGenXML() parameters

Parameter	Description	IN/OUT parameter
DAD	A CLOB containing the DAD file.	IN
resultTabName	The name of the result table, which should exist before the call. The table contains only one column of either XMLVARCHAR or XMLCLOB type.	IN
result_column	The name of the column in the result table in which the composed XML documents are stored.	IN
valid_column	The name of the column that indicates whether the XML document is valid when it is validated against a document type definition (DTD).	IN
overrideType	A flag to indicate the type of the following *override* parameter: • **NO_OVERRIDE**: No override. • **SQL_OVERRIDE**: Override by an SQL_stmt. • **XML_OVERRIDE**: Override by an XPath-based condition.	IN

Table 56. dxxGenXML() parameters (continued)

Parameter	Description	IN/OUT parameter
override	Overrides the condition in the DAD file. The input value is based on the *overrideType*. • **NO_OVERRIDE**: A NULL string. • **SQL_OVERRIDE**: A valid SQL statement. Using this *overrideType* requires that SQL mapping is used in the DAD file. The input SQL statement overrides the SQL_stmt in the DAD file. • **XML_OVERRIDE**: A string that contains one or more expressions in double quotation marks separated by ″AND″. Using this *overrideType* requires that RDB_node mapping is used in the DAD file.	IN
resultDoc	A CLOB that contains the composed XML document.	OUT
valid	valid is set as follows: • If VALIDATION=YES then valid=1 for successful validation or valid=0 for unsuccessful validation. • If VALIDATION=NO then valid=NULL.	OUT
maxRows	The maximum number of rows in the result table.	IN
numRows	The actual number generated rows in the result table.	OUT
returnCode	The return code from the stored procedure.	OUT
returnMsg	The message text that is returned in case of error.	OUT

Examples:

The following example fragment assumes that a result table is created with the name of XML_ORDER_TAB, and that the table has one column of XMLVARCHAR type. A complete, working sample is located in `DXXSAMPLES/QCSRC(GENX)`.

```
#include "dxx.h"
#include "dxxrc.h"

             EXEC SQL INCLUDE SQLCA;
             EXEC SQL BEGIN DECLARE SECTION;
             SQL TYPE is CLOB(100K) dad;           /* DAD */
             SQL TYPE is CLOB_FILE  dadFile;       /* dad file */
             char           result_tab[32]; /* name of the result table */
             char           verride[2];    /* override, will set to NULL*/
             short          overrideType;  /* defined in dxx.h */
             short          max_row;       /* maximum number of rows */
             short          num_row;       /* actual number of rows */
             long           returnCode;    /* return error code */
             char           returnMsg[1024]; /* error message text */
             short          dad_ind;
             short          rtab_ind;
             short          ovtype_ind;
             short          ov_inde;
             short          maxrow_ind;
```

```
              short            numrow_ind;
              short            returnCode_ind;
              short            returnMsg_ind;

              EXEC SQL END DECLARE SECTION;

              /* create table */
              EXEC SQL CREATE TABLE xml_order_tab (xmlorder XMLVarchar);

              /* read data from a file to a CLOB */
              strcpy(dadfile.name,"dxxinstall/dad/litem3.dad");
              dadfile.name_length = strlen("dxxinstall/dad/litem3.dad");
              dadfile.file_options = SQL_FILE_READ;
              EXEC SQL VALUES (:dadfile) INTO :dad;
              strcpy(result_tab,"xml_order_tab");
              override[0] = '\0';
              overrideType = NO_OVERRIDE;
              max_row = 500;
              num_row = 0;
              returnCode = 0;
              msg_txt[0] = '\0';
              collection_ind = 0;
              dad_ind = 0;
              rtab_ind = 0;
              ov_ind = -1;
              ovtype_ind = 0;
              maxrow_ind = 0;
              numrow_ind = -1;
              returnCode_ind = -1;
              returnMsg_ind = -1;

              /* Call the stored procedure */
              EXEC SQL CALL dxxGenXML(:dad:dad_ind;
                     :result_tab:rtab_ind,
                     :overrideType:ovtype_ind,:override:ov_ind,
                     :max_row:maxrow_ind,:num_row:numrow_ind,
                     :returnCode:returnCode_ind,:returnMsg:returnMsg_ind);
#include "dxx.h"
#include "dxxrc.h"

EXEC SQL INCLUDE SQLCA;
EXEC SQL BEGIN DECLARE SECTION;
SQL TYPE is CLOB(100K) dad;    /* DAD */
EXEC SQL DECLARE :dad VARIABLE CCSID 1047;
                       /* specifies the CCSID for DAD when running from USS */
                       /* to ensure that DB2 UDB converts */
        /* the code page correctly */
char    result_tab[32];        /* name of the result table */
char    result_colname[32];    /* name of the result column */
char    valid_colname[32];     /* name of the valid column, will set to NULL */
char    override[2];           /* override, will set to NULL*/
short   overrideType;          /* defined in dxx.h */
short   max_row;               /* maximum number of rows */
short   num_row;               /* actual number of rows */
long    returnCode;            /* return error code */
char    returnMsg[1024];       /* error message text */
short   dad_ind;
short   rtab_ind;
short   rcol_ind;
short   vcol_ind;
short   ovtype_ind;
short   ov_ind;
short   maxrow_ind;
short   numrow_ind;
short   returnCode_ind;
short   returnMsg_ind;
EXEC SQL END DECLARE SECTION;
```

```
FILE   *file_handle;
long    file_length=0;

/* create table */
EXEC SQL CREATE TABLE xml_order_tab (xmlorder XMLVarchar);

/* initialize the DAD CLOB object. */
file_handle = fopen( "/dxx/samples/dad/getstart_xcollection.dad", "r" );
if ( file_handle != NULL ) {  file_length = fread ((void *) &dad.data
, 1, FILE_SIZE, file_handle);
  if (file_length == 0) {
    printf ("Error reading dad file
             /dxx/samples/dad/getstart_xcollection.dad\n");
    rc = -1;
    goto exit;
 } else
    dad.length = file_length;
}
else {
  printf("Error opening dad file  \n", );
  rc = -1;
  goto exit;
}
/* initialize host variable and indicators */
strcpy(result_tab,"xml_order_tab");
strcpy(result_colname, "xmlorder")
valid_colname = '\0';
override[0] = '\0';
overrideType = NO_OVERRIDE;
max_row = 500;
num_row = 0;
returnCode = 0;
msg_txt[0] = '\0';
dad_ind = 0;
rtab_ind = 0;
rcol_ind = 0;
vcol_ind = -1;
ov_ind = -1;
ovtype_ind = 0;
maxrow_ind = 0;
numrow_ind = -1;
returnCode_ind = -1;
returnMsg_ind = -1;

/* Call the store procedure */
EXEC SQL CALL "DB2XML.DXXGENXML" (:dad:dad_ind;
                          :result_tab:rtab_ind,
                          :result_colname:rcol_ind,
                          :valid_colname:vcol_ind,
                          :overrideType:ovtype_ind,:override:ov_ind,
                          :max_row:maxrow_ind,:num_row:numrow_ind,
                          :returnCode:returnCode_ind,
                          :returnMsg:returnMsg_ind);

if (SQLCODE < 0) {
    EXEC SQL ROLLBACK;
  else
    EXEC SQL COMMIT;
}

exit:
  return rc;
```

Related concepts:

- “XML Extender composition stored procedures” on page 200

Related tasks:

- "Composing XML documents by using SQL mapping" on page 60
- "Composing XML collections by using RDB_node mapping" on page 63
- "Calling XML Extender composition stored procedures" on page 201

Related reference:

- "How to read syntax diagrams" on page x

dxxRetrieveXML() stored procedure

Purpose:

The stored procedure dxxRetrieveXML() serves as a means for retrieving decomposed XML documents. As input, dxxRetrieveXML() takes a buffer containing the DAD file, the name of the created result table, and the maximum number of rows to be returned. It returns a result set of the result table, the actual number of rows in the result set, an error code, and message text.

To support dynamic query, dxxRetrieveXML() takes an input parameter, *override*. Based on the input *overrideType*, the application can override the SQL_stmt for SQL mapping or the conditions in RDB_node for RDB_node mapping in the DAD file. The input parameter *overrideType* is used to clarify the type of the *override*.

The requirements of the DAD file for dxxRetrieveXML() are the same as the requirements for dxxGenXML(). The only difference is that the DAD is not an input parameter for dxxRetrieveXML(), but it is the name of an enabled XML collection.

Syntax:

```
dxxRetrieveXML(char(collectionName32) collectionName,   /* input */
                char(resultTabName32) resultTabName,     /* input */
               char resultColName, char resultValidCol   /* input */

               integer        overrideType,     /* input */
               varchar_value  override,         /* input */
           integer        maxRows,          /* input */
               integer        numRows,          /* output */
               long           returnCode,       /* output */
               varchar(1024)  returnMsg)        /* output */
```

Where *varchar_value* is 32672 for Windows and UNIX and 16366 for iSeries and z/OS.

Parameters:

Table 57. dxxRetrieveXML() parameters

Parameter	Description	IN/OUT parameter
collectionName	The name of an enabled XML collection.	IN
resultTabName	The name of the result table, which should exist before the call. The table contains only one column of either XMLVARCHAR or XMLCLOB type.	IN
result_column	The name of the column in the result table in which the composed XML documents are stored.	IN

Table 57. dxxRetrieveXML() parameters (continued)

Parameter	Description	IN/OUT parameter
valid_column	The name of the column that indicates whether the XML document is valid when it is validated against a document type definition (DTD).	IN
overrideType	A flag to indicate the type of the following *override* parameter: • **NO_OVERRIDE**: No override. • **SQL_OVERRIDE**: Override by an SQL_stmt. • **XML_OVERRIDE**: Override by an XPath-based condition.	IN
override	Overrides the condition in the DAD file. The input value is based on the *overrideType*. • **NO_OVERRIDE**: A NULL string. • **SQL_OVERRIDE**: A valid SQL statement. Using this *overrideType* requires that SQL mapping is used in the DAD file. The input SQL statement overrides the SQL_stmt in the DAD file. • **XML_OVERRIDE**: A string that contains one or more expressions in double quotation marks, separated by ″AND″. Using this *overrideType* requires that RDB_node mapping is used in the DAD file.	IN
maxRows	The maximum number of rows in the result table.	IN
numRows	The actual number of generated rows in the result table.	OUT
returnCode	The return code from the stored procedure.	OUT
returnMsg	The message text that is returned in case of error.	OUT

Examples:

The following fragment is an example of a call to dxxRetrieveXML(). In this example, a result table is created with the name of XML_ORDER_TAB, and it has one column of XMLVARCHAR type. A complete, working sample is located in dxx_install\samples\db2xml\qcsrc(rtrx).

```
#include "dxx.h"
#include "dxxrc.h"

            EXEC SQL INCLUDE SQLCA;
            EXEC SQL BEGIN DECLARE SECTION;
              char    collection[32];    /* dad buffer */
              char    result_tab[32];    /* name of the result table */
              char    override[2];       /* override, will set to NULL*/
              short   overrideType;      /* defined in dxx.h */
              short   max_row;           /* maximum number of rows */
              short   num_row;           /* actual number of rows */
              long    returnCode;        /* return error code */
              char    returnMsg[1024];   /* error message text */
              short   dadbuf_ind;
              short   rtab_ind;
              short   ovtype_ind;
              short   ov_inde;
              short   maxrow_ind;
              short   numrow_ind;
              short   returnCode_ind;
              short   returnMsg_ind;

              EXEC SQL END DECLARE SECTION;

              /* create table */
              EXEC SQL CREATE TABLE xml_order_tab (xmlorder XMLVarchar);

              /* initialize host variable and indicators */
              strcpy(collection,"sales_ord");
              strcpy(result_tab,"xml_order_tab");
              override[0] = '\0';
              overrideType = NO_OVERRIDE;
              max_row = 500;
              num_row = 0;
              returnCode = 0;
              msg_txt[0] = '\0';
              collection_ind = 0;
              rtab_ind = 0;
              ov_ind = -1;
              ovtype_ind = 0;
              maxrow_ind = 0;
              numrow_ind = -1;
              returnCode_ind = -1;
              returnMsg_ind = -1;

              /* Call the store procedure */
              EXEC SQL CALL dxxRetrieve(:collection:collection_ind;
                     :result_tab:rtab_ind,
                     :overrideType:ovtype_ind,:override:ov_ind,
                     :max_row:maxrow_ind,:num_row:numrow_ind,
                     :returnCode:returnCode_ind,:returnMsg:returnMsg_ind);
#include "dxx.h"
#include "dxxrc.h"

EXEC SQL INCLUDE SQLCA;
EXEC SQL BEGIN DECLARE SECTION;
char    collectionName[32];    /* name of an XML collection */
char    result_tab[32];        /* name of the result table */
char    result_colname[32];    /* name of the result column */
char    valid_colname[32];     /* name of the valid column, will set to NULL*/
char    override[2];           /* override, will set to NULL*/
short   overrideType;          /* defined in dxx.h */
short   max_row;               /* maximum number of rows */
short   num_row;               /* actual number of rows */
long    returnCode;            /* return error code */
char    returnMsg[1024];       /* error message text */
short   collectionName_ind;
short   rtab_ind;
short   rcol_ind;
short   vcol_ind;
short   ovtype_ind;
short   ov_ind;
short   maxrow_ind;
short   numrow_ind;
short   returnCode_ind;
short   returnMsg_ind;
EXEC SQL END DECLARE SECTION;

/* create table */
```

```
EXEC SQL CREATE TABLE xml_order_tab (xmlorder XMLVarchar);

/* initial host variable and indicators */
strcpy(collection, "sales_ord");
strcpy(result_tab,"xml_order_tab");
strcpy(result_col,"xmlorder");
valid_colname[0] = '\0';
override[0] = '\0';
overrideType = NO_OVERRIDE;
max_row = 500;
num_row = 0;
returnCode = 0;
msg_txt[0] = '\0';
collectionName_ind = 0;
rtab_ind = 0;
rcol_ind = 0;
vcol_ind = -1;
ov_ind = -1;
ovtype_ind = 0;
maxrow_ind = 0;
numrow_ind = -1;
returnCode_ind = -1;
returnMsg_ind = -1;

/* Call the store procedure */
EXEC SQL CALL "DB2XML.DXXRETRIEVE"
                 (:collectionName:collectionName_ind,
                 :result_tab:rtab_ind,
                 :result_colname:rcol_ind,
                 :valid_colname:vcol_ind,
                 :overrideType:ovtype_ind,:override:ov_ind,
                 :max_row:maxrow_ind,:num_row:numrow_ind,
                 :returnCode:returnCode_ind,:returnMsg:returnMsg_ind);

if (SQLCODE < 0) {
    EXEC SQL ROLLBACK;
  else
    EXEC SQL COMMIT;
}
```

Related concepts:

- "XML Extender composition stored procedures" on page 200

Related tasks:

- "Composing XML documents by using SQL mapping" on page 60
- "Composing XML collections by using RDB_node mapping" on page 63
- "Calling XML Extender composition stored procedures" on page 201

Related reference:

- "How to read syntax diagrams" on page x
- Appendix C, "XML Extender limits," on page 311

dxxGenXMLClob stored procedure

Purpose:

As input, dxxGenXMLClob takes a buffer containing the DAD. It constructs XML documents using data that is stored in the XML collection tables that are specified by the `<Xcollection>` in the DAD and returns the first and typically the only XML document generated into the *resultDoc* CLOB.

Syntax:

```
dxxGenXMLClob(CLOB(100k)                DAD            /*input*/
              integer                   overrideType,    /*input*/
              varchar(varchar_value)  override,        /*input*/
              CLOB(1M)                  resultDoc,       /*output*/
              integer                   valid,           /*output*/
              integer                   numDocs,         /*output*/
              long                      returnCode,      /*output*/
              varchar(1024)             returnMsg),      /*output*/
```

Where *varchar_value* is 32672 for Windows and UNIX and 16366 for iSeries and z/OS.

Parameters:

Table 58. dxxGenXMLClob parameters

Parameter	**Description**	**IN/OUT parameter**
DAD	A CLOB containing the DAD file.	IN
overrideType	A flag to indicate the type of *override* parameter: **NO_OVERRIDE** No override. **SQL_OVERRIDE** Override by an SQL_stmt **XML_OVERRIDE** Override by an XPath-based condition.	IN
override	Overrides the condition in the DAD file. The input value is based on the *overrideType*. **NO_OVERRIDE** A NULL string. **SQL_OVERRIDE** A valid SQL statement. Using this *overrideType* requires that SQL mapping be used in the DAD file. The input SQL statement overrides the SQL_stmt in the DAD file. **XML_OVERRIDE** A string that contains one or more expressions in double quotation marks separated by the word and. Using this *overrideType* requires that RDB_node mapping be used in the DAD file	IN
resultDoc	A CLOB that contains the composed XML document.	OUT
valid	valid is set as follows: • If VALIDATION=YES then valid=1 for successful validation or valid=0 for unsuccessful validation. • If VALIDATION=NO then valid=NULL.	OUT
numDocs	The number of XML documents that would be generated from the input data. **Note:** Currently only the first document is returned.	OUT
returnCode	The return code from the stored procedure.	OUT

Table 58. dxxGenXMLClob parameters (continued)

Parameter	**Description**	**IN/OUT parameter**
returnMsg	The message text that is returned in case of error.	OUT

The CLOB parameter size is 1 MB. If you have CLOB files that are larger than 1 MB, XML Extender provides a command file to redefine the stored procedure parameter. Download the `crtgenxc.zip` file from the DB2 UDB XML Extender Web site. This ZIP file contains the following programs:

crtgenxc.db2
For use on XML Extender V7.2 FixPak 5 and later for UNIX and Windows.

crtgenxc.iseries
For use with XML Extender for iSeries

crtgenxc.zox.jci and crtgenxc.zos.cmd
For use with XML Extender for OS/390 V7, APAR PQ58249 and later.

To specify the CLOB length: Open the file in an editor and modify the *resultDoc* parameter, shown in the following example.

```
out    resultDoc     clob(clob_size),
```

Size recommendation: The size limit of the *resultDoc* parameter depends on your system setup, but be aware that the amount specified in this parameter is the amount allocated by JDBC, regardless of the size of the document. The size should accommodate your largest XML files, but should not exceed 1.5 gigabytes.

Related concepts:

- "XML Extender composition stored procedures" on page 200

Related tasks:

- "Composing XML documents by using SQL mapping" on page 60
- "Composing XML collections by using RDB_node mapping" on page 63
- "Calling XML Extender composition stored procedures" on page 201

Related reference:

- "How to read syntax diagrams" on page x
- Appendix C, "XML Extender limits," on page 311

dxxRetrieveXMLClob stored procedure

Purpose:

The dxxRetrieveXMLClob stored procedure enables document composition from relational data.

The requirements for using dxxRetrieveXMLClob are the same as the requirements for dxxGenXMLClob. The only difference is that the DAD is not an input parameter for dxxRetrieveXMLClob, but it is the name of an enabled XML collection.

Syntax:

```
dxxRetrieveXMLClob(varchar(collectionName)         collelctionName  /*input*/
              integer                 overrideType,   /*input*/
              varchar(varchar_value)  override,       /*input*/
              CLOB(1M)                resultDoc,      /*output*/
              integer                 valid,          /*output*/
              integer                 numDocs,        /*output*/
              long                    returnCode,     /*output*/
              varchar(1024)           returnMsg),     /*output*/
```

Parameters:

Table 59. dxxRetrieveXMLClob parameters

Parameter	Description	IN/OUT parameter
collectionName	The name of an enabled XML collection.	IN
overrideType	A flag to indicate the type of *override* parameter: **NO_OVERRIDE** No override. **SQL_OVERRIDE** Override by an SQL_stmt **XML_OVERRIDE** Override by an XPath-based condition.	IN
override	Overrides the condition in the DAD file. The input value is based on the *overrideType*. **NO_OVERRIDE** A NULL string. **SQL_OVERRIDE** A valid SQL statement. Using this *overrideType* requires that SQL mapping be used in the DAD file. The input SQL statement overrides the SQL_stmt in the DAD file. **XML_OVERRIDE** A string that contains one or more expressions in double quotation marks separated by the word and. Using this *overrideType* requires that RDB_node mapping be used in the DAD file	IN
resultDoc	The maximum number of rows in the result table.	IN
valid	valid is set as follows: • If VALIDATION=YES then valid=1 for successful validation or valid=0 for unsuccessful validation. • If VALIDATION=NO then valid=NULL.	OUT

Table 59. dxxRetrieveXMLClob parameters (continued)

Parameter	Description	IN/OUT parameter
numDocs	The number of XML documents that would be generated from the input data. NOTE: currently only the first document is returned.	OUT
returnCode	The return code from the stored procedure.	OUT
returnMsg	The message text that is returned in case of error.	OUT

The CLOB parameter size is 1 MB. If you have CLOB files that are larger than 1 MB, XML Extender provides a command file to redefine the stored procedure parameter. Download the `crtgenxc.zip` file from the DB2 UDB XML Extender Web site. This ZIP file contains the following programs:

crtgenxc.db2
For use on XML Extender V7.2 Fixpak 5 and later for UNIX and Windows.

crtgenxc.iseries
For use with XML Extender for iSeries

crtgenxc.zox.jci and crtgenxc.zos.cmd
For use with XML Extender for OS/390 V7, APAR PQ58249 and later.

To specify the CLOB length: Open the file in an editor and modify the *resultDoc* parameter, shown in the following example.

```
out    resultDoc     clob(clob_size),
```

Size recommendation: The size limit of the *resultDoc* parameter depends on your system setup, but be aware that the amount specified in this parameter is the amount allocated by JDBC, regardless of the size of the document. The size should accommodate your largest XML files, but should not exceed 1.5 gigabytes.

Related concepts:
- “XML Extender composition stored procedures” on page 200

Related tasks:
- “Composing XML documents by using SQL mapping” on page 60
- “Composing XML collections by using RDB_node mapping” on page 63
- “Calling XML Extender composition stored procedures” on page 201

Related reference:
- “How to read syntax diagrams” on page x
- Appendix C, “XML Extender limits,” on page 311

XML Extenders decomposition stored procedures

The decomposition stored procedures dxxInsertXML() and dxxShredXML() are used to break down or shred incoming XML documents and to store data in new or existing database tables. The dxxInsertXML() stored procedure takes an enabled XML collection name as input. The dxxShredXML() stored procedure takes a DAD file as input; it does not require an enabled XML collection.

dxxShredXML() stored procedure

Purpose:

Decomposes XML documents, based on a DAD file mapping, storing the content of the XML elements and attributes in specified DB2 UDB tables. In order for dxxShredXML() to work, all tables specified in the DAD file must exist, and all columns and their data types that are specified in the DAD must be consistent with the existing tables. The stored procedure requires that the columns specified in the join condition, in the DAD, correspond to primary- foreign key relationships in the existing tables. The join condition columns that are specified in the RDB_node of the root element_node must exist in the tables.

The stored procedure fragment in this section is a sample for explanation purposes.

Syntax:

```
dxxShredXML(CLOB(100K)    DAD,            /* input */
            CLOB(1M)      xmlobj,         /* input */
            long          returnCode,     /* output */
            varchar(1024) returnMsg)      /* output */
```

Parameters:

Table 60. dxxShredXML() parameters

Parameter	Description	IN/OUT parameter
DAD	A CLOB containing the DAD file.	IN
xmlobj	An XML document object in XMLCLOB type.	IN
returnCode	The return code from the stored procedure.	OUT
returnMsg	The message text that is returned in case of error.	OUT

Examples:

The following fragment is an example of a call to dxxShredXML().

```
#include "dxx.h"
#include "dxxrc.h"

EXEC SQL INCLUDE SQLCA;
            EXEC SQL BEGIN DECLARE SECTION;
              SQL TYPE is CLOB dad;           /* DAD*/
              SQL TYPE is CLOB_FILE  dadFile; /* DAD file*/
              SQL TYPE is CLOB xmlDoc;        /* input XML document */
              SQL TYPE is CLOB_FILE xmlFile;  /* input XMLfile */
              long       returnCode;         /* error code */
              char       returnMsg[1024];    /* error message text */
              short      dad_ind;
              short      xmlDoc_ind;
              short      returnCode_ind;
              short      returnMsg_ind;
              EXEC SQL END DECLARE SECTION;

              /* initialize host variable and indicators */
              strcpy(dadFile.name,"dxx_install
              /samples/db2xml/dad/getstart_xcollection.dad
              ");
              dadFile.name_length=strlen("dxx_install
              /samples/db2xml/dad/getstart_xcollection.dad
              ");
              dadFile.file_option=SQL_FILE_READ;
              strcpy(xmlFile.name,"dxx_install
                /samples/db2xml/xml/getstart.xml");
              xmlFile.name_length=strlen("dxx_install
                /samples/db2xml/xml/getstart.xml")");
              xmlFile.file_option=SQL_FILE_READ;
              SQL EXEC VALUES (:dadFile) INTO :dad;
              SQL EXEC VALUES (:xmlFile) INTO :xmlDoc;
              returnCode = 0;
              returnMsg[0] = '\0';
              dad_ind = 0;
              xmlDoc_ind = 0;
              returnCode_ind = -1;
              returnMsg_ind = -1;

              /* Call the store procedure */
              EXEC SQL CALL DB2XML.dxxShredXML(:dad:dad_ind;
                                :xmlDoc:xmlDoc_ind,
                                :returnCode:returnCode_ind,
                                :returnMsg:returnMsg_ind);
#include "dxx.h"
#include "dxxrc.h"

EXEC SQL INCLUDE SQLCA;
EXEC SQL BEGIN DECLARE SECTION;
SQL TYPE is CLOB(100K) dad;    /* DAD */
EXEC SQL DECLARE :dad VARIABLE CCSID 1047;
                       /* specifies the CCSID for DAD when */
        /* running from USS */
                       /* to ensure that DB2 UDB */
        /* converts the code page correctly */
SQL TYPE is CLOB(100K) xmlDoc; /* input xml document */
EXEC SQL DECLARE :xmlDoc VARIABLE CCSID 1047;
                               /* specifies the CCSID for DAD */
            /* when running from USS to ensure */
            /*  that DB2 UDB converts the */
                               /* code page correctly */
long    returnCode;            /* return error code */
char    returnMsg[1024];       /* error message text */
short   dad_ind;
short   xmlDoc_ind;
short   returnCode_ind;
short   returnMsg_ind;
EXEC SQL END DECLARE SECTION;

FILE   *file_handle;
long    file_length=0;

/* initialize the DAD CLOB object. */
file_handle = fopen( "/dxxsamples/dad/getstart_xcollection.dad", "r" );
if ( file_handle != NULL ) {
  file_length = fread ((void *) &dad.data
, 1, FILE_SIZE, file_handle);
  if (file_length == 0) {
    printf ("Error reading dad file getstart_xcollection.dad\n");
    rc = -1;
    goto exit;
 } else
    dad.length = file_length;
}
else {
  printf("Error opening dad file  \n");
  rc = -1;
  goto exit;
}

/* Initialize the XML CLOB object. */
  file_handle = fopen( "/dxxsamples/xml/getstart_xcollection.xml", "r" );
  if ( file_handle != NULL ) {
    file_length = fread ((void *) &xmlDoc.data
, 1, FILE_SIZE,
                                  file_handle);
    if (file_length == 0) {
      printf ("Error reading xml file getstart_xcollection.xml \n");
      rc = -1;
      goto exit;
    } else
        xmlDoc.length = file_length;
  }
  else {
    printf("Error opening xml file \n");
    rc = -1;
    goto exit;
  }

/* initialize host variable and indicators */
returnCode = 0;
msg_txt[0] = '\0';
dad_ind = 0;
xmlDoc_ind = 0;
returnCode_ind = -1;
returnMsg_ind = -1;

/* Call the store procedure */
EXEC SQL CALL "DB2XML.DXXSHRED" (:dad:dad_ind;
                               :xmlDoc:xmlDoc_ind,
                               :returnCode:returnCode_ind,
                               :returnMsg:returnMsg_ind);

if (SQLCODE < 0) {
    EXEC SQL ROLLBACK;
  else
    EXEC SQL COMMIT;
}

exit:
  return rc;
```

Related concepts:

- “XML Extenders decomposition stored procedures” on page 215

Related tasks:

- “Decomposing an XML collection by using RDB_node mapping” on page 65
- “Decomposing XML documents into DB2 UDB data” on page 97
- “Calling XML Extender composition stored procedures” on page 201

Related reference:

- "How to read syntax diagrams" on page x
- Appendix C, "XML Extender limits," on page 311

dxxInsertXML() stored procedure

Purpose:

Takes two input parameters, the name of an enabled XML collection and the XML document that are to be decomposed, and returns two output parameters, a return code and a return message.

Syntax:

```
dxxInsertXML(char(32) collectionName, /*input*/
             CLOB(1M)       xmlobj,          /* input */
             long           returnCode,      /* output */
             varchar(1024)  returnMsg)       /* output */
```

Parameters:

Table 61. dxxInsertXML() parameters

Parameter	Description	IN/OUT parameter
collectionName	The name of an enabled XML collection.	IN
xmlobj	An XML document object in CLOB type.	IN
returnCode	The return code from the stored procedure.	OUT
returnMsg	The message text that is returned in case of error.	OUT

Examples:

In the following fragment example, the dxxInsertXML() call decomposes the input XML document `dxx_install/xml/order1.xml` and inserts data into the SALES_ORDER collection tables according to the mapping that is specified in the DAD file with which it was enabled with. .

```
#include "dxx.h"
#include "dxxrc.h"

EXEC SQL INCLUDE SQLCA;
EXEC SQL BEGIN DECLARE SECTION;
char        collection[64];  /* name of an XML collection */
SQL TYPE is CLOB_FILE xmlDoc;       /* input XML document */
long        returnCode;      /* error code */
char        returnMsg[1024]; /* error message text */
short       collection_ind;
short       xmlDoc_ind;
short       returnCode_ind;
short       returnMsg_ind;
EXEC SQL END DECLARE SECTION;

/* initialize host variable and indicators */
strcpy(collection,"sales_ord")
strcpy(xmlobj.name,"dxx_install/samples
db2xml/xml/getstart.xml");
```

```
xmlobj.name_length=strlen("dxx_install/samples
db2xml/xml/getstart.xml");
xmlobj.file_option=SQL_FILE_READ;
returnCode = 0;
returnMsg[0] = '\0';
collection_ind = 0;
xmlobj_ind = 0;
returnCode_ind = -1;
returnMsg_ind = -1;

/* Call the store procedure */
EXEC SQL CALL DB2XML.dxxInsertXML(:collection:collection_ind;
:xmlobj:xmlobj_ind,
:returnCode:returnCode_ind,:returnMsg:returnMsg_ind);
```

```
#include "dxx.h"
#include "dxxrc.h"

EXEC SQL INCLUDE SQLCA;
EXEC SQL BEGIN DECLARE SECTION;
char    collectionName[32];   /* name of an XML collection */
SQL TYPE is CLOB(100K) xmlDoc; /* input xml document */
long    returnCode;            /* return error code */
char    returnMsg[1024];       /* error message text */
short   collectionName_ind;
short   xmlDoc_ind;
short   returnCode_ind;
short   returnMsg_ind;
EXEC SQL END DECLARE SECTION;

FILE   *file_handle;
long    file_length=0;

/* initialize the DAD CLOB object. */
file_handle = fopen( "/dxxsamples/dad/getstart_xcollection.dad", "r" );
if ( file_handle != NULL ) {
  file_length = fread ((void *) , &dad.data;
1, FILE_SIZE, file_handle);
  if (file_length == 0) {
    printf ("Error reading dad file getstart_xcollection.dad\n");
    rc = -1;
    goto exit;
 } else
    dad.length = file_length;
}
else {
  printf("Error opening dad file  \n");
  rc = -1;
  goto exit;
}

/* initialize host variable and indicators */
strcpy(collectionName, "sales_ord");
returnCode = 0;
msg_txt[0] = '\0';
collectionName_ind = 0;
xmlDoc_ind = 0;
returnCode_ind = -1;
returnMsg_ind = -1;

/* Call the store procedure */
EXEC SQL CALL "DB2XML.DXXINSERTXML" (:collection_name:collection_name_ind,
                                     :xmlDoc:xmlDoc_ind,
                                     :returnCode:returnCode_ind,
                                     :returnMsg:returnMsg_ind);

if (SQLCODE < 0) {
    EXEC SQL ROLLBACK;
  else
    EXEC SQL COMMIT;
}

exit:
  return rc;
```

Related concepts:

- "XML Extenders decomposition stored procedures" on page 215

Related tasks:

- "Decomposing an XML collection by using RDB_node mapping" on page 65
- "Decomposing XML documents into DB2 UDB data" on page 97
- "Calling XML Extender composition stored procedures" on page 201

Related reference:

- "How to read syntax diagrams" on page x
- Appendix C, "XML Extender limits," on page 311

Chapter 11. MQSeries stored procedures and functions

XML Extender stored procedures and functions for MQSeries

XML Extender provides two methods of storing and accessing XML data. Using the XML column method, you can store XML documents in a DB2® table while querying, updating, and retrieving the documents contents. The MQ XML user-defined functions enable you to query XML documents and then publish the results to a message queue. Additionally, you can use the XML collection method to store the untagged contents of an XML document in one or multiple tables or compose XML documents from multiple tables. Using the MQ XML stored procedures, you can retrieve an XML document from a message queue, decompose it into untagged data, and store the data in DB2 UDB tables.You can also compose an XML document from DB2 data and send the document to an MQSeries® message queue.

MQSeries supports three messaging models to distribute XML data and documents:

datagrams
Messages are sent to a single destination with no reply expected.

publish/subscribe
One or more publishers send a message to a publication service which distributes the message to interested subscribers.

request/reply
Messages are sent to a single destination and the sender expects to receive a response.

MQSeries can be used in numerous ways. Simple datagrams are exchanged to coordinate multiple applications, to exchange information, request services, and to provide notification of interesting events. Publish/subscribe is most often used to disseminate real-time information in a timely manner. The request/reply style is generally used as a simple form of pseudo-synchronous remote procedure call. More complex models can also be constructed by combining these basic styles.

The fundamental messaging techniques described here are used in a wide variety of ways. Because MQSeries is available across a very wide range of operating systems it provides an important mechanism to link disparate applications from similar or dissimilar environments.

To use MQXML functions and stored procedures, ensure that you have the following software installed.

- DB2 Universal Database™ Version 7.2 or later
- DB2 MQSeries Functions Version 7.2 (Available as an optional installation feature of DB2 Universal Database Version 7.2. Installation information is available in the DB2 Universal Database Version 7.2 Release Notes.)
- MQSeries Publish/Subscribe or MQSeries Integrator when using publishing functions.

MQPublishXML function

Purpose:

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The MQPublishXML function publishes XMLVARCHAR and XMLCLOB data to MQSeries. This function requires the installation of either MQSeries Publish/Subscribe or MQSeries Integrator. See the following Web site for more information:

`http://www.software.ibm.com/MQSeries`

The MQPublishXML function publishes the XML data contained in *msg-data* to the MQSeries publisher specified by *publisher-service* using the quality of publish policy *publish-policy*. The topic of the message is optionally specified by *topic*. An optional user defined message correlation identifier can be specified by *correl-id*. The function returns a 1 if successful.

Syntax:

```
►►──MQPublishXML──(──┬─────────────────────────────────────────┬──msg-data──,──┬───────┬──)──────────►◄
                     ├─publisher-service───────────────────────┤               └─topic─┘
                     └─publisher-service──,──publish-policy────┘
```

Parameters:

Table 62. MQPublishXML parameters

Parameter	Data type	Description
publisher-service	VARCHAR(48)	A string containing the logical MQSeries destination to which the message is to be sent. When specified, the *publisher-service* refers to a publisher Service Point defined in the AMT.XML repository file. If the *publisher-service* is not specified, then the DB2.DEFAULT.PUBLISHER will be used. The maximum size of publisher-service is 48 bytes.
publish-policy	VARCHAR(48)	A string containing the MQSeries AMI *publish policy* to be used in handling this message. If specified, the *publish-policy* refers to a policy which is defined in the AMT.XML repository file. The publish policy also defines a set of quality of publish options that should be applied to the messaging operation options. These options include message priority and message persistence the *service-policy* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of service-policy is 48 bytes. For more information, see the MQSeries Application Messaging Interface.

Table 62. MQPublishXML parameters (continued)

Parameter	Data type	Description
msg-data	XMLVARCHAR or XMLCLOB	An XMLVARCHAR or XMLCLOB expression containing the data to be sent via MQSeries.
topic	VARCHAR(40)	A string containing the topic that the message is to be published under. If no topic is specified, none will be associated with the message. The maximum size of topic is 40 bytes. Multiple topics can be listed within a topic string by separating each topic by ":".

Return Codes:
If successful, the MQPublishXML functions return a 1. A value of 0 is returned if the function is unsuccessful.
Related concepts:

- "XML Extender stored procedures and functions for MQSeries" on page 221

Related reference:

- "How to read syntax diagrams" on page x

MQReadXML function

Purpose:

The MQREADXML function returns XMLVARCHAR data from the MQSeries location that is specified by the *receive-service*. It uses the quality of *receive-policy*. The MQREADXML function does not remove messages from the queue associated with *receive-service*

Syntax:

```
>>──MQREADXML──(──┬──────────────────────────────────┬──)──────────────────><
                  ├─receive-service──────────────────┤
                  └─receive-service──,──receive-policy─┘
```

Parameters:

Table 63. MQReadXML parameters

Parameter	Data type	Description
receive-service	VARCHAR(48)	A string containing the logical MQSeries destination from which the message is to be received. If the *receive-service* is specified, it refers to a service point defined in the AMT.XML repository file. If *receive-service* is not specified, then the DB2.DEFAULT.SERVICE is used. The maximum size of *receive-service* is 48 bytes
receive-policy	VARCHAR(48)	A string containing the MQSeries AMI service policy used in the handling of a message. When the *receive-policy* is specified, it refers to a policy defined in the AMT.XML repository file. A receive policy defines a set of quality of receive options that are applied to the messaging operation. These options include message priority and message persistence. If the *receive-policy* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of *receive-policy* is 48 bytes.

Results:
When a message in the queue has been read successfully, MQREADXML returns a db2xml.xmlvarchar. A NULL is returned if no messages are available.
Examples:
Example 1: This example reads the message at the head of the queue that is specified by the default service *DB2.DEFAULT.SERVICE*. It uses the default policy *DB2.DEFAULT.POLICY* to read the message.

```
values DB2XML.MQREADXML()
```

This example returns the contents of the message as an XMLVARCHAR. If no messages are available a NULL is returned.

Example 2: This example reads the message at the head of the queue specified by the service *MYSERVICE* using the default policy *DB2.DEFAULT.POLICY*.

```
 values DB2XML.MQREADXML('MYSERVICE')
```

In the example, the contents of the message are returned as XMLVARCHAR. If no messages are available the a NULL is returned.

Example 3: This example reads the message at the head of the queue specified by the service *MYSERVICE* using the policy *MYPOLICY*.

```
values DB2XML.MQREADXML('MYSERVICE','MYPOLICY')
```

The contents of the message are returned as XMLVARCHAR if successful. If no messages are available a NULL is returned.

Related concepts:

- "XML Extender stored procedures and functions for MQSeries" on page 221

Related reference:

- "How to read syntax diagrams" on page x

MQReadAllXML function

Purpose:

The MQReadAllXML function returns a table containing the messages and message metadata from the MQSeries location specified by *receive-service* using the quality of *service-policy*. Performing this operation does not remove the messages from the queue associated with *receive-service*. If *num-rows* is specified, then a maximum of num-rows messages will be returned. If num-rows is not specified then all the available messages are returned.

Syntax:

```
►►──MQREADALLXML──(──┬──────────────────────────────────────┬──┬──────────┬──)──────►◄
                     ├─receive-service──────────────────────┤  └─num-rows─┘
                     └─receive-service──,──service-policy───┘
```

Parameters:

Table 64. MQReadAllXML parameters

Parameter	Data type	Description
receive-service	VARCHAR(48)	A string containing the logical MQSeries destination from which the message is to be read. If specified, the *receive-service* must refer to a service point defined in the AMT.XML repository file. However, if *receive-service* is not specified, then the DB2.DEFAULT.SERVICE will be used. The maximum size of *receive-service* is 48 bytes.
service-policy	VARCHAR(48)	A string containing the MQSeries AMI Service Policy used in the handling of this message. When the *service-policy* is specified, it refers to a Policy defined in the AMT.XML repository file. The maximum size of receive-service is 48 bytes. For additional information, refer to the MQSeries Application Messaging Interface manual.

Table 64. MQReadAllXML parameters (continued)

Parameter	Data type	Description
num-rows	INTEGER	A positive integer containing the maximum number of messages to be returned by the function.

Results:
The MQReadAllXML function returns a table containing messages and message metadata as described below.

Table 65. Result set table

Column Name	Data Type	Description
MSG	XMLVARCHAR	The contents of the MQSeries message. The maximum length is 4K bytes.
CORRELID	VARCHAR(24)	A correlation ID that can be used to relate to messages.
TOPIC	VARCHAR(40)	The topic the message was published with, if available.
QNAME	VARCHAR(48)	The queue name the message was received at
MSGID	VARCHAR(24)	The MQSeries assigned unique identifier for a message.
MSGFORMAT	VARCHAR(8)	The format of the message as defined by MQSeries. Typical strings have a format of MQSTR.

Examples:
Example 1: All the messages from the queue that are specified by the default service DB2.DEFAULT.SERVICE are read using the default policy DB2.DEFAULT.POLICY. The messages and all the metadata are returned in a table format.

```
 select * from table (DB2XML.MQREADALLXML()) t
```

Example 2: All messages that are specified by the service MYSERVICE by using the default policy DB2.DEFAULT.POLICY. Only the *msg* and *correlid* columns are returned. The message queue is in a table format, wherein you can select the fields that you want.

```
select t.MSG, t.CORRELID from table (DB2XML.MQREADALLXML('MYSERVICE')) t
```

Example 3: The queue that is specified by the default service DB2.DEFAULT.SERVICE is read using the default policy DB2.DEFAULT.POLICY.. Only messages with a *CORRELID* of ’1234’ are returned. Up to 10 messages are read and returned. All columns are returned.

```
select * from table (DB2XML.MQREADALLXML()) t where t.CORRELID = '1234'
```

Example 4: The messages that are specified by the default service DB2.DEFAULT.SERVICE are read using the default policy DB2.DEFAULT.POLICY . All columns are returned.

```
select * from table (DB2XML.MQREADALLXML(10)) t
```

Related concepts:

- “XML Extender stored procedures and functions for MQSeries” on page 221

Related reference:

- “How to read syntax diagrams” on page x

MQReadXMLCLOB function

Purpose:

The MQREADXMLCLOB function returns XMLCLOB data from the MQSeries location specified by *receive-service* using the quality of service policy *receive-policy*. Performing this operation does not remove the message from the queue associated with the *receive-service*. The message at the head of the queue will be returned. The return value is an XMLCLOB containing the messages. If no messages are available to be returned a NULL will be returned.

Syntax:

```
►►──MQReadXMLCLOB──(──┬──────────────────────────────────────┬──)─────────────►◄
                      ├─receive-service──────────────────────┤
                      └─receive-service──,──receive-policy───┘
```

Parameters:

Table 66. MQReadXMLCLOB parameters

Parameter	Data type	Description
receive-service	VARCHAR(48)	A string containing the logical MQSeries destination from which the message is to be received. If specified, the *receive-service* refers to a Service Point defined in the AMT.XML repository file. If *receive-service* is not specified, then the DB2.DEFAULT.SERVICE will be used. The maximum size of *receive-service* is 48 bytes

Table 66. MQReadXMLCLOB parameters (continued)

Parameter	Data type	Description
receive-policy	VARCHAR(48)	A string containing the MQSeries AMI Service Policy used in the handling of this message. When the *receive-policy* is specified, it refers to a Policy defined in the AMT.XML repository file. A Service Policy defines a set of quality of service options that are applied to the messaging operation. These options include message priority and message persistence. If the *receive-policy* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of receive-service is 48 bytes.

Results:
When a message in the queue has been read successfully, MQREADXMLCLOB returns a db2xml.xmlclob. A NULL is returned if no messages are available.

MQReadAllXMLCLOB function

Purpose:

The MQReadAllXMLCLOB function returns a table containing the messages and message metadata from the MQSeries location specified by *receive-service* using the quality of service policy receive-service. Performing this operation does not remove the messages from the queue associated with receive-service. If *num-rows* is specified, then a maximum of num-rows messages will be returned. If num-rows is not specified then all available messages will be returned.

Syntax:

```
►►──MQReadAllXMLCLOB──(──┬─────────────────────────────────────┬──┬──────────┬──)──────►◄
                         ├─receive-service─────────────────────┤  └─num-rows─┘
                         └─receive-service──,──service-policy──┘
```

Parameters:

Table 67. MQReadAllXMLCLOB parameters

Parameter	Data type	Description
receive-service	VARCHAR(48)	A string containing the logical MQSeries destination from which the message is to be read. If specified, the *receive-service* must refer to a Service Point defined in the AMT.XML repository file. However, if *receive-service* is not specified, then the DB2.DEFAULT.SERVICE will be used. The maximum size of *receive-service* is 48 bytes.
service-policy	VARCHAR(48)	A string containing the MQSeries AMI service policy used in the handling of this message. When the *service-policy* is specified, it refers to a policy defined in the AMT.XML repository file. The maximum size of *service-policy* is 48 bytes.
num-rows	INTEGER	A positive integer containing the maximum number of messages to be returned by the function.

Results:

The MQReadAllXMLCLOB function returns a table containing messages and message metadata as described below.

Table 68. MQReadAllXMLCLOB Result set table

Column Name	Data Type	Description
MSG	XMLCLOB	The contents of the MQSeries message, up to 1MB in length.
CORRELID	VARCHAR(24)	A correlation ID that can be used to relate messages.
TOPIC	VARCHAR(40)	The topic the message was published with, if available.
QNAME	VARCHAR(48)	The queue name the message was received at
MSGID	VARCHAR(24)	The MQSeries assigned unique identifier for this message
MSGFORMAT	VARCHAR(8)	The format of the message as defined by MQSeries. Typical strings have a format of MQSTR.

Example 1: All the messages from the queue that are specified by the default service DB2.DEFAULT.SERVICE are read using the default policy DB2.DEFAULT.POLICY. The messages and all the metadata are returned in a table format.

```
 select * from table (DB2XML.MQREADALLXMLCLOB()) t
```

Example 2: Messages from the head of the queue are specified by the service MYSERVICE by using the default policy DB2.DEFAULT.POLICY. Only the *msg* and *correlid* columns are returned.

```
select t.MSG, t.CORRELID
from table (DB2XML.MQREADALLXMLCLOB('MYSERVICE')) t
```

Example 3: The head of the queue that is specified by the default service DB2.DEFAULT.SERVICE is read using the default policy DB2.DEFAULT.POLICY . Only messages with a *CORRELID* of '1234' are returned. All columns are returned.

```
select *
from table (DB2XML.MQREADALLXMLCLOB()) t where t.CORRELID = '1234'
```

Example 4: The first 10 messages from the head of the queue that are specified by the default service DB2.DEFAULT.SERVICE are read using the default policy DB2.DEFAULT.POLICY. All columns are returned.

```
select * from table (DB2XML.MQREADALLXMLCLOB(10)) t
```

Related concepts:

- "XML Extender stored procedures and functions for MQSeries" on page 221

Related reference:

- "How to read syntax diagrams" on page x

MQReceiveXML function

Purpose:

The MQReceiveXML removes one message associated with *receive-service* from the queue. The function returns XMLVARCHAR data from the MQSeries location specified by the *receive-service* function which uses the quality of *receive-service*.

Syntax:

```
►►──MQReceiveXML──(──┬─────────────────────────────────────────────────┬──)──────►◄
                     ├─receive-service─────────────────────────────────┤
                     ├─receive-service──,──service-policy──────────────┤
                     └─receive-service──,──service-policy──correl-id───┘
```

Parameters:

Table 69. MQReceiveXML parameters

Parameter	Data type	Description
receive-service	VARCHAR(48)	A string containing the logical MQSeries destination from which the message is to be received. If specified, *receive-service* refers to a service point defined in the AMT.XML repository file. If *receive-service* is not specified, then the DB2.DEFAULT.SERVICE will be used. The maximum size of *receive-service* is 48 bytes.
service-policy	VARCHAR(48)	A string containing the MQSeries AMI service policy to be used in the handling of this message. If specified, the *service-policy* must refer to a policy defined in the AMT.XML repository file. If the *service-policy* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of *service-policy* is 48 bytes.
correl-id	VARCHAR(24)	A string containing an optional correlation identifier to be associated with this message. The *correl-id* is often specified in request/reply to scenarios to associate requests with replies. If it is not outlined, no correlation ID will be specified. The maximum size of *correl-id* is 24 bytes.

Results:
MQReceiveXML functions return a db2xml.XMLVARCHAR if the messages are received from the queue successfully. The maximum message size is 4000 bytes. A NULL is returned if no messages are available. If the *correl-id* is specified then the first message with a matching correlation identifier will be returned. If *correl-id* is not specified then the message at the head of the queue will be returned. The message is removed from the queue.
Examples:
Example 1: This example receives the message that is at the head of the queue and is specified by the default service DB2.DEFAULT.SERVICE using the default policy DB2.DEFAULT.POLICY.

```
values db2xml.MQRECEIVEXML()
```

If successful this example returns the contents of a message as an XMLVARCHAR. If no messages are available a NULL is returned.

Related concepts:

- “XML Extender stored procedures and functions for MQSeries” on page 221

Related reference:

- "How to read syntax diagrams" on page x

MQReceiveAllXML function

Purpose:

The MQReceiveAllXML removes messages associated with *receive-service* from the queue. If the correl-id is specified then only those messages with a matching correlation identifier will be returned. If *correl-id* is not specified then the message at the head of the queue will be returned. If *num-rows* are specified, then a maximum of *num-rows* messages will be returned. If it is not specified then all available messages will be returned.

Syntax:

```
►►──MQReceiveALLXML──(──┬──────────────────────────────────────────────┬──┬──────────┬──)──────────►◄
                        ├─receive-service──────────────────────────────┤  └─num-rows─┘
                        ├─receive-service──,──receive-policy───────────┤
                        └─receive-service──,──receive-policy──correl-id┘
```

Parameters:

Table 70. MQReceiveAllXML parameters

Parameter	Data type	Description
receive-service	VARCHAR(48)	A string containing the logical MQSeries destination to which the message is to be sent. When specified, the *send-service* refers to a Service Point defined in the ATM.XML repository file. If *send-service* is not specified, then the DB2.DEFAULT.SERVICE will be used. The maximum size of *send-service* is 48 bytes.
receive-policy	VARCHAR(48)	A string containing the MQSeries AMI service policy to be used in the handling of this message. If specified, the *receive-policy* must refer to a policy defined in the AMT.XML repository file. If the *receive-policy* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of *receive-policy* is 48 bytes.

Table 70. MQReceiveAllXML parameters (continued)

Parameter	Data type	Description
correl-id	VARCHAR(24)	A string containing an optional correlation identifier to be associated with this message. The *correl-id* is often specified in request/reply scenarios to associate requests with replies. If it is not outlined no correlation id will be specified. The maximum size of *correl-id* is 24 bytes.
num-rows	INTEGER	A positive integer that contains the maximum number of messages returned by the function.

Results:
When a table of messages is successfully received from the queue, MQRECEIVEXML returns a db2xml.xmlvarchar. A NULL is returned when no messages are available. The messages are returned as a table of messages with meta-data.

Column Name	Data type	Description
MSG	XMLVARCHAR	The contents of the MQSeries message.
CORRELID	VARCHAR(24)	A correlation ID that can be used to relate messages.
TOPIC	VARCHAR(40)	The topic the message was published with, if available.
QNAME	VARCHAR(48)	The queue name the message was received at.
MSGID	CHAR(24)	The MQSeries assigned unique identifier for this message
MSGFORMAT	VARCHAR(8)	The format of the message as defined by MQSeries. Typical strings have a format of MQSTR.

Examples:
Example 1: All messages received from the queue are specified by the default service (DB2.DEFAULT.SERVICE) using the default policy (DB2.DEFAULT.POLICY). The messages and all the metadata are returned as a table.

```
select * from table (MQRECEIVEALLXML()) t
```

Example 2: All the messages are received from the head of the queue and are specified by the service MYSERVICE using the default policy (DB2.DEFAULT.POLICY). Only the MSG and CORRELID columns are returned. The messages are in table format, wherein you can select the fields that you want.

```
select t.MSG, t.CORRELID from table (MQRECEIVEALLXML('MYSERVICE')) t
```

Example 3: All the messages received from the head of the queue are specified by the service MYSERVICE using the policy MYPOLICY that match the id '1234'. Only the MSG and CORRELID columns are returned.

```
select t.MSG, t.CORRELID from table
(MQRECEIVEALLXML('MYSERVICE','MYPOLICY','1234')) t
```

Example 4: The first 10 messages are received from the head of the queue and specified by the default service (DB2.DEFAULT.SERVICE) using the default policy (DB2.DEFAULT.POLICY) . All columns are returned.

```
 select * from table (MQRECEIVEALLXML(10)) t
```

MQRcvAllXMLCLOB function

Purpose:

The MQRcvAllXMLCLOB removes the messages from the queue associated with *receive-service*. If the correl-id is specified then only those messages with a matching correlation identifier will be returned. If *correl-id* is not specified then all messages will be returned. If *num-rows* is specified, then a maximum of *num-rows* messages will be returned as XMLCLOB. If it is not specified then all available messages will be returned.

Syntax:

```
►►──MQRcvAllXMLCLOB──(─────────────────────────────────────────────┬──┬──────────┬──)──────────►◄
                      ├─receive-service─────────────────────────────┤  └─num-rows─┘
                      ├─receive-service──,──receive-policy──────────┤
                      └─receive-service──,──receive-policy──correl-id─┘
```

Parameters:

Table 71. MQRcvAllXMLCLOB parameters

Parameter	Data type	Description
receive-service	VARCHAR(48)	A string containing the logical MQSeries destination from which the message is to be received. If specified, the *receive-service* refers to a Service Point defined in the AMT.XML repository file. If *receive-service* is not specified, then the DB2.DEFAULT.SERVICE will be used. The maximum size of receive-service is 48 bytes.
receive-policy	VARCHAR(48)	A string containing the MQSeries AMI service policy to be used in the handling of this message. If specified, the *receive-policy* must refer to a policy defined in the AMT.XML repository file. If the *receive-policy* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of *receive-policy* is 48 bytes.

Table 71. MQRcvAllXMLCLOB parameters (continued)

Parameter	Data type	Description
correl-id	VARCHAR(24)	A string containing an optional correlation identifier to be associated with this message. The *correl-id* is often specified in request/reply scenarios to associate requests with replies. If it is not outlined no correlation id will be specified. The maximum size of *correl-id* is 24 bytes.
num-rows	INTEGER	A positive integer that contains the maximum number of messages returned by the function.

Results:
When a message is successfully received from the queue, MQRcvAllXMLCLOB returns an XMLCLOB. A NULL is returned when no messages are available. The messages are returned in a table as described below

Table 72. MQRcvAllXML result set table

Column Name	Data type	Description
MSG	XMLCLOB	The contents of the MQSeries message.
CORRELID	VARCHAR(24)	A correlation ID that can be used to relate messages.
TOPIC	VARCHAR(40)	If the topic the message was published with, if available.
QNAME	VARCHAR(48)	The queue name the message was received at.
MSGID	CHAR(24)	The MQSeries assigned unique identifier for this message
MSGFORMAT	VARCHAR(8)	The format of the message as defined by MQSeries. Typical strings have a format of MQSTR.

MQReceiveXMLCLOB function

Purpose:

The MQReceiveXMLCLOB removes messages associated with *receive-service* from the queue. The function returns XMLVARCHAR data from the MQSeries location specified by the *service-policy* function which uses the quality of *receive-service*.

Syntax:

```
►►──MQReceiveXMLCLOB──(──┬────────────────────────────────────────────────┬──)──────────►◄
                         ├─receive-service────────────────────────────────┤
                         ├─receive-service──,──service-policy─────────────┤
                         └─receive-service──,──service-policy──correl-id──┘
```

Parameters:

Table 73. MQReceiveXMLCLOB parameters

Parameter	Data type	Description
receive-service	VARCHAR(48)	A string containing the logical MQSeries destination from which the message is to be received. When the *receive-service* is specified, it refers to a Service Point defined in the AMT.XML repository file. However, if *receive-service* is not specified, then the DB2.DEFAULT.SERVICE will be used. The maximum size of *receive-service* is 48 bytes.
service-policy	VARCHAR(48)	A string containing the MQSeries AMI Service Policy to be used in handling of this message. If specified, the receive-service must refer to a Policy defined in the AMT.XML repository file. If *service-policy* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of *service-policy* is 48 bytes.
correl-id	VARCHAR(24)	A string containing an optional correlation identifier to be associated with this message. The *correl-id* is often specified in request/reply to scenarios to associate requests with replies. If it is not outlined, no correlation ID will be specified. The maximum size of *correl-id* is 24 bytes.

Results:
MQReceiveXMLCLOB functions return a db2xml.XMLCLOB if messages are received from the queue successfully. A NULL is returned if no messages are available. If the *correl-id* is specified then the first message with a matching correlation identifier will be returned. However, if the *correl-id* is not specified then the message at the head of the queue will be returned.

MQSENDXML function

Purpose:

The MQSENDXML function sends the data contained in *msg-data* to the MQSeries location specified by send-service using the send-policy. An optional user-defined message correlation identifier can also be specified by correl-id. The function returns a 1 if successful.

Syntax:

```
►►──MQSENDXML──(──┬──────────────────────────────────┬──msg-data──,──┬─────────────┬──)──────────►◄
                  ├─send-service─────────────────────┤               └─correl-id───┘
                  └─send-service──,──send-policy─────┘
```

Parameters:

Table 74. MQSendXML parameters

Parameter	Data type	Description
msg-data	XMLVARCHAR or XMLCLOB	An expression containing the data to be sent via MQSeries.
send-service	VARCHAR(48)	A string containing the logical MQSeries destination to which the message is to be sent. When the *send-service* is listed, it refers to a Service Point defined in the AMT.XML repository file. The DB2.DEFAULT.SERVICE is used when the *send-service* is not specified. The maximum size of *send-service* is 48 bytes.
send-policy	VARCHAR(48)	A string containing the MQSeries AMI Service Policy used to handle the message. When specified, the *send-policy* refers to a policy defined in the AMT.XML repository file. If the *send-policy* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of send-policy is 48 bytes.
correl-id	VARCHAR(24)	A string containing an optional correlation identifier associated with the message. The correl-id is often specified in request/reply scenarios to associate requests with replies. If it is not specified, no correlation id will be shown. The maximum size of correl-id is 24 bytes.

Results:
A successful message results in a value of 1. A message containing *msg-data* will be sent to the location specified by send-service using the policy defined by *send-policy*.

MQSENDXMLFILE function

Purpose:

The MQSENDXMLFILE function sends the data contained in *xml_file* to the MQSeries location specified by send-service using the quality of service policy. An optional user defined message correlation identifier can be specified by correl-id. The function returns a '1' if successful.

Syntax:

```
►►──MQSENDXMLFILE──(──┬────────────────────────────────┬──xml_file──,──┬───────────┬──)────────►◄
                      ├─send-service───────────────────┤               └─correl-id─┘
                      └─send-service──,──send-policy───┘
```

Parameters:

Table 75. MQSENDXMLFILE parameter

Parameter	Data type	Description
xml_file	XMLCLOB	An XML file name with a maximum size of 80 bytes. The file contains the data to be sent via MQSeries.
send-service	VARCHAR(48)	A string containing the logical MQSeries destination to which the message is to be sent. When specified, the *send-service* refers to a Service Point defined in the AMT.XML repository file. If *send-service* is not specified, then the DB2.DEFAULT.SERVICE will be used. The maximum size of *send-service* is 48 bytes.
send-policy	VARCHAR(48)	A string containing the MQSeries AMI service to be used in handling of this message. If specified, the *send-policy* refers to a Policy defined in the AMT.XML repository file. If *send-policy* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of *send-policy* is 48 bytes

Table 75. MQSENDXMLFILE parameter (continued)

Parameter	Data type	Description
correl-id	VARCHAR(24)	A string containing an optional correlation identifier to be associated with this message. The *correl-id* is often specified in request/reply scenarios to associate requests with replies. If not specified, no correlation id will be listed. The maximum size of *correl-id* is 24 bytes.

Results:
If the function is successful, it results in a ’1’. The side effect of successfully executing this function is that a message containing *msg-data* will be sent to the location specified by *send-service* using the policy defined by *send-policy*.
Examples:
Example 1: XML documents contained in file ″c:\xml\test1.xml″ are sent to the default service (DB2.DEFAULT.SERVICE) using the default policy (DB2.DEFAULT.POLICY) with no correlation identifier.

```
Values MQSENDXMLFILE('c:\xml\test1.xml');
```

This example returns the value ’1’ if successful

Example 2: XML documents contained in file `c:\xml\test2.xml` are sent to the service MYSERVICE using policy MYPOLICY with no correlation identifier.

```
Values MQSENDXMLFILE('MYSERVICE', 'MYPOLICY', 'c:\xml\test2.xml');
```

This example returns the value ’1’ if successful

Example 3: XML documents contained in file ″c:\xml\test3.xml″are sent to the service MYSERVICE using policy MYPOLICY with correlation identifier ″Test3″.

```
Values MQSENDXML('MYSERVICE','MYPOLICY', 'c:\xml\test3.xml', 'Test3');
```

This example returns the value ’1’ if successful.

Example 4: XML documents contained in file ″c:\xml\test4.xml″ are sent to the service MYSERVICE using the default policy (DB2.DEFAULT.POLICY) and no correlation identifier.

```
Values MQSENDXMLFILE('MYSERVICE', 'c:\xml\test4.xml');
```

This example returns the value ’1’ if successful.

MQSendXMLFILECLOB function

Purpose:

The MQSendXMLFILECLOB function sends the data contained in *xml_file* to the MQSeries location specified by send-service using the quality of *send-policy*. The data type that is sent is XMLCLOB. An optional user defined message correlation identifier can be specified by correl-id. The function returns a 1 if successful.

Syntax:

```
►►──MQSendXMLFILECLOB──(──┬────────────────────────────────┬──xml_file──,──┬────────────┬──)───────►◄
                          ├─send-service───────────────────┤               └─correl-id──┘
                          └─send-service──,──send-policy───┘
```

Parameters:

Table 76. MQSENDXMLFILE parameter

Parameter	Data type	Description
xml_file	XMLCLOB	An XML file name with a maximum size of 80 bytes. The file contains the data to be sent via MQSeries.
send-service	VARCHAR(48)	A string containing the logical MQSeries destination to which the message is to be sent. When specified, the send-service refers to a Service Point defined in the AMT.XML repository file. If *send-service* is not specified, then the DB2.DEFAULT.SERVICE will be used. The maximum size of send-service is 48 bytes
send-policy	VARCHAR(48)	A string containing the MQSeries AMI service to be used in handling of this message. If specified, the *send-policy* refers to a Policy defined in the AMT.XML repository file. If *send-policy* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of *send-policy* is 48 bytes
correl-id	VARCHAR(24)	A string containing an optional correlation identifier to be associated with this message. The *correl-id* is often specified in request/reply scenarios to associate requests with replies. If not specified, no correlation id will be listed. The maximum size of *correl-id* is 24 bytes.

Results:
If the function is successful, it results in a '1'. The side effect of successfully executing this function is that a message containing *msg-data* will be sent to the location specified by *send-service* using the policy defined by *send-policy*.

Types of stored procedures for message queues

Composition stored procedures:

Use the composition stored procedures, dxxmqGen(), dxxmqGenCLOB(), dxxmqRetrieve(), and dxxmqRetrieveCLOB() to generate XML documents using data in existing database tables, and to send the generated XML documents to a message queue. The dxxmqGen() and dxxmqGenCLOB() stored procedures use a DAD file as input. They do not require enabled XML collections. The dxxmqRetrieve and dxxmqRetrieveCLOB stored procedures use collection names as input.

Decomposition stored procedures:

The decomposition stored procedures dxxmqInsert(), dxxmqInsertAll(), dxxInsertCLOB(), dxxmqShred(), dxxmqShredCLOB, and dxxmqShredAll() are used to break down or shred incoming XML documents from a message queue, and to store the data in new or existing database tables.

The dxxmqInsert(), dxxmqInsertAll(), dxxmqInsertAllCLOB(), and dxxInsertCLOB() stored procedures use an enabled XML collection name as input.

The dxxmqShred(), dxxmqShredAll(), dxxmqShredCLOB, and dxxmqShredAllCLOB stored procedures use a DAD file as input. They do not require an enabled XML collection.

The table below summarizes the different stored procedures and explains their functions.

Table 77. The MQSeries XML stored procedures

Function	Purpose
dxxmqGen	Invoke the dxxmqGen stored procedure to compose XML documents, using a DAD file as a input parameter. The resulting document type is XMLVARCHAR(4000).
dxxmqGenCLOB	Constructs an XML document from data that is stored in the XML collection tables specified in the DAD file, and sends the XML document to an MQ message queue. The resulting document type is XMLCLOB(1M).
dxxmqRetrieve	Invoke the dxxmqRetrieve stored procedure to compose XML documents, using a collection name as a input parameter. The resulting document type is XMLVARCHAR(4000).
dxxmqRetrieveCLOB	Invoke the dxxmqRetrieve stored procedure to compose XML documents, using a collection name as a input parameter. The resulting document type is XMLCLOB(1M).
dxxmqShred	Invoke the dxxmqShred stored procedure to decompose an XML document using a DAD file as an input parameter. The resulting document type is XMLVARCHAR(4000).
dxxmqShredAll	Invoke the dxxmqShredAll stored procedure to decompose multiple XML documents using a DAD file as an input parameter. The resulting document type is XMLVARCHAR(4000).

Table 77. The MQSeries XML stored procedures (continued)

Function	Purpose
dxxmqShredCLOB	Decomposes an incoming XML document from a message queue, based on a DAD file mapping, and stores the content of the XML elements and attributes in specified DB2 UDB tables. The resulting document type is XMLCLOB(1M).
dxxmqShredAllCLOB	Decomposes an incoming XML document from a message queue, based on a DAD file mapping, and stores the content of the XML elements and attributes in specified DB2 UDB tables. The resulting document type is XMLCLOB(1M).
dxxmqInsert	Invoke the dxxmqInsert stored procedure to decompose an XML document using a collection name as an input parameter. The resulting document type is XMLVARCHAR(4000).
dxxmqInsertAll	Invoke the dxxmqInsertAll stored procedure to decompose multiple XML documents using a collection name as an input parameter. The resulting document type is XMLVARCHAR(4000).
dxxmqInsertCLOB	Breaks down or shreds an incoming XML document from a message queue, and stores the data in new or existing database tables. The resulting document type is XMLCLOB(1M).
dxxmqInsertAllCLOB	Breaks down or shreds all incoming XML documents from a message queue, and stores the data in new or existing database tables. The dxxmqInsertAllCLOB stored procedure uses a collection name, rather than a DAD file name, to determine how to store the data. The resulting document type is XMLCLOB(1M).

Related reference:

- “dxxmqGenCLOB stored procedure” on page 245
- “dxxmqRetrieve stored procedure” on page 247
- “dxxmqRetrieveCLOB stored procedure” on page 249
- “dxxmqShred stored procedure” on page 251
- “dxxmqShredAll stored procedure” on page 253
- “dxxmqShredCLOB stored procedure” on page 254
- “dxxmqInsert stored procedure” on page 256
- “dxxmqInsertAll stored procedure” on page 260
- “dxxmqInsertCLOB stored procedure” on page 258
- “dxxmqGen() stored procedure” on page 243
- “dxxmqShredAllCLOB stored procedure” on page 255
- “dxxmqInsertAllCLOB stored procedure” on page 261

dxxmqGen() stored procedure

Purpose:

Constructs an XML document from data that is stored in the XML collection tables specified in the DAD file, and sends the XML document to a MQ message queue. The stored procedure returns a string to indicate the status of the stored procedure.

To support dynamic query, dxxmqGen() takes an input parameter, *override*. Based on the input *overrideType*, the application can override the SQL_stmt for SQL mapping or the conditions in RDB_node for RDB_node mapping in the DAD file. The input parameter *overrideType* is used to clarify the type of the *override*.

Syntax:

```
dxxmqGen(varchar(48)    serviceName,     /*input*/
         varchar(48)    policyName,      /*input*/
         varchar(80)    dadFileName,     /*input*/
         integer        overrideType,    /*input*/
         varchar(1024)  override,        /*input*/
         integer        maxRows,         /*input*/
         integer        numRows,         /*output*/
         char(20)       status)          /*output*/
```

Parameters:

Table 78. dxxmqGen() parameters

Parameter	Description	IN/OUT parameter
serviceName	A string containing the logical MQSeries destination to which the message is to be sent. When the *serviceName* is listed, it refers to a service point defined in the AMT.XML repository file. The DB2.DEFAULT.SERIVCE is used when the *serviceName* is not specified. The maximum size of *serviceName* is 48 bytes.	IN
policyName	A string containing the MQSeries AMI Service Policy used to handle messages. When specified, the *policyName* refers to a policy defined in the AMT.XML repository file. If the *policyName* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of *policyName* is 48 bytes.	IN
dadFileName	The name of the DAD file.	IN
overrideType	A flag to indicate the type of the following *override* parameter: • **NO_OVERRIDE**: No override. • **SQL_OVERRIDE**: Override by an SQL_stmt. • **XML_OVERRIDE**: Override by an XPath-based condition.	IN

Table 78. dxxmqGen() parameters (continued)

Parameter	Description	IN/OUT parameter
override	Overrides the condition in the DAD file. The input value is based on the *overrideType*. • **NO_OVERRIDE**: A NULL string. • **SQL_OVERRIDE**: A valid SQL statement. Using this *overrideType* requires that SQL mapping is used in the DAD file. The input SQL statement overrides the SQL_stmt in the DAD file. • **XML_OVERRIDE**: A string that contains one or more expressions in double quotation marks separated by ″AND″. Using this *overrideType* requires that RDB_node mapping is used in the DAD file.	IN
maxRows	The maximum number of messages generated in the message queue.	IN
numRows	The actual number of generated rows in the message queue.	OUT
status	The text and codes returned that specify whether or not the stored procedure ran successfully, any error codes that are generated, and the number of XML documents which are received or sent to the message queue.	OUT

Examples:

The following example fragment generates an XML document and sends it to the queue. It assumes that a MQ/AMI service, *myService*, and a policy, *myPolicy*, have been defined in the repository file. This file stores repository definitions in XML format.

```
#include "dxx.h"
#include "dxxrc.h"
               EXEC SQL INCLUDE SQLCA;
               EXEC SQL BEGIN DECLARE SECTION;
               char           serviceName[48];  /* name of the MQ/AMI service*/
               char           policyName[48];   /* name of the MQ/AMI policy*/
               char           dadFileName[80];  /* name of the DAD file */
               char           override[2];      /* override, will set to NULL*/
               short          overrideType;     /* defined in dxx.h */
               short          max_row;          /* maximum number of rows */
               short          num_row;          /* actual number of rows */
               char           status[20]        /* status code or message */
               short          ovtype_ind;
               short          ov_ind;
               short          maxrow_ind;
               short          numrow_ind;
               short          dadFileName_ind;
               short          serviceName_ind;
               short          policyName_ind;
               short          status_ind;

               EXEC SQL END DECLARE SECTION;
               strcpy(dadFileName,"c:\dxx\dad\litem3.dad");
               strcpy(serviceName,"myService");
               strcpy(policyName,"myPolicy");
```

```
 override[0] = '\0';
 overrideType = NO_OVERRIDE;
 max_row = 500;
 num_row = 0;
 status[0] = '\0';
 dadFileName_ind = 0;
 serviceName_ind = 0;
 policyName_ind = 0;
 maxrow_ind = 0;
 numrow_ind = -1;
 ovtype_ind=0;
 ov_ind=-1;
 status_ind = -1;

/* Call the store procedure */
EXEC SQL CALL dxxmqGen(:serviceName:serviceName_ind,
       :policyName:policyName_ind,
       :dadFileName:dadFileName_ind,
       :overrideType:ovtype_ind,
       :override:ov_ind,
       :max_row:maxrow_ind,
       :num_row:numrow_ind,
       :status:status_ind);
```

Related concepts:

- “XML Extender stored procedures and functions for MQSeries” on page 221

Related tasks:

- “Calling XML Extender composition stored procedures” on page 201

Related reference:

- “How to read syntax diagrams” on page x
- Appendix C, “XML Extender limits,” on page 311

dxxmqGenCLOB stored procedure

Purpose:

Constructs an XML document from data that is stored in the XML collection tables specified in the DAD file, and sends the XML document to a MQ message queue. The document type is XMLCLOB. The stored procedure returns a string to indicate the status of the stored procedure. This stored procedure is not supported for the Enterprise Server Edition (ESE).

To support dynamic query, dxxmqGenCLOB takes an input parameter, *override*. Based on the input *overrideType*, the application can override the SQL_stmt for SQL mapping or the conditions in RDB_node for RDB_node mapping in the DAD file. The input parameter *overrideType* is used to clarify the type of the *override*.

Syntax:

```
dxxmqGenCLOB(varchar(48)    serviceName,     /*input*/
             varchar(48)    policyName,      /*input*/
             varchar(80)    dadFileName,     /*input*/
             integer        overrideType,    /*input*/
             varchar(1024)  override,        /*input*/
             integer        maxRows,         /*input*/
             integer        numRows,         /*output*/
              char(20)       status)         /*output*/
```

Parameters:

Table 79. dxxmqGenCLOB parameters

Parameter	Description	IN/OUT parameter
serviceName	A string containing the logical MQSeries destination to which the message is to be sent. When the *serviceName* is listed, it refers to a service point defined in the AMT.XML repository file. The DB2.DEFAULT.SERIVCE is used when the *serviceName* is not specified. The maximum size of *serviceName* is 48 bytes.	IN
policyName	A string containing the MQSeries AMI Service Policy used to handle messages. When specified, the *policyName* refers to a policy defined in the AMT.XML repository file. If the *policyName* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of *policyName* is 48 bytes.	IN
dadFileName	The name of the DAD file.	IN
overrideType	A flag to indicate the type of the following *override* parameter: • **NO_OVERRIDE**: No override. • **SQL_OVERRIDE**: Override by an SQL_stmt. • **XML_OVERRIDE**: Override by an XPath-based condition.	IN
override	Overrides the condition in the DAD file. The input value is based on the *overrideType*. • **NO_OVERRIDE**: A NULL string. • **SQL_OVERRIDE**: A valid SQL statement. Using this *overrideType* requires that SQL mapping is used in the DAD file. The input SQL statement overrides the SQL_stmt in the DAD file. • **XML_OVERRIDE**: A string that contains one or more expressions in double quotation marks separated by ″AND″. Using this *overrideType* requires that RDB_node mapping is used in the DAD file.	IN
maxRows	The maximum number of messages generated in the message queue.	IN
numRows	The actual number of generated rows in the message queue.	OUT
status	The text and codes returned that specify whether or not the stored procedure ran successfully, any error codes that are generated, and the number of XML documents which are received or sent to the message queue.	OUT

Related concepts:

- "XML Extender stored procedures and functions for MQSeries" on page 221

Related reference:

- "How to read syntax diagrams" on page x
- Appendix C, "XML Extender limits," on page 311

dxxmqRetrieve stored procedure

Purpose:

The stored procedure dxxmqRetrieve() serves as a means for retrieving decomposed XML documents. As input, dxxmqRetrieve() takes a buffer containing the enabled XML collection name, the MQ/AMI service and policy names. It sends the composed XML document to a MQ Queue; it returns the number of rows sent to the queue and a status message. The dxxmqRetrieve stored procedure enables the same DAD file to be used for both composition and decomposition.

To support dynamic query, dxxmqRetrieve() takes an input parameter, *override*. Based on the input *overrideType*, the application can override the SQL_stmt for SQL mapping or the conditions in RDB_node for RDB_node mapping in the DAD file. The input parameter *overrideType* is used to clarify the type of the *override*.

The requirements of the DAD file for dxxmqRetrieve() are the same as the requirements for dxxmqGen(). The only difference is that the DAD is not an input parameter for dxxmqRetrieve(); the required parameter is instead the name of an enabled XML collection.

Syntax:

```
dxxmqRetrieve(varchar(48)    serviceName,        /*input*/
              varchar(48)    policyName,         /*input*/
              varchar(80)    collectionName,     /*input*/
              integer        overrideType,       /*input*/
              varchar(1024)  override,           /*input*/
              integer        maxrows,            /*input*/
              integer        numrows,            /*output*/
              char(20)       status)             /*output*/
```

Parameters:

Table 80. dxxmqRetrieve() parameters

Parameter	Description	IN/OUT parameter
serviceName	A string containing the logical MQSeries destination to which the message is to be sent. When the *serviceName* is listed, it refers to a Service Point defined in the AMT.XML repository file. The DB2.DEFAULT.SERVICE is used when the *serviceName* is not specified. The maximum size of *serviceName* is 48 bytes.	IN

Table 80. dxxmqRetrieve() parameters (continued)

Parameter	Description	IN/OUT parameter
policyName	A string containing the MQSeries AMI Service Policy used to handle messages. When specified, the *policyName* refers to a policy defined in the AMT.XML repository file. If the *policyName* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of *policyName* is 48 bytes.	IN
collectionName	The name of an enabled collection.	IN
overrideType	A flag to indicate the type of the following *override* parameter: • **NO_OVERRIDE**: No override. • **SQL_OVERRIDE**: Override by an SQL_stmt. • **XML_OVERRIDE**: Override by an XPath-based condition.	IN
override	Overrides the condition in the DAD file. The input value is based on the *overrideType*. • **NO_OVERRIDE**: A NULL string. • **SQL_OVERRIDE**: A valid SQL statement. Using this *overrideType* requires that SQL mapping is used in the DAD file. The input SQL statement overrides the SQL_stmt in the DAD file. • **XML_OVERRIDE**: A string that contains one or more expressions in double quotation marks separated by ″AND″. The maximum length is 1024 bytes. The *overrideType* string requires that RDB_node mapping is used in the DAD file.	IN
maxRows	The maximum number of rows in the result table.	IN
numRows	The actual number generated rows in the result table.	OUT
status	The text and codes returned that specify whether or not the stored procedure ran successfully, any error codes that are generated, and the number of XML documents which are received or sent to the message queue.	OUT

Examples:

The following fragment is an example of a call to dxxmqRetrieve().

```
#include "dxx.h"
#include "dxxrc.h"
             EXEC SQL INCLUDE SQLCA;
             EXEC SQL BEGIN DECLARE SECTION;
             char      serviceName[48];   /* name of the MQ/AMI service*/
             char      policyName[48];    /* name of the MQ/AMI policy*/
             char      collection[32];    /* name of the XML collection */
```

```
 char      override[2];       /* override, will set to NULL*/
 short     overrideType;      /* defined in dxx.h */
 short     max_row;           /* maximum number of rows */
 short     num_row;           /* actual number of rows */
 char      status[20];        /* status code or message */
 short     ovtype_ind;
 short     ov_ind;
 short     maxrow_ind;
 short     numrow_ind;
 short     collection_ind;
 short     serviceName_ind;
 short     policyName_ind;
 short     status_ind;

 EXEC SQL END DECLARE SECTION;

 /* initialize host variable and indicators */
 strcpy(collection,"sales_ord");
 strcpy(serviceName,"myService");
 strcpy(policyName,"myPolicy");
 override[0] = '\0';
 overrideType = NO_OVERRIDE;
 max_row = 500;
 num_row = 0;
 status[0] = '\0';
 serviceName_ind = 0;
 policyName_ind = 0;
 collection_ind = 0;
 maxrow_ind = 0;
 numrow_ind = -1;
 ovtype_ind=0;
 ov_ind=-1;
 status_ind = -1;

/* Call the store procedure */
EXEC SQL CALL dxxmqRetrieve(:serviceName:serviceName_ind,
       :policyName:policyName_ind,
       :collection:collection_ind,
       :overrideType:ovtype_ind,
       :override:ov_ind,
       :max_row:maxrow_ind,
       :num_row:numrow_ind,
       :status:status_ind);
```

Related concepts:

- "XML Extender stored procedures and functions for MQSeries" on page 221

Related reference:

- "How to read syntax diagrams" on page x
- Appendix C, "XML Extender limits," on page 311

dxxmqRetrieveCLOB stored procedure

Purpose:

The stored procedure dxxmqRetrieveCLOB serves as a means for retrieving decomposed XML documents. As input, dxxmqRetrieveCLOB takes a buffer containing the enabled XML collection name, the MQ/AMI service and policy names. It sends the composed XML document to a MQ Queue; and it returns the number of rows sent to the queue and a status message.The dxxmqRetrieveCLOB stored procedure enables the same DAD file to be used for both composition and decomposition. This stored procedure is not supported for Enterprise Server Edition (ESE).

To support dynamic query, dxxmqRetrieveCLOB takes an input parameter, *override*. Based on the input *overrideType*, the application can override the SQL_stmt for SQL mapping or the conditions in RDB_node for RDB_node mapping in the DAD file. The input parameter *overrideType* is used to clarify the type of the *override*.

The requirements of the DAD file for dxxmqRetrieveCLOB are the same as the requirements for dxxmqGenCLOB. The only difference is that the DAD is not an input parameter for dxxmqRetrieveCLOB; the required parameter is instead the name of an enabled XML collection.

Syntax:

```
dxxmqRetrieveCLOB(varchar(48)    serviceName,       /*input*/
                  varchar(48)    policyName,        /*input*/
                  varchar(80)    collectionName,    /*input*/
                  integer        overrideType,      /*input*/
                  varchar(1024)  override,          /*input*/
                  integer        maxrows,           /*input*/
                  integer        numrows,           /*output*/
                  char(20)       status)            /*output*/
```

Parameters:

Table 81. dxxmqRetrieveCLOB parameters

Parameter	Description	IN/OUT parameter
serviceName	A string containing the logical MQSeries destination to which the message is to be sent. When the *serviceName* is listed, it refers to a Service Point defined in the AMT.XML repository file. The DB2.DEFAULT.SERVICE is used when the *serviceName* is not specified. The maximum size of *serviceName* is 48 bytes.	IN
policyName	A string containing the MQSeries AMI Service Policy used to handle messages. When specified, the *policyName* refers to a policy defined in the AMT.XML repository file. If the *policyName* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of *policyName* is 48 bytes.	IN
collectionName	The name of an enabled collection.	IN
overrideType	A flag to indicate the type of the following *override* parameter: • **NO_OVERRIDE**: No override. • **SQL_OVERRIDE**: Override by an SQL_stmt. • **XML_OVERRIDE**: Override by an XPath-based condition.	IN

Table 81. dxxmqRetrieveCLOB parameters (continued)

Parameter	Description	IN/OUT parameter
override	Overrides the condition in the DAD file. The input value is based on the *overrideType*. • **NO_OVERRIDE**: A NULL string. • **SQL_OVERRIDE**: A valid SQL statement. Using this *overrideType* requires that SQL mapping is used in the DAD file. The input SQL statement overrides the SQL_stmt in the DAD file. • **XML_OVERRIDE**: A string that contains one or more expressions in double quotation marks separated by ″AND″. The maximum size is 1024 bytes. The *overrideType* string requires that RDB_node mapping is used in the DAD file.	IN
maxRows	The maximum number of rows in the result table.	IN
numRows	The actual number generated rows in the result table.	OUT
status	The text and codes returned that specify whether or not the stored procedure ran successfully, any error codes that are generated, and the number of XML documents which are received or sent to the message queue.	OUT

Related concepts:

- “XML Extender stored procedures and functions for MQSeries” on page 221

Related reference:

- “How to read syntax diagrams” on page x
- Appendix C, “XML Extender limits,” on page 311

dxxmqShred stored procedure

Purpose:

Decomposes an incoming XML document from a message queue, based on a DAD file mapping, and stores the content of the XML elements and attributes in specified DB2 UDB tables.

In order for dxxmqShred() to work, all tables specified in the DAD file must exist, and all columns and their data types that are specified in the DAD must be consistent with the existing tables. The stored procedure requires that the columns specified in the join condition, in the DAD, correspond to primary- foreign key relationships in the existing tables. The join condition columns that are specified in the RDB_node of the root element_node must exist in the tables.

Syntax:

```
dxxmqShred(varchar(48)   serviceName,     /* input */
           varchar(48)   policyName,     /* input */
           varchar(80)   dadFileName,    /* input */
           varchar(10)   status)         /* output */
```

Parameters:

Table 82. dxxmqShred() parameters

Parameter	Description	IN/OUT parameter
serviceName	A string containing the logical MQSeries destination to which the message is to be sent. When the *serviceName* is listed, it refers to a Service Point defined in the AMT.XML repository file. The DB2.DEFAULT.SERVICE is used when the *serviceName* is not specified. The maximum size of *serviceName* is 48 bytes.	IN
policyName	A string containing the MQSeries AMI Service Policy used to handle messages. When specified, the *policyName* refers to a policy defined in the AMT.XML repository file. If the *policyName* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of *policyName* is 48 bytes.	IN
dadFileName	The name of the DAD file. The maximum size is 80 bytes.	IN
status	The text and codes returned that specify whether or not the stored procedure ran successfully, any error codes that are generated, and the number of XML documents which are received or sent to the message queue.	OUT

Examples:

The following fragment is an example of a call to dxxmqShred().

```
#include "dxx.h"
#include "dxxrc.h"

EXEC SQL INCLUDE SQLCA;
        EXEC SQL BEGIN DECLARE SECTION;
         char        serviceName[48];    /* name of the MQ/AMI service */
         char        policyName[48];     /* name of the MQ/AMI policy */
         char        dadFileName[80];    /* name of the DAD file */
         char        status[20];         /* status code or message */
         short       serviceName_ind;
         short       policyName_ind;
         short       dadFileName_ind;
         short       status_ind;
         EXEC SQL END DECLARE SECTION;

              /* initialize host variable and indicators */
         strcpy(dadFileName,"e:/dxx/samples/dad/getstart_xcollection.dad");
         strcpy(serviceName, "myService");
         strcpy(policyName, "myPolicy");
         status[0]='\0';
         serviceName_ind=0;
```

```
policyName_ind=0;
dadFileName_ind=0;
status_ind=-1;

     /* Call the store procedure */
EXEC SQL CALL dxxmqShred(:serviceName:serviceName_ind,
                  :policyName:policyName_ind,
                  :dadFileName:dadFileName_ind,
                  :status:status_ind);
```

Related reference:

- Appendix C, "XML Extender limits," on page 311

dxxmqShredAll stored procedure

Purpose:

Decomposes all incoming XML documents from a message queue, based on a DAD file mapping. The contents of the XML elements and attributes are stored in specified DB2 UDB tables.

In order for dxxmqShredAll() to work, all tables specified in the DAD file must exist, and all columns and their data types that are specified in the DAD must be consistent with the existing tables. The stored procedure requires that the columns specified in the join condition, in the DAD, correspond to primary-foreign key relationships in the existing tables. The join condition columns that are specified in the RDB_node of the root element_node must exist in the tables.

Syntax:

```
dxxmqShredAll(varchar(48)   serviceName,     /* input */
              varchar(48)   policyName,     /* input */
              varchar(80)   dadFileName,    /* input */
              varchar(20)   status)         /* output */
```

Parameters:

Table 83. dxxmqShredAll() parameters

Parameter	Description	IN/OUT parameter
serviceName	A string containing the logical MQSeries destination to which the message is to be sent. When the *serviceName* is listed, it refers to a Service Point defined in the AMT.XML repository file. The DB2.DEFAULT.SERVICE is used when the *serviceName* is not specified. The maximum size of *serviceName* is 48 bytes.	IN
policyName	A string containing the MQSeries AMI Service Policy used to handle messages. When specified, the *policyName* refers to a policy defined in the AMT.XML repository file. If the *policyName* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of *policyName* is 48 bytes.	IN
dadFileName	The name of the DAD file. The maximum size is 80 bytes.	IN

Table 83. dxxmqShredAll() parameters (continued)

Parameter	Description	IN/OUT parameter
status	The text and codes returned that specify whether or not the stored procedure ran successfully, any error codes that are generated, and the number of XML documents which are received or sent to the message queue.	OUT

Examples:

The following fragment is an example of a call to dxxmqShredAll().

```
#include "dxx.h"
#include "dxxrc.h"

EXEC SQL INCLUDE SQLCA;
      EXEC SQL BEGIN DECLARE SECTION;
        char       serviceName[48];   /* name of the MQ/AMI service */
        char       policyName[48];    /* name of the MQ/AMI policy */
        char       dadFileName[80];   /* name of the DAD file */
        char       status[20];        /* status code or message */
        short      serviceName_ind;
        short      policyName_ind;
        short      dadFileName_ind;
        short      status_ind;
        EXEC SQL END DECLARE SECTION;

              /* initialize host variable and indicators */
        strcpy(dadFileName,"e:/dxx/samples/dad/getstart_xcollection.dad");
        strcpy(serviceName, "myService");
        strcpy(policyName, "myPolicy");
        status[0]=\0;
        serviceName_ind=0;
        policyName_ind=0;
        dadFileName_ind=0;
        status_ind=-1;

          /* Call the store procedure */
        EXEC SQL CALL dxxmqShredAll(:serviceName:serviceName_ind,
                             :policyName:policyName_ind,
                             :dadFileName:dadFileName_ind,
                             :status:status_ind);
```

Related concepts:

- “XML Extender stored procedures and functions for MQSeries” on page 221

Related reference:

- “How to read syntax diagrams” on page x
- Appendix C, “XML Extender limits,” on page 311

dxxmqShredCLOB stored procedure

Purpose:

Decomposes an incoming XML document from a message queue, based on a DAD file mapping, and stores the content of the XML elements and attributes in specified DB2 UDB tables. The incoming document type is XMLCLOB.

For dxxmqShredCLOB, all tables specified in the DAD file must exist, and all columns and data types that are specified in the DAD must be consistent with the existing tables. This stored procedure requires that the columns specified in the join condition of the DAD, correspond to primary-foreign key relationships in the existing tables. The joint condition columns that are specified in the RDB_node of the root element_node must exist in the tables.

Syntax:

```
dxxmqShredCLOB(varchar(48)   serviceName,    /* input */
               varchar(48)   policyName,     /* input */
               varchar(80)   dadFileName,    /* input */
               varchar(10)   status)         /* output */
```

Parameters:

Table 84. dxxmqShredCLOB parameters

Parameter	Description	IN/OUT parameter
serviceName	A string containing the logical MQSeries destination to which the message is to be sent. When the *serviceName* is listed, it refers to a Service Point defined in the AMT.XML repository file. The DB2.DEFAULT.SERVICE is used when the *serviceName* is not specified. The maximum size of *serviceName* is 48 bytes.	IN
policyName	A string containing the MQSeries AMI Service Policy used to handle messages. When specified, the *policyName* refers to a policy defined in the AMT.XML repository file. If the *policyName* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of *policyName* is 48 bytes.	IN
dadFileName	The name of the DAD file. The maximum size in 80 bytes.	IN
status	The text and codes returned that specify whether or not the stored procedure ran successfully, any error codes that are generated, and the number of XML documents which are received or sent to the message queue.	OUT

Related concepts:

- “XML Extender stored procedures and functions for MQSeries” on page 221

Related reference:

- “How to read syntax diagrams” on page x
- Appendix C, “XML Extender limits,” on page 311

dxxmqShredAllCLOB stored procedure

Purpose:

Decomposes an incoming XML document from a message queue, based on a DAD file mapping, and stores the content of the XML elements and attributes in specified DB2 UDB tables.

For dxxmqShredAllCLOB, all tables specified in the DAD file must exist, and all columns and data types that are specified in the DAD must be consistent with the existing tables. This stored procedure requires that the columns specified in the join condition of the DAD, correspond to primary-foreign key relationships in the existing tables. The joint condition columns that are specified in the RDB_node of the root element_node must exist in the tables.

Syntax:

```
dxxmqShredCLOB(varchar(48)   serviceName,    /* input */
               varchar(48)   policyName,     /* input */
               varchar(80)   dadFileName,    /* input */
               varchar(10)   status)         /* output */
```

Parameters:

Table 85. dxxmqShredAllCLOB parameters

Parameter	Description	IN/OUT Parameter
serviceName	A string containing the logical MQSeries destination to which the message is to be sent. When the *serviceName* is listed, it refers to a Service Point defined in the AMT.XML repository file. The DB2.DEFAULT.SERVICE is used when the *serviceName* is not specified. The maximum size of *serviceName* is 48 bytes.	IN
policyName	A string containing the MQSeries AMI Service Policy used to handle messages. When specified, the *policyName* refers to a policy defined in the AMT.XML repository file. If the *policyName* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of *policyName* is 48 bytes.	IN
dadFileName	The name of the DAD file. The maximum size is 80 bytes.	IN
status	The text and codes returned that specify whether or not the stored procedure ran successfully, any error codes that are generated, and the number of XML documents which are received or sent to the message queue.	OUT

Related reference:

- Appendix C, “XML Extender limits,” on page 311

dxxmqInsert stored procedure

Purpose:

Breaks down or shreds an incoming XML document from a message queue, and stores the data in new or existing database tables. dxxmqInsert uses a collection name, rather than a DAD file name, to determine how to store the data.

Syntax:

```
dxxmqInsert(varchar(48)  serviceName,      /* input */
            varchar(48)   policyName,      /* input */
            varchar(80)   collectionName,  /* input */
            varchar(20)   status)          /* output */
```

Parameters:

Table 86. dxxmqInsert() parameters

Parameter	Description	IN/OUT parameter
serviceName	A string containing the logical MQSeries destination to which the message is to be sent. When the *serviceName* is listed, it refers to a Service Point defined in the AMT.XML repository file. The DB2.DEFAULT.SERVICE is used when the *serviceName* is not specified. The maximum size of *serviceName* is 48 bytes.	IN
policyName	A string containing the MQSeries AMI Service Policy used to handle messages. When specified, the *policyName* refers to a policy defined in the AMT.XML repository file. If the *policyName* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of *policyName* is 48 bytes.	IN
collectionName	The name of an enabled XML collection. The maximum size is 80 bytes.	IN
status	The text and codes returned that specify whether or not the stored procedure ran successfully, any error codes that are generated, and the number of XML documents which are received or sent to the message queue.	OUT

Examples:

In the following fragment example, the dxxmqInsert() call retrieves the input XML document `order1.xml` from a message queue defined by *serviceName*, decomposes the document, and inserts data into the SALES_ORDER collection tables according to the mapping that is specified in the DAD file with which it was enabled.

```
#include "dxx.h"
#include "dxxrc.h"

EXEC SQL INCLUDE SQLCA;
            EXEC SQL BEGIN DECLARE SECTION;
```

```
char         serviceName[48];
char         policyName[48];
char         collection[80];     /* name of an XML collection */
char         status[10];

short                serviceName_ind;
short                policyName_ind;
short                collection_ind;
short                status_ind;
EXEC SQL END DECLARE SECTION;

/* initialize host variable and indicators */
strcpy(serviceName, "myService");
strcpy(policyName, "myPolicy");
strcpy(collection,"sales_ord")
status[0]=\0;
serviceName_ind = 0;
policyName_ind = 0;
collection_ind = 0;
status_ind = -1;

/* Call the store procedure */
EXEC SQL CALL dxxmqInsert(:serviceName:serviceName_ind,
                :policyName:policyName_ind,
                :collection:collection_ind,
                :status:status_ind);
```

Related concepts:

- "XML Extender stored procedures and functions for MQSeries" on page 221

Related reference:

- "How to read syntax diagrams" on page x
- Appendix C, "XML Extender limits," on page 311

dxxmqInsertCLOB stored procedure

Purpose:

Breaks down or shreds an incoming XML document from a message queue, and stores the data in new or existing database tables. dxxmqInsertCLOB uses a collection name, rather than a DAD file name, to determine how to store the data. The incoming document type is XMLCLOB

Syntax:

```
dxxmqInsertCLOB(varchar(48)  serviceName,  /* input */
            varchar(48)   policyName,      /* input */
            varchar(80)   collectionName,  /* input */
            varchar(20)   status)          /* output */
```

Parameters:

Table 87. dxxmqInsertCLOB() parameters

Parameter	Description	IN/OUT parameter
serviceName	A string containing the logical MQSeries destination to which the message is to be sent. When the *serviceName* is listed, it refers to a Service Point defined in the AMT.XML repository file. The DB2.DEFAULT.SERVICE is used when the *serviceName* is not specified. The maximum size of *serviceName* is 48 bytes.	IN
policyName	A string containing the MQSeries AMI Service Policy used to handle messages. When specified, the *policyName* refers to a policy defined in the AMT.XML repository file. If the *policyName* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of *policyName* is 48 bytes.	IN
collectionName	The name of an enabled XML collection.	IN
status	The text and codes returned that specify whether or not the stored procedure ran successfully, any error codes that are generated, and the number of XML documents which are received or sent to the message queue.	OUT

Examples:

In the following fragment example, the dxxmqInsertCLOB() call retrieves the input XML document `order1.xml` from a message queue defined by *serviceName*, decomposes the document, and inserts data into the SALES_ORDER collection tables according to the mapping that is specified in the DAD file with which it was enabled.

```
#include "dxx.h"
#include "dxxrc.h"

EXEC SQL INCLUDE SQLCA;
            EXEC SQL BEGIN DECLARE SECTION;
              char          serviceName[48];
              char          policyName[48];
              char          collection[48];     /* name of an XML collection */
              char          status[10];

              short                 serviceName_ind;
              short                 policyName_ind;
              short                 collection_ind;
              short                 status_ind;
              EXEC SQL END DECLARE SECTION;

              /* initialize host variable and indicators */
              strcpy(serviceName, "myService");
              strcpy(policyName, "myPolicy");
              strcpy(collection,"sales_ord")
              status[0] = \0;
              serviceName_ind = 0;
              policyName_ind = 0;
              collection_ind = 0;
              status_ind = -1;

              /* Call the store procedure */
              EXEC SQL CALL dxxmqInsertCLOB(:serviceName:serviceName_ind;
                              :policyName:policyName_ind,
                              :collection:collection_ind,
                              :status:status_ind);
```

Related reference:

- Appendix C, "XML Extender limits," on page 311

dxxmqInsertAll stored procedure

Purpose:

Breaks down or shreds all incoming XML documents from a message queue, and stores the data in new or existing database tables. dxxmqInsertAll uses a collection name, rather than a DAD file name, to determine how to store the data.

Syntax:

```
dxxmqInsertAll(varchar(48)  serviceName,      /* input */
               varchar(48)   policyName,      /* input */
               varchar(48)   collectionName,  /* input */
               varchar(20)   status)          /* output */
```

Parameters:

Table 88. dxxmqInsertAll() parameters

Parameter	Description	IN/OUT parameter
serviceName	A string containing the logical MQSeries destination to which the message is to be sent. When the *serviceName* is listed, it refers to a Service Point defined in the AMT.XML repository file. The DB2.DEFAULT.SERVICE is used when the *serviceName* is not specified. The maximum size of *serviceName* is 48 bytes.	IN
policyName	A string containing the MQSeries AMI Service Policy used to handle messages. When specified, the *policyName* refers to a policy defined in the AMT.XML repository file. If the *policyName* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of *policyName* is 48 bytes.	IN
collectionName	The name of an enabled XML collection. The maximum size is 80 bytes.	IN

Table 88. dxxmqInsertAll() parameters (continued)

Parameter	Description	IN/OUT parameter
status	The text and codes returned that specify whether or not the stored procedure ran successfully, any error codes that are generated, and the number of XML documents which are received or sent to the message queue.	OUT

Examples:

In the following fragment example, the dxxmqInsertAll call retrieves all input XML documents from a message queue defined by *serviceName*, decomposes the documents, and inserts data into the SALES_ORDER collection tables according to the mapping that is specified in the DAD file with which it was enabled.

```
#include "dxx.h"
#include "dxxrc.h"

EXEC SQL INCLUDE SQLCA;
            EXEC SQL BEGIN DECLARE SECTION;
              char          serviceName[48];
              char          policyName[48];
              char          collection[80];     /* name of an XML collection */
              char          status[10];

              short                 serviceName_ind;
              short                 policyName_ind;
              short                 collection_ind;
              short                 status_ind;
              EXEC SQL END DECLARE SECTION;

              /* initialize host variable and indicators */
              strcpy(serviceName, "myService");
              strcpy(policyName, "myPolicy");
              strcpy(collection,"sales_ord");
              status[0]='\0';
              serviceName_ind = 0;
              policyName_ind = 0;
              collection_ind = 0;
              status_ind = -1;

              /* Call the store procedure */
              EXEC SQL CALL dxxmqInsertAll(:serviceName:serviceName_ind,
                              :policyName:policyName_ind,
                              :collection:collection_ind,
                              :status:status_ind);
```

Related concepts:

- “XML Extender stored procedures and functions for MQSeries” on page 221

Related reference:

- “How to read syntax diagrams” on page x
- Appendix C, “XML Extender limits,” on page 311

dxxmqInsertAllCLOB stored procedure

Purpose:

Breaks down or shreds all incoming XML documents from a message queue, and stores the data in new or existing database tables. The dxxmqInsertAllCLOB stored procedure uses a collection name, rather than a DAD file name, to determine how to store the data.

Syntax:

```
dxxmqInsertAllCLOB(varchar(48)  serviceName,  /* input */
              varchar(48)   policyName,      /* input */
              varchar(48)   collectionName,  /* input */
              varchar(20)   status)          /* output */
```

Parameters:

Table 89. dxxmqInsertAllCLOB() parameters

Parameter	Description	IN/OUT parameter
serviceName	A string containing the logical MQSeries destination to which the message is to be sent. When the *serviceName* is listed, it refers to a Service Point defined in the AMT.XML repository file. The DB2.DEFAULT.SERVICE is used when the *serviceName* is not specified. The maximum size of *serviceName* is 48 bytes.	IN
policyName	A string containing the MQSeries AMI Service Policy used to handle messages. When specified, the *policyName* refers to a policy defined in the AMT.XML repository file. If the *policyName* is not specified, then the default DB2.DEFAULT.POLICY will be used. The maximum size of *policyName* is 48 bytes.	IN
collectionName	The name of an enabled XML collection.	IN
status	The text and codes returned that specify whether or not the stored procedure ran successfully, any error codes that are generated, and the number of XML documents which are received or sent to the message queue.	OUT

Examples:

In the following fragment example, the dxxmqInsertAllCLOB call retrieves all input XML documents from a message queue defined by *serviceName*, decomposes the documents, and inserts data into the SALES_ORDER collection tables according to the mapping that is specified in the DAD file with which it was enabled.

```
#include "dxx.h"
#include "dxxrc.h"

EXEC SQL INCLUDE SQLCA;
            EXEC SQL BEGIN DECLARE SECTION;
              char          serviceName[48];
              char          policyName[48];
              char          collection[48];     /* name of an XML collection */
              char          status[10];

              short                 serviceName_ind;
              short                 policyName_ind;
              short                 collection_ind;
              short                 status_ind;
              EXEC SQL END DECLARE SECTION;

              /* initialize host variable and indicators */
              strcpy(serviceName, "myService");
              strcpy(policyName, "myPolicy");
              strcpy(collection,"sales_ord")
              status[0] = '\0';
              serviceName_ind = 0;
              policyName_ind = 0;
              collection_ind = 0;
              status_ind = -1;

              /* Call the store procedure */
              EXEC SQL CALL dxxmqInsertAllCLOB(:serviceName:serviceName_ind;
                              :policyName:policyName_ind,
                              :collection:collection_ind,
                              :status:status_ind);
```

Related reference:

- Appendix C, “XML Extender limits,” on page 311

Chapter 12. Extensible stylesheet language transformation (XSLT)

Creating an HTML document using an XSLT stylesheet

The Extensible stylesheet language transformation(XSLT) consists of a series of markups that can be used to apply formatting rules to each of the elements inside an XML document. XSL works by applying various style rules to the contents of an XML document based on the elements that it encounters. By design, XSLT stylesheets are regular XML documents.

Originally created for page layout, XSLT is now used in a variety of ways. For example, it can be used as a general-purpose translation tool, a system for reorganizing document content, or a way to generate multiple results such as HTML, WAP, and SVG from a single source.

XSLT is a critical bridge between XML processing and more familiar languages such as HTML.XSLT, and allows you to transform an XML structure into other data types by removing or replacing the XML tags. It also allows you to change the order of the information, extract some special information, or sort the information.

Prerequisites:

To create an HTML document using a stylesheet, you need to complete the following tasks:

1. Create an XML file in the result table.
2. Create a stylesheet.

You can create your HTML file by using XSLTransformToFile or XSLTransformToClob. This output file can be written either on the DB2 UDB server or from the command line in a text editor.

Procedure:

To create your HTML file on the DB2 UDB server, type the following syntax:

```
SELECT XSLTransformToFile( CAST(doc AS CLOB(4k)),
    '$dxx_install$\samples\db2xml\xslt\getstart.xsl',
         0,
   '$dxx_install$\samples\db2xml\html\getstart.html')
 FROM RESULT_TAB
```

where *$dxx_install$* is the directory where you installed DB2 XML Extender.

To create your HTML file from the command line, open any text editor and type the following command:

```
getstart_xslt.cmd
```

Related reference:

- “XSLTransformToClob() stored procedure” on page 266
- “XSLTransformToFile() stored procedure” on page 267

XSLTransformToClob() stored procedure

Purpose:

XSLTransformToClob() reads an XML document as CLOB locator and a stylesheet as CLOB or from a file, and returns the document as CLOB.

Syntax:

```
►►—XSLTransformToClob—(—xmlobj—,—stylesheet—┬───────────┬—,—validate—)————————►◄
                                             └—,—param—┘
```

Parameters:

Parameter	Data type	Description
xmlobj	CLOB	The XML document
stylesheet	CLOB, VARCHAR	The style sheet The location and name of the stylesheet input file
param	CLOB VARCHAR	The XML parameter document. The location and name of the XML parameter fil.
validate	INTEGER	Enable (1) or disable (0) validation of the xmlobj

Results:
The XSLTransformToClob() returns a data of CLOB type if successful.
Examples:
The following examples create a sample table and store the two input files in the database: `getstart.xml` and `getstart.xsl`. The database must be enabled for XML Extender.

```
CREATE TABLE xslt_tab(xmlobj CLOB(4k), stylesheet CLOB(4k))
INSERT INTO xslt_tab(xmlobj, stylesheet) VALUES(
 DB2XML.XMLCLOBFromFile('c:\dxx_installsamples\db2xml\xml\getstart.xml
'),
DB2XML.XMLCLOBFromFile('c:\dxx_installsamples\db2xml\xslt\getstart.xsl
'))
```

Example 1: The following example transforms an XML document into a HTML document using the table created:

```
SELECT XSLTransformToClob(xmlobj, stylesheet)
FROM xslt_tab
```

Example 2: This example transforms an XML document into an HTML document using a stylesheet file

```
SELECT XSLTransformToClob( xmlobj,
  c:\dxx_installsamples\db2xml\xslt\getstart.xsl
')
  FROM xslt_tab
```

Example 3: In this example the output is changed by additional parameters. The XML parameter document must define the namespace. The parameters must be wrapped in the *<param>* element. The corresponding value also can be specified in a *value* attribute, or in the content of the *<param>* element.

```
c:\dxx_install\samples\db2xml\xml\getstart_xslt_param.xml:
<?xml version="1.0"?>
<params xmlns="http://www.ibm.com.XSLtransformParameters">
   <param name="noShipments" value="true"/>
   <param name="headline">The customers...</param>
</params>

SELECT XSLTranfsormToClob( xmlobj, stylesheet, param, 1)
FROM xslt_tab
```

XSLTransformToFile() stored procedure

Purpose:

Reads an XML document as a CLOB and a style sheet as a CLOB or from a file. The XSLTransformToFile() user-defined function(UDF) then writes the results from the style sheet and XML document into a file. When a directory and a file extension are given as parameters, the UDF will create a file with a unique filename in this directory.

Syntax:

```
►►──XSLTransformToFile──(──xmlobj──,──stylesheet──┬─────────────┬──,──validate──,────►
                                                  └─,──param────┘

►─filename──┬──────────────────────┬──)──────────────────────────────────────────►◄
            └─,──dir──,──suffix────┘
```

Parameters:

Table 90. XSLTransformDir() parameter descriptions

Parameter	Data type	Description
xmlobj	CLOB	The XML document
stylesheet	CLOB VARCHAR	The style sheet The location and name of the stylesheet input file
param	VARCHAR VARCH	The XML parameter document The location and name of the XML parameter file
validate	INTEGER	Enable (1) or disable (0) validation of the xmlobj
filename	VARCHAR	The name of the output file
dir	VARCHAR	The directory of the output file
suffix	VARCHAR	The suffix of the output file

Results:
The XSLTransformToFile() returns a VARCHAR for the written file name.
Examples:
The following example creates a sample table and stores two files in the `getstart.xml` and `getstart.xsl` tables. To create the sample table, the DB2 UDB database must be enabled for XML Extender.

```
CREATE TABLE xslt_tab(xmlobj CLOB(4k), stylesheet CLOB(4k))

INSERT INTO xslt_tab(xmlobj, stylesheet) VALUES(
DB2XML.XMLCLOBFromFile('$dxx_install$\samples\db2xml\xml\getstart.xml
'),
DB2XML.XMLCLOBFromFile('$dxx_install$\samples\db2xml\xslt\getstart.xsl
'))
```

where *$dxx_install$* is the directory where you installed DB2 XML Extender.

Example 1: This example transforms the XML document into an HTML document and writes the created document to the specified file:

```
SELECT XSLTransformFile( xmlobj, stylesheet,
   '$dxx_install$samples\db2xml\html\getstart.html

  FROM xslt_tab
```

where *$dxx_install$* is the directory where you installed DB2 XML Extender.

Example 2: This example writes an HTML document to a file using a stylesheet file. Validation is enabled but the result is the same. This feature is necessary to include default values from an XML schema in the transformation process. No parameters are specified. The file name is generated by the UDF.

```
SELECT XSLTransformToFile( xmlobj,
   '/$dxx_install$\samples/db2xml/xslt/getstart.xsl',
   '/$dxx_install$\samples/db2xml/html/getstart.html')
     FROM xslt_tab
```

where *$dxx_install$* is the directory where you installed DB2 XML Extender.

Example 3: In this example the output is changed by additional parameters. The XML parameter document must define the namespace. The parameters must be wrapped in the *<param>* element. The corresponding value also can be specified in a *value* attribute, or in the content of the *<param>* element.

```
$dxx_install$\samples\db2xml\xml\getstart_xslt_param.xml:', 'html')
<?xml version="1.0"?>
<params xmlns="http://www.ibm.com.XSLtransformParameters">
   <param name="noShipments" value="true"/>
   <param name="headline">The customers...</param>
</params>
```

where *$dxx_install$* is the directory where you installed DB2 XML Extender.

Example 4: This example writes an HTML document into a file using a stylesheet file and stores the file name for each row in an additional column in the table.

```
UPDATE TABLE xslt_tab ADD COLUMN filename VARCHAR(512)
UPDATE TABLE xslt_tab SET filename =
  XSLTransformToFile(xmlobj,stylesheet, param, 1,
    '$dxx_install$samples\db2xml\html
         ', 'html')
  FROM xslt_tab
```

where *$dxx_install$* is the directory where you installed DB2 XML Extender.

Chapter 13. XML Extender administration support tables

When a database is enabled, a DTD repository table (DTD_REF) and an XML_USAGE table are created. The DTD_REF table contains information about all of the DTDs. The XML_USAGE table stores common information for each XML-enabled column. Each is created with specific PUBLIC privileges.

DTD reference table

The XML Extender also serves as an XML DTD repository. When a database is XML-enabled, a DTD repository table, DTD_REF, is created. Each row of this table represents a DTD with additional metadata information. You can access this table, and insert your own DTDs. The DTDs in the DTD_REF table are used to validate XML documents and to help applications to define a DAD file. It has the schema name of DB2XML. A DTD_REF table can have the columns shown in Table 91.

Table 91. DTD_REF table

Column name	Data type	Description
DTDID	VARCHAR(128)	The primary key (unique and not NULL). It is used to identify the DTD. When the DTD is specified in the DAD file, the DAD file must adhere to the schema that is defined by the DTD.
CONTENT	XMLCLOB	The content of the DTD.
ROW_ID	ROWID	An identifier of the row.
USAGE_COUNT	INTEGER	The number of XML columns and XML collections in the database that use the DTD to define their DAD files.
AUTHOR	VARCHAR(128)	The author of the DTD. This information is optional.
CREATOR	VARCHAR(128)	The user ID that does the first insertion. This column is optional.
UPDATOR	VARCHAR(128)	The user ID that does the last update. This column is optional.

A DTD can be modified by the application only when the USAGE_COUNT is zero.

Privileges granted to PUBLIC

Privileges of INSERT, UPDATE, DELETE, and SELECT are granted for PUBLIC.

XML usage table (XML_USAGE)

The XML_USAGE table stores common information for each XML-enabled column. The XML_USAGE table's schema name is DB2XML, and its primary key is (`table_name`, `col_name`). Only read privileges of this table are granted to PUBLIC. An XML_USAGE table is created at the time the database is enabled. The columns in the XML_USAGE table are shown in Table 92 on page 270.

Table 92. XML_USAGE table

Column name	Description
table_schema	For an XML column, the schema name of the user table that contains an XML column. For an XML collection, a value of DXX_COLL as the default schema name.
table_name	For an XML column, the name of the user table that contains an XML column. For an XML collection, a value DXX_COLLECTION, which identifies the entity as a collection.
col_name	The name of the XML column or XML collection. It is part of the composite key along with the table_name.
DTDID	A string associating a DTD inserted into DTD_REF with a DTD specified in a DAD file; this value must match the value of the DTDID element in the DAD. This column is a foreign key.
DAD	The content of the DAD file that is associated with the XML column or XML collection.
access_mode	Specifies which access mode is used: 1 for XML collection, 0 for XML column
default_view	Stores the default view name if there is one.
trigger_suffix	Not NULL. For unique trigger names.
validation	1 for yes, 0 for no
row_id	An identifier of the row.

Do not add, modify, or delete entries from the XML_USAGE table; it is for XML Extender internal use only.

Privileges granted to PUBLIC

For XML_USAGE, the privilege of SELECT is granted for PUBLIC. INSERT, DELETE, and UPDATE are granted to DB2XML.

Chapter 14. Troubleshooting

Troubleshooting XML_Extender

All embedded SQL statements in your program and DB2 UDB command line interface (CLI) calls in your program, including those that invoke the DB2 UDB XML Extender user-defined functions (UDFs), generate codes that indicate whether the embedded SQL statement or DB2 UDB CLI call ran successfully.

Your program can retrieve information that supplements these codes including SQLSTATE information and error messages. You can use this diagnostic information to isolate and fix problems in your program.

Occasionally the source of a problem cannot be easily diagnosed. In these cases, you might need to provide information to IBM Software Support to isolate and fix the problem. The XML Extender includes a trace facility that records XML Extender activity. The trace information can be valuable input to IBM Software Support. You should use the trace facility only under instruction from IBM Software Support.

This chapter describes the trace facility, and error codes and messages.

Related reference:
- "SQLSTATE codes and associated message numbers for XML Extender" on page 274
- "XML Extender messages" on page 278
- "Stopping the trace" on page 272
- "Starting the trace for XML Extender" on page 271

Starting the trace for XML Extender

Purpose:

Records the XML Extender server activity. To start the trace, apply the `on` option to **dxxtrc**, along with the name of an existing directory to contain the trace file. When the trace is turned on, the file, `dxxDB2.trc`, is placed in the specified directory. The trace file is not limited in size.

Syntax:

Starting the trace from the USS command line:

```
►►──dxxtrc──on──trace_directory──────────────────────────────────────────────►◄
```

Starting the trace from TSO:

```
call 'dxx.load(dxxtrc)' 'on "trace_directory"' asis
```

Starting the trace from JCL:

```
//STEP EXEC PGM=DXXTRC,
// PARM='on "trace_directory"'
```

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Parameters:

Table 93. Trace parameters

Parameter	Description
trace_directory	Name of an existing USS path and directory where the `dxxdb2.trc` is placed. Required, no default.

Examples:

The following example demonstrates starting the trace for an instance db2inst1. The trace file, `dxxdb2inst1.trc`, is placed in the `/home/db2inst1/dxx_install/log` directory.

```
dxxtrc on /home/db2inst1/dxx_install/log
```

The following examples show starting the trace, with file, `dxxdb2.trc`, in the `/u/user1/dxx/trace` directory.

From USS:

```
dxxtrc on /u/user1/trace
```

From TSO:

```
call 'dxx.load(dxxtrc)' 'on "/u/user1/dxx/trace"' asis
```

From JCL:

```
//STEP EXEC PGM=DXXTRC,
// PARM='on "/u/user1/dxx/trace"'
```

Stopping the trace

Purpose:

Turns the trace off. Trace information is no longer logged.

Recommendation: Because running the trace log file size is not limited and can impact performance, turn trace off in a production environment.

Syntax:

Stopping the trace from the USS command line:

```
►►—dxxtrc—off——————————————————————————————————————————————►◄
```

Stopping the trace from TSO:

```
call 'dxx.load(dxxtrc)' 'off' asis
```

Stopping the trace from JCL:

```
//STEP EXEC PGM=DXXTRC,
// PARM='off'
```

Examples:

This example shows that the trace facility is turned off.

```
dxxtrc off
```

The following examples demonstrate stopping the trace.

From USS:

```
dxxtrc off
```

From TSO:

```
call 'dxx.load(dxxtrc)' 'off' asis
```

From JCL:

```
//STEP EXEC PGM=DXXTRC,
//  PARM='off'
```

XML Extender UDF return codes

Embedded SQL statements return codes in the SQLCODE, SQLWARN, and SQLSTATE fields of the SQLCA structure. This structure is defined in an SQLCA INCLUDE file. (For more information about the SQLCA structure and SQLCA INCLUDE file, see the *DB2 Application Development GuideDB2 Application Programming and SQL Guide*.)

DB2 CLI calls return SQLCODE and SQLSTATE values that you can retrieve using the SQLError function. (For more information about retrieving error information with the SQLError function, see the *ODBC Guide and Reference*.)

An SQLCODE value of 0 means that the statement ran successfully (with possible warning conditions). A positive SQLCODE value means that the statement ran successfully but with a warning. (Embedded SQL statements return information about the warning that is associated with 0 or positive SQLCODE values in the SQLWARN field.) A negative SQLCODE value means that an error occurred.

DB2 associates a message with each SQLCODE value. If an XML Extender UDF encounters a warning or error condition, it passes associated information to DB2 UDB for inclusion in the SQLCODE message.

Embedded SQL statements and DB2 UDB CLI calls that invoke the DB2 XML Extender UDFs might return SQLCODE messages and SQLSTATE values that are unique to these UDFs, but DB2 UDB returns these values in the same way that it does for other embedded SQL statements or other DB2 UDB CLI calls. Thus, the way that you access these values is the same as for embedded SQL statements or DB2 UDB CLI calls that do not start the DB2 UDB XML Extender UDFs.

XML Extenders stored procedure return codes

The XML Extender provides return codes to help resolve problems with stored procedures. When you receive a return code from a stored procedure, check the following file, which matches the return code with an XML Extender error message number and the symbolic constant.

```
dxx_install/include/dxxrc.h
```

Related reference:

- "SQLSTATE codes and associated message numbers for XML Extender" on page 274

SQLSTATE codes and associated message numbers for XML Extender

Table 94. SQLSTATE codes and associated message numbers

SQLSTATE	Message Number	Description
00000	DXX*nnnn*I	No error occurred.
01HX0	DXXD003W	The element or attribute specified in the path expression is missing from the XML document.
38X00	DXXC000E	The XML Extender is unable to open the specified file.
38X01	DXXA072E	XML Extender tried to automatically bind the database before enabling it, but could not find the bind files.
	DXXC001E	The XML Extender could not find the file specified.
38X02	DXXC002E	The XML Extender is unable to read data from the specified file.
38X03	DXXC003E	The XML Extender is unable to write data to the file.
	DXXC011E	The XML Extender is unable to write data to the trace control file.
38X04	DXXC004E	The XML Extender was unable to operate the specified locator.
38X05	DXXC005E	The file size is greater than the XMLVarchar size, and the XML Extender is unable to import all the data from the file.
38X06	DXXC006E	The file size is greater than the size of the XMLCLOB, and the XML Extender is unable to import all the data from the file.
38X07	DXXC007E	The number of bytes in the LOB locator does not equal the file size.
38X08	DXXD001E	A scalar extraction function used a location path that occurs multiple times. A scalar function can use only a location path that does not have multiple occurrence.
38X09	DXXD002E	The path expression is syntactically incorrect.
38X10	DXXG002E	The XML Extender was unable to allocate memory from the operating system.
38X11	DXXA009E	This stored procedure is for an XML column only.
38X12	DXXA010E	While attempting to enable the column, the XML Extender could not find the DTD ID, which is the identifier specified for the DTD in the document access definition (DAD) file.

Table 94. SQLSTATE codes and associated message numbers (continued)

SQLSTATE	Message Number	Description
	DXXQ060E	The XML Extender could not find the SCHEMA ID while attempting to enable the column. The SCHEMA ID corresponds to the value of the location attribute of the nonamespacelocation tag which is inside the schemabindings tag in the DAD file.
38X14	DXXD000E	There was an attempt to store an invalid document into a table. Validation failed.
38X15	DXXA056E	The validation element in the document access definition (DAD) file is wrong or missing.
	DXXA057E	The name attribute of a side table in the document access definition (DAD) file is wrong or missing.
	DXXA058E	The name attribute of a column in the document access definition (DAD) file is wrong or missing.
	DXXA059E	The type attribute of a column in the document access definition (DAD) file is wrong or missing.
	DXXA060E	The path attribute of a column in the document access definition (DAD) file is wrong or missing.
	DXXA061E	The multi_occurrence attribute of a column in the document access definition (DAD) file is wrong or missing.
	DXXQ000E	A mandatory element is missing from the document access definition (DAD) file.
	DXXQ056E	The specified element/attribute cannot be mapped to a column that is specified as part of a foreign key. Data values for foreign keys are determined by that of the primary keys; a mapping of the specified element/attribute in the XML document to a table and column is not necessary.
	DXXQ057E	The schemabindings and DTD ID tags cannot exist together in the DAD file.
	DXXQ058E	The nonamespacelocation tag inside the schemabindings tag is missing in the DAD file.
	DXXQ059E	The doctype tag cannot be located inside the XCollection tag in the DAD for schema validation.

Table 94. SQLSTATE codes and associated message numbers (continued)

SQLSTATE	Message Number	Description
	DXXQ062E	This error condition is usually caused by a missing multi_occurrence = YES specification on the parent element_node of the given element or attribute.
	DXXQ063E	The value of the multi_occurrence attribute on the specified element_node in the document access definition (DAD) file is wrong or missing. The value must be 'yes' or 'no', case insensitive.
	DXXQ064E	A key column specified in the join condition was not mapped to any element or attribute node.
38X16	DXXG004E	A null value for a required parameter was passed to an XML stored procedure.
38X17	DXXQ001E	The SQL statement in the document access definition (DAD) file or the statement that overrides it is not valid. A SELECT statement is required for generating XML documents.
38X18	DXXG001E	XML Extender encountered an internal error.
	DXXG006E	XML Extender encountered an internal error while using CLI.
38X19	DXXQ002E	The system is running out of space in memory or disk. There is no space to contain the resulting XML documents.
38X20	DXXQ003W	The user-defined SQL query generates more XML documents than the specified maximum. Only the specified number of documents are returned.
38X21	DXXQ004E	The specified column is not one of the columns in the result of the SQL query.
38X22	DXXQ005E	The mapping of the SQL query to XML is incorrect.
38X23	DXXQ006E	An attribute_node element in the document access definition (DAD) file does not have a name attribute.
38X24	DXXQ007E	The attribute_node element in the document access definition (DAD) does not have a column element or RDB_node.

Table 94. SQLSTATE codes and associated message numbers (continued)

SQLSTATE	Message Number	Description
38X25	DXXQ008E	A text_node element in the document access definition (DAD) file does not have a column element.
38X26	DXXQ009E	The specified result table could not be found in the system catalog.
38X27	DXXQ010E DXXQ040E	The RDB_node of the attribute_node or text_node must have a table.
	DXXQ011E	The RDB_node of the attribute_node or text_node must have a column.
	DXXQ017E	An XML document generated by the XML Extender is too large to fit into the column of the result table.
	DXXQ040E	The specified element name in document access definition (DAD) file is wrong.
38X28	DXXQ012E	XML Extender could not find the expected element while processing the DAD.
	DXXQ016E	All tables must be defined in the RDB_node of the top element in the document access definition (DAD) file. Sub-element tables must match the tables defined in the top element. The table name in this RDB_node is not in the top element.
38X29	DXXQ013E	The element table or column must have a name in the document access definition (DAD) file.
	DXXQ015E	The condition in the condition element in the document access definition (DAD) file has an invalid format.
	DXXQ061E	The format of the string representation is invalid. If the string is a date, time, or timestamp value, the syntax does not conform to its data type.
38X30	DXXQ014E	An element_node element in the document access definition (DAD) file does not have a name attribute.
	DXXQ018E	The ORDER BY clause is missing from the SQL statement in a document access definition (DAD) file that maps SQL to XML.
38X31	DXXQ019E	The objids element does not have a column element in the document access definition (DAD) file that maps SQL to XML.

Table 94. SQLSTATE codes and associated message numbers (continued)

SQLSTATE	Message Number	Description
38x33	DXXG005E	This parameter is not supported in this release. It will be supported in the future release.
38x34	DXXG000E	An invalid file name was specified.
38X36	DXXA073E	The database was not bound when you tried to enable it.
38X37	DXXG007E	The server operating system locale is inconsistent with the DB2 UDB code page.
38X38	DXXG008E	The server operating system locale can not be found in the code page table.
38X41	DXXQ048E	The stylesheet processor returned an internal error. The XML document or the stylesheet might not be vaild.
38X42	DXXQ049E	The specified output file already exists in this directory.
38X43	DXXQ050E	The UDF was unable to create a unique file name for the output document in the specified directory because it does not have access. All file names that can be generated are in use or directory might not exist.
38X44	DXXQ051E	One or more input or output parameters have no valid value.
38X45	DXXQ055E	ICU error encountered during conversion operation.

XML Extender messages

DXXA000I Enabling column *<column_name>*. **Please Wait.**

Explanation: This is an informational message.

User Response: No action required.

DXXA001S An unexpected error occurred in build *<build_ID>*, **file** *<file_name>*, **and line** *<line_number>*.

Explanation: An unexpected error occurred.

User Response: If this error persists, contact your Software Service Provider. When reporting the error, be sure to include all the message text, the trace file, and an explanation of how to reproduce the problem.

DXXA002I Connecting to database *<database>*.

Explanation: This is an informational message.

User Response: No action required.

DXXA003E Cannot connect to database *<database>*.

Explanation: The database specified might not exist or could be corrupted.

User Response:

1. Ensure the database is specified correctly.
2. Ensure the database exists and is accessible.
3. Determine if the database is corrupted. If it is, ask your database administrator to recover it from a backup.

DXXA004E Cannot enable database *<database>***.**

Explanation: The database might already be enabled or might be corrupted.

User Response:

1. Determine if the database is enabled.
2. Determine if the database is corrupted. If it is, ask your database administrator to recover it from a backup.

DXXA005I Enabling database *<database>***. Please wait.**

Explanation: This is an informational message.

User Response: No action required.

DXXA006I The database *<database>* **was enabled successfully.**

Explanation: This is an informational message.

User Response: No action required.

DXXA007E Cannot disable database *<database>***.**

Explanation: The database cannot be disabled by XML Extender if it contains any XML columns or collections.

User Response: Backup any important data, disable any XML columns or collections, and update or drop any tables until there are no XML data types left in the database.

DXXA008I Disabling column *<column_name>***. Please Wait.**

Explanation: This is an information message.

User Response: No action required.

DXXA009E Xcolumn tag is not specified in the DAD file.

Explanation: This stored procedure is for XML Column only.

User Response: Ensure the Xcolumn tag is specified correctly in the DAD file.

DXXA010E Attempt to find DTD ID *<dtdid>* **failed.**

Explanation: While attempting to enable the column, the XML Extender could not find the DTD ID, which is the identifier specified for the DTD in the document access definition (DAD) file.

User Response: Ensure the correct value for the DTD ID is specified in the DAD file.

DXXA011E Inserting a record into DB2XML.XML_USAGE table failed.

Explanation: While attempting to enable the column, the XML Extender could not insert a record into the DB2XML.XML_USAGE table.

User Response: Ensure the DB2XML.XML_USAGE table exists and that a record by the same name does not already exist in the table.

DXXA012E Attempt to update DB2XML.DTD_REF table failed.

Explanation: While attempting to enable the column, the XML Extender could not update the DB2XML.DTD_REF table.

User Response: Ensure the DB2XML.DTD_REF table exists. Determine whether the table is corrupted or if the administration user ID has the correct authority to update the table.

DXXA013E Attempt to alter table *<table_name>* **failed.**

Explanation: While attempting to enable the column, the XML Extender could not alter the specified table.

User Response: Check the privileges required to alter the table.

DXXA014E The specified root ID column: *<root_id>* **is not a single primary key of table** *<table_name>***.**

Explanation: The root ID specified is either not a key, or it is not a single key of table *table_name*.

User Response: Ensure the specified root ID is the single primary key of the table.

DXXA015E The column DXXROOT_ID already exists in table *<table_name>***.**

Explanation: The column DXXROOT_ID exists, but was not created by XML Extender.

User Response: Specify a primary column for the root ID option when enabling a column, using a different different column name.

DXXA016E The input table *<table_name>* **does not exist.**

Explanation: The XML Extender was unable to find the specified table in the system catalog.

User Response: Ensure that the table exists in the database, and is specified correctly.

DXXA017E The input column ***<column_name>*** **does not exist in the specified table** ***<table_name>*****.**

Explanation: The XML Extender was unable to find the column in the system catalog.

User Response: Ensure the column exists in a user table.

DXXA018E The specified column is not enabled for XML data.

Explanation: While attempting to disable the column, XML Extender could not find the column in the DB2XML.XML_USAGE table, indicating that the column is not enabled. If the column is not XML-enabled, you do not need to disable it.

User Response: No action required.

DXXA019E A input parameter required to enable the column is null.

Explanation: A required input parameter for the enable_column() stored procedure is null.

User Response: Check all the input parameters for the enable_column() stored procedure.

DXXA020E Columns cannot be found in the table ***<table_name>*****.**

Explanation: While attempting to create the default view, the XML Extender could not find columns in the specified table.

User Response: Ensure the column and table name are specified correctly.

DXXA021E Cannot create the default view ***<default_view>*****.**

Explanation: While attempting to enable a column, the XML Extender could not create the specified view.

User Response: Ensure that the default view name is unique. If a view with the name already exists, specify a unique name for the default view.

DXXA022I Column ***<column_name>*** **enabled.**

Explanation: This is an informational message.

User Response: No response required.

DXXA023E Cannot find the DAD file.

Explanation: While attempting to disable a column, the XML Extender was unable to find the document access definition (DAD) file.

User Response: Ensure you specified the correct database name, table name, or column name.

DXXA024E The XML Extender encountered an internal error while accessing the system catalog tables.

Explanation: The XML Extender was unable to access system catalog table.

User Response: Ensure the database is in a stable state.

DXXA025E Cannot drop the default view ***<default_view>*****.**

Explanation: While attempting to disable a column, the XML Extender could not drop the default view.

User Response: Ensure the administration user ID for XML Extender has the privileges necessary to drop the default view.

DXXA026E Unable to drop the side table ***<side_table>*****.**

Explanation: While attempting to disable a column, the XML Extender was unable to drop the specified table.

User Response: Ensure that the administrator user ID for XML Extender has the privileges necessary to drop the table.

DXXA027E Could not disable the column.

Explanation: XML Extender could not disable a column because an internal trigger failed. Possible causes:

- The system is out of memory.
- A trigger with this name does not exist.

User Response: Use the trace facility to create a trace file and try to correct the problem. If the problem persists, contact your Software Service Provider and provide the trace file.

DXXA028E Could not disable the column.

Explanation: XML Extender could not disable a column because an internal trigger failed. Possible causes:

- The system is out of memory.
- A trigger with this name does not exist.

User Response: Use the trace facility to create a trace file and try to correct the problem. If the problem persists, contact your Software Service Provider and provide the trace file.

DXXA029E Could not disable the column.

Explanation: XML Extender could not disable a column because an internal trigger failed. Possible causes:

- The system is out of memory.
- A trigger with this name does not exist.

User Response: Use the trace facility to create a trace file and try to correct the problem. If the problem persists, contact your Software Service Provider and provide the trace file.

DXXA030E Could not disable the column.

Explanation: XML Extender could not disable a column because an internal trigger failed. Possible causes:

- The system is out of memory.
- A trigger with this name does not exist.

User Response: Use the trace facility to create a trace file and try to correct the problem. If the problem persists, contact your Software Service Provider and provide the trace file.

DXXA031E Unable to reset the DXXROOT_ID column value in the application table to NULL.

Explanation: While attempting to disable a column, the XML Extender was unable to set the value of DXXROOT_ID in the application table to NULL.

User Response: Ensure that the administrator user ID for XML Extender has the privileges necessary to alter the application table.

DXXA032E Decrement of USAGE_COUNT in DB2XML.XML_USAGE table failed.

Explanation: While attempting to disable the column, the XML Extender was unable to reduce the value of the USAGE_COUNT column by one.

User Response: Ensure that the DB2XML.XML_USAGE table exists and that the administrator user ID for XML Extender has the necessary privileges to update the table.

DXXA033E Attempt to delete a row from the DB2XML.XML_USAGE table failed.

Explanation: While attempting to disable a column, the XML Extender was unable to delete its associate row in the DB2XML.XML_USAGE table.

User Response: Ensure that the DB2XML.XML_USAGE table exists and that the administration user ID for XML Extender has the privileges necessary to update this table.

DXXA034I XML Extender has successfully disabled column *<column_name>*.

Explanation: This is an informational message

User Response: No action required.

DXXA035I XML Extender is disabling database *<database>*. **Please wait.**

Explanation: This is an informational message.

User Response: No action is required.

DXXA036I XML Extender has successfully disabled database *<database>*.

Explanation: This is an informational message.

User Response: No action is required.

DXXA037E The specified table space name is longer than 18 characters.

Explanation: The table space name cannot be longer than 18 alphanumeric characters.

User Response: Specify a name less than 18 characters.

DXXA038E The specified default view name is longer than 18 characters.

Explanation: The default view name cannot be longer than 18 alphanumeric characters.

User Response: Specify a name less than 18 characters.

DXXA039E The specified ROOT_ID name is longer than 18 characters.

Explanation: The ROOT_ID name cannot be longer than 18 alphanumeric characters.

User Response: Specify a name less than 18 characters.

DXXA046E Unable to create the side table *<side_table>*.

Explanation: While attempting to enable a column, the XML Extender was unable to create the specified side table.

User Response: Ensure that the administrator user ID for XML Extender has the privileges necessary to create the side table.

DXXA047E Could not enable the column.

Explanation: XML Extender could not enable a column because an internal trigger failed. Possible causes:

- The DAD file has incorrect syntax.
- The system is out of memory.
- Another trigger exists with the same name.

User Response: Use the trace facility to create a trace file and try to correct the problem. If the problem persists, contact your Software Service Provider and provide the trace file.

DXXA048E Could not enable the column.

Explanation: XML Extender could not enable a column because an internal trigger failed. Possible causes:

- The DAD file has incorrect syntax.
- The system is out of memory.
- Another trigger exists with the same name.

User Response: Use the trace facility to create a trace file and try to correct the problem. If the problem persists, contact your Software Service Provider and provide the trace file.

DXXA049E Could not enable the column.

Explanation: XML Extender could not enable a column because an internal trigger failed. Possible causes:

- The DAD file has incorrect syntax.
- The system is out of memory.
- Another trigger exists with the same name.

User Response: Use the trace facility to create a trace file and try to correct the problem. If the problem persists, contact your Software Service Provider and provide the trace file.

DXXA050E Could not enable the column.

Explanation: XML Extender could not enable a column because an internal trigger failed. Possible causes:

- The DAD file has incorrect syntax.
- The system is out of memory.
- Another trigger exists with the same name.

User Response: Use the trace facility to create a trace file and try to correct the problem. If the problem persists, contact your Software Service Provider and provide the trace file.

DXXA051E Could not disable the column.

Explanation: XML Extender could not disable a column because an internal trigger failed. Possible causes:

- The system is out of memory.
- A trigger with this name does not exist.

User Response: Use the trace facility to create a trace file and try to correct the problem. If the problem persists, contact your Software Service Provider and provide the trace file.

DXXA052E Could not disable the column.

Explanation: XML Extender could not disable a column because an internal trigger failed. Possible causes:

- The DAD file has incorrect syntax.
- The system is out of memory.
- Another trigger exists with the same name.

User Response: Use the trace facility to create a trace file and try to correct the problem. If the problem persists, contact your Software Service Provider and provide the trace file.

DXXA053E Could not enable the column.

Explanation: XML Extender could not enable a column because an internal trigger failed. Possible causes:

- The DAD file has incorrect syntax.
- The system is out of memory.
- Another trigger exists with the same name.

User Response: Use the trace facility to create a trace file and try to correct the problem. If the problem persists, contact your Software Service Provider and provide the trace file.

DXXA054E Could not enable the column.

Explanation: XML Extender could not enable a column because an internal trigger failed. Possible causes:

- The DAD file has incorrect syntax.
- The system is out of memory.
- Another trigger exists with the same name.

User Response: Use the trace facility to create a trace file and try to correct the problem. If the problem persists, contact your Software Service Provider and provide the trace file.

DXXA056E The validation value *<validation_value>* **in the DAD file is invalid.**

Explanation: The validation element in document access definition (DAD) file is wrong or missing.

User Response: Ensure that the validation element is specified correctly in the DAD file.

DXXA057E A side table name *<side_table_name>* **in DAD is invalid.**

Explanation: The name attribute of a side table in the document access definition (DAD) file is wrong or missing.

User Response: Ensure that the name attribute of a side table is specified correctly in the DAD file.

DXXA058E A column name *<column_name>* **in the DAD file is invalid.**

Explanation: The name attribute of a column in the document access definition (DAD) file is wrong or missing.

User Response: Ensure that the name attribute of a column is specified correctly in the DAD file.

DXXA059E The type *<column_type>* **of column** *<column_name>* **in the DAD file is invalid.**

Explanation: The type attribute of a column in the document access definition (DAD) file is wrong or missing.

User Response: Ensure that the type attribute of a column is specified correctly in the DAD file.

DXXA060E The path attribute *<location_path>* **of** *<column_name>* **in the DAD file is invalid.**

Explanation: The path attribute of a column in the document access definition (DAD) file is wrong or missing.

User Response: Ensure that the path attribute of a column is specified correctly in the DAD file.

DXXA061E The multi_occurrence attribute *<multi_occurrence>* **of** *<column_name>* **in the DAD file is invalid.**

Explanation: The multi_occurrence attribute of a column in the document access definition (DAD) file is wrong or missing.

User Response: Ensure that the multi_occurrence attribute of a column is specified correctly in the DAD file.

DXXA062E Unable to retrieve the column number for *<column_name>* **in table** *<table_name>***.**

Explanation: XML Extender could not retrieve the column number for *column_name* in table *table_name* from the system catalog.

User Response: Make sure the application table is well defined.

DXXA063I Enabling collection *<collection_name>***. Please Wait.**

Explanation: This is an information message.

User Response: No action required.

DXXA064I Disabling collection *<collection_name>***. Please Wait.**

Explanation: This is an information message.

User Response: No action required.

DXXA065E Calling stored procedure *<procedure_name>* **failed.**

Explanation: Check the shared library db2xml and see if the permission is correct.

User Response: Make sure the client has permission to run the stored procedure.

DXXA066I XML Extender has successfully disabled collection *<collection_name>***.**

Explanation: This is an informational message.

User Response: No response required.

DXXA067I XML Extender has successfully enabled collection *<collection_name>***.**

Explanation: This is an informational message.

User Response: No response required.

DXXA068I XML Extender has successfully turned the trace on.

Explanation: This is an informational message.

User Response: No response required.

DXXA069I XML Extender has successfully turned the trace off.

Explanation: This is an informational message.

User Response: No response required.

DXXA070W The database has already been enabled.

Explanation: The enable database command was executed on the enabled database

User Response: No action is required.

DXXA071W The database has already been disabled.

Explanation: The disable database command was executed on the disabled database

User Response: No action is required.

DXXA072E XML Extender couldn't find the bind files. Bind the database before enabling it.

Explanation: XML Extender tried to automatically bind the database before enabling it, but could not find the bind files

User Response: Bind the database before enabling it.

DXXA073E The database is not bound. Please bind the database before enabling it.

Explanation: The database was not bound when user tried to enable it.

User Response: Bind the database before enabling it.

DXXA074E Wrong parameter type. The stored procedure expects a STRING parameter.

Explanation: The stored procedure expects a STRING parameter.

User Response: Declare the input parameter to be STRING type.

DXXA075E Wrong parameter type. The input parameter should be a LONG type.

Explanation: The stored procedure expects the input parameter to be a LONG type.

User Response: Declare the input parameter to be a LONG type.

DXXA076E XML Extender trace instance ID invalid.

Explanation: Cannot start trace with the instance ID provided.

User Response: Ensure that the instance ID is a valid iSeries user ID.

DXXA077E The license key is not valid. See the server error log for more detail.

Explanation: The software license has expired or does not exist.

User Response: Contact your service provider to obtain a new software license.

DXXC000E Unable to open the specified file.

Explanation: The XML Extender is unable to open the specified file.

User Response: Ensure that the application user ID has read and write permission for the file.

DXXC001E The specified file is not found.

Explanation: The XML Extender could not find the file specified.

User Response: Ensure that the file exists and the path is specified correctly.

DXXC002E Unable to read file.

Explanation: The XML Extender is unable to read data from the specified file.

User Response: Ensure that the application user ID has read permission for the file.

DXXC003E Unable to write to the specified file.

Explanation: The XML Extender is unable to write data to the file.

User Response: Ensure that the application user ID has write permission for the file or that the file system has sufficient space.

DXXC004E Unable to operate the LOB Locator: rc=*<locator_rc>***.**

Explanation: The XML Extender was unable to operate the specified locator.

User Response: Ensure the LOB Locator is set correctly.

DXXC005E Input file size is greater than XMLVarchar size.

Explanation: The file size is greater than the XMLVarchar size and the XML Extender is unable to import all the data from the file.

User Response: Use the XMLCLOB column type.

DXXC006E The input file exceeds the DB2 UDB LOB limit.

Explanation: The file size is greater than the size of the XMLCLOB and the XML Extender is unable to import all the data from the file.

User Response: Decompose the file into smaller objects or use an XML collection.

DXXC007E Unable to retrieve data from the file to the LOB Locator.

Explanation: The number of bytes in the LOB Locator does not equal the file size.

User Response: Ensure the LOB Locator is set correctly.

DXXC008E Can not remove the file *<file_name>*.

Explanation: The file has a sharing access violation or is still open.

User Response: Close the file or stop any processes that are holding the file. You might have to stop and restart DB2.

DXXC009E Unable to create file to *<directory>* **directory.**

Explanation: The XML Extender is unable to create a file in directory *directory*.

User Response: Ensure that the directory exists, that the application user ID has write permission for the directory, and that the file system has sufficient space for the file.

DXXC010E Error while writing to file *<file_name>*.

Explanation: There was an error while writing to the file *file_name*.

User Response: Ensure that the file system has sufficient space for the file.

DXXC011E Unable to write to the trace control file.

Explanation: The XML Extender is unable to write data to the trace control file.

User Response: Ensure that the application user ID has write permission for the file or that the file system has sufficient space.

DXXC012E Cannot create temporary file.

Explanation: Cannot create file in system temp directory.

User Response: Ensure that the application user ID has write permission for the file system temp directory or that the file system has sufficient space for the file.

DXXC013E The results of the extract UDF exceed the size limit for the UDF return type.

Explanation: The data returned by an extract UDF must fit into the size limit of the return type of the UDF, as defined in the DB2 UDB XML Extenders Administration and Programming guide. For example, the results of extractVarchar must be no more than 4000 bytes (including the terminating NULL).

User Response: Use an extract UDF that has a larger size limit for the return type: 254 bytes for extractChar(), 4 KB for extractVarchar(), and 2 GB for extractClob().

DXXD000E An invalid XML document is rejected.

Explanation: There was an attempt to store an invalid document into a table. Validation has failed.

User Response: Check the document with its DTD using an editor that can view invisible invalid characters. To suppress this error, turn off validation in the DAD file.

DXXD001E *<location_path>* **occurs multiple times.**

Explanation: A scalar extraction function used a location path that occurs multiple times. A scalar function can only use a location path that does not have multiple occurrences.

User Response: Use a table function (add an 's' to the end of the scalar function name).

DXXD002E A syntax error occurred near position *<position>* **in the search path.**

Explanation: The path expression is syntactically incorrect.

User Response: Correct the search path argument of the query. Refer to the documentation for the syntax of path expressions.

DXXD003W Path not found. Null is returned.

Explanation: The element or attribute specified in the path expression is missing from the XML document.

User Response: Verify that the specified path is correct.

DXXG000E The file name *<file_name>* **is invalid.**

Explanation: An invalid file name was specified.

User Response: Specify a correct file name and try again.

DXXG001E An internal error occurred in build *<build_ID>*, **file** *<file_name>*, **and line** *<line_number>*.

Explanation: XML Extender encountered an internal error.

User Response: Contact your Software Service Provider. When reporting the error, be sure to include all the messages, the trace file and how to reproduce the error.

DXXG002E The system is out of memory.

Explanation: The XML Extender was unable to allocate memory from the operating system.

User Response: Close some applications and try again. If the problem persists, refer to your operating system documentation for assistance. Some operating systems might require that you reboot the system to correct the problem.

DXXG004E Invalid null parameter.

Explanation: A null value for a required parameter was passed to an XML stored procedure.

User Response: Check all required parameters in the argument list for the stored procedure call.

DXXG005E Parameter not supported.

Explanation: This parameter is not supported in this release, will be supported in the future release.

User Response: Set this parameter to NULL.

DXXG006E Internal Error CLISTATE=*<clistate>*, **RC=***<cli_rc>*, **build** *<build_ID>*, **file** *<file_name>*, **line** *<line_number>* **CLIMSG=***<CLI_msg>*.

Explanation: XML Extender encountered an internal error while using CLI.

User Response: Contact your Software Service Provider. Potentially this error can be caused by incorrect user input. When reporting the error, be sure to include all output messages, trace log, and how to reproduce the problem. Where possible, send any DADs, XML documents, and table definitions which apply.

DXXG007E Locale *<locale>* **is inconsistent with DB2 UDB code page** *<code_page>*.

Explanation: The server operating system locale is inconsistent with DB2 UDB code page.

User Response: Correct the server operating system locale and restart DB2.

DXXG008E Locale *<locale>* **is not supported.**

Explanation: The server operating system locale can not be found in the code page table.

User Response: Correct the server operating system locale and restart DB2.

DXXG017E The limit for *XML_Extender_constant* **has been exceeded in build** *build_ID*, **file** *file_name*, **and line** *line_number*.

Explanation: Check the XML Extender Administration and Programming Guide to see whether your application has exceeded a value in the limits table. If no limit has been exceeded, contact your Software Service Provider. When reporting the error, include all output messages, trace files, and information on how to reproduce the problem such as input DADs, XML documents, and table definitions.

User Response: Correct the server operating system locale and restart DB2.

DXXM001W A DB2 UDB error occurred.

Explanation: DB2 encountered the specified error.

User Response: See any accompanying messages for futher explanation and refer to DB2 UDB messages and codes documentation for your operating system.

DXXQ000E *<Element>* **is missing from the DAD file.**

Explanation: A mandatory element is missing from the document access definition (DAD) file.

User Response: Add the missing element to the DAD file.

DXXQ001E Invalid SQL statement for XML generation.

Explanation: The SQL statement in the document access definition (DAD) or the one that overrides it is not valid. A SELECT statement is required for generating XML documents.

User Response: Correct the SQL statement.

DXXQ002E Cannot generate storage space to hold XML documents.

Explanation: The system is running out of space in memory or disk. There is no space to contain the resulting XML documents.

User Response: Limit the number of documents to be generated. Reduce the size of each documents by removing some unnecessary element and attribute nodes from the document access definition (DAD) file.

DXXQ003W Result exceeds maximum.

Explanation: The user-defined SQL query generates more XML documents than the specified maximum. Only the specified number of documents are returned.

User Response: No action is required. If all documents are needed, specify zero as the maximum number of documents.

DXXQ004E The column *<column_name>* **is not in the result of the query.**

Explanation: The specified column is not one of the columns in the result of the SQL query.

User Response: Change the specified column name in the document access definition (DAD) file to make it one of the columns in the result of the SQL query. Alternatively, change the SQL query so that it has the specified column in its result.

DXXQ005E Wrong relational mapping. The element *<element_name>* **is at a lower level than its child column** *<column_name>*.

Explanation: The mapping of the SQL query to XML is incorrect.

User Response: Make sure that the columns in the result of the SQL query are in a top-down order of the relational hierarchy. Also make sure that there is a single-column candidate key to begin each level. If such a key is not available in a table, the query should generate one for that table using a table expression and the DB2 UDB built-in function generate_unique().

DXXQ006E An attribute_node element has no name.

Explanation: An attribute_node element in the document access definition (DAD) file does not have a name attribute.

User Response: Ensure that every attribute_node has a name in the DAD file.

DXXQ007E The attribute_node *<attribute_name>* **has no column element or RDB_node.**

Explanation: The attribute_node element in the document access definition (DAD) does not have a column element or RDB_node.

User Response: Ensure that every attribute_node has a column element or RDB_node in the DAD.

DXXQ008E A text_node element has no column element.

Explanation: A text_node element in the document access definition (DAD) file does not have a column element.

User Response: Ensure that every text_node has a column element in the DAD.

DXXQ009E Result table *<table_name>* **does not exist.**

Explanation: The specified result table could not be found in the system catalog.

User Response: Create the result table before calling the stored procedure.

DXXQ010E RDB_node of *<node_name>* **does not have a table in the DAD file.**

Explanation: The RDB_node of the attribute_node or text_node must have a table.

User Response: Specify the table of RDB_node for attribute_node or text_node in the document access definition (DAD) file.

DXXQ011E RDB_node element of *<node_name>* **does not have a column in the DAD file.**

Explanation: The RDB_node of the attribute_node or text_node must have a column.

User Response: Specify the column of RDB_node for attribute_node or text_node in the document access definition (DAD) file.

DXXQ012E Errors occurred in DAD.

Explanation: XML Extender could not find the expected element while processing the DAD.

User Response: Check that the DAD is a valid XML document and contains all the elements required by the DAD DTD. Consult the XML Extender publication for the DAD DTD.

DXXQ013E The table or column element does not have a name in the DAD file.

Explanation: The element table or column must have a name in the document access definition (DAD) file.

User Response: Specify the name of table or column element in the DAD.

DXXQ014E An element_node element has no name.

Explanation: An element_node element in the document access definition (DAD) file does not have a name attribute.

User Response: Ensure that every element_node element has a name in the DAD file.

DXXQ015E The condition format is invalid.

Explanation: The condition in the condition element in the document access definition (DAD) has an invalid format.

User Response: Ensure that the format of the condition is valid.

DXXQ016E The table name in this RDB_node is not defined in the top element of the DAD file.

Explanation: All tables must be defined in the RDB_node of the top element in the document access definition (DAD) file. Sub-element tables must match the tables defined in the top element. The table name in this RDB_node is not in the top element.

User Response: Ensure that the table of the RDB node is defined in the top element of the DAD file.

DXXQ017E The column in the result table *<table_name>* **is too small.**

Explanation: An XML document generated by the XML Extender is too large to fit into the column of the result table.

User Response: Drop the result table. Create another result table with a bigger column. Rerun the stored procedure.

DXXQ018E The ORDER BY clause is missing from the SQL statement.

Explanation: The ORDER BY clause is missing from the SQL statement in a document access definition (DAD) file that maps SQL to XML.

User Response: Edit the DAD file. Add an ORDER BY clause that contains the entity-identifying columns.

DXXQ019E The element objids has no column element in the DAD file.

Explanation: The objids element does not have a column element in the document access definition (DAD) file that maps SQL to XML.

User Response: Edit the DAD file. Add the key columns as sub-elements of the element objids.

DXXQ020I XML successfully generated.

Explanation: The requested XML documents have been successfully generated from the database.

User Response: No action is required.

DXXQ021E Table *<table_name>* **does not have column** *<column_name>***.**

Explanation: The table does not have the specified column in the database.

User Response: Specify another column name in DAD or add the specified column into the table database.

DXXQ022E Column *<column_name>* **of** *<table_name>* **should have type** *<type_name>***.**

Explanation: The type of the column is wrong.

User Response: Correct the type of the column in the document access definition (DAD).

DXXQ023E Column *<column_name>* **of** *<table_name>* **cannot be longer than** *<length>***.**

Explanation: The length defined for the column in the DAD is too long.

User Response: Correct the column length in the document access definition (DAD).

DXXQ024E Can not create table *<table_name>***.**

Explanation: The specified table can not be created.

User Response: Ensure that the user ID creating the table has the necessary authority to create a table in the database.

DXXQ025I XML decomposed successfully.

Explanation: An XML document has been decomposed and stored in a collection successfully.

User Response: No action is required.

DXXQ026E XML data *<xml_name>* **is too large to fit in column** *<column_name>***.**

Explanation: The specified piece of data from an XML document is too large to fit into the specified column.

User Response: Increase the length of the column using the ALTER TABLE statement or reduce the size of the data by editing the XML document.

DXXQ028E Cannot find the collection *<collection_name>* **in the XML_USAGE table.**

Explanation: A record for the collection cannot be found in the XML_USAGE table.

User Response: Verify that you have enabled the collection.

DXXQ029E Cannot find the DAD in XML_USAGE table for the collection ***<collection_name>*****.**

Explanation: A DAD record for the collection cannot be found in the XML_USAGE table.

User Response: Ensure that you have enabled the collection correctly.

DXXQ030E Wrong XML override syntax.

Explanation: The XML_override value is specified incorrectly in the stored procedure.

User Response: Ensure that the syntax of XML_override is correct.

DXXQ031E Table name cannot be longer than maximum length allowed by DB2.

Explanation: The table name specified by the condition element in the DAD is too long.

User Response: Correct the length of the table name in document access definition (DAD).

DXXQ032E Column name cannot be longer than maximum length allowed by DB2.

Explanation: The column name specified by the condition element in the DAD is too long.

User Response: Correct the length of the column name in the document access definition (DAD).

DXXQ033E Invalid identifier starting at *<identifier>*

Explanation: The string is not a valid DB2 UDB SQL identifier.

User Response: Correct the string in the DAD to conform to the rules for DB2 UDB SQL identifiers.

DXXQ034E Invalid condition element in top RDB_node of DAD: *<condition>*

Explanation: The condition element must be a valid WHERE clause consisting of join conditions connected by the conjunction AND.

User Response: See the XML Extender documentation for the correct syntax of the join condition in a DAD.

DXXQ035E Invalid join condition in top RDB_node of DAD: *<condition>*

Explanation: Column names in the condition element of the top RDB_node must be qualified with the table name if the DAD specifies multiple tables.

User Response: See the XML Extender documentation for the correct syntax of the join condition in a DAD.

DXXQ036E A Schema name specified under a DAD condition tag is longer than allowed.

Explanation: An error was detected while parsing text under a condition tag within the DAD. The condition text contains an id qualified by a schema name that is too long.

User Response: Correct the text of the condition tags in document access definition (DAD).

DXXQ037E Cannot generate *<element>* **with multiple occurrences.**

Explanation: The element node and its descendents have no mapping to database, but its multi_occurrence equals YES.

User Response: Correct the DAD by either setting the multi_occurrence to NO or create a RDB_node in one of its descendents.

DXXQ038E The SQL statement is too long: SQL_statement

Explanation: The SQL statement specified in the *<SQL_stmt>* element of DAD exceeds the allowed number of bytes.

User Response: Reduce the length of the SQL statement to less than or equal to 32765 bytes for Windows and UNIX, or 16380 bytes for OS/390 and iSeries.

DXXQ039E Too many columns specified for a table in the DAD file.

Explanation: A DAD file used for decomposition or RDB composition can have a maximum of 100 text_node and attribute_node elements that specify unique columns within the same table.

User Response: Reduce the total number of text_node and attribute_node elements that refer to unique columns within the same table 100 or less.

DXXQ040E The element name *<element_name>* **in the DAD file is invalid.**

Explanation: The specified element name in the document access definition (DAD) file is wrong.

User Response: Ensure that the element name is typed correctly in the DAD file. See the DTD for the DAD file.

DXXQ041W XML document successfully generated. One or more override paths specified is invalid and ignored.

Explanation: Specify only one override path.

User Response: Ensure that the element name is typed correctly in the DAD file. See the DTD for the DAD file.

DXXQ043E Attribute *<attr_name>* **not found under element** *<elem_name>***.**

Explanation: The attribute *<attr_name>* was not present in element *<elem_name>* or one of its child elements.

User Response: Ensure the attribute appears in the XML document everywhere that the DAD requires it.

DXXQ044E Element *<elem_name>* **does not have an ancestor element***<ancestor>***.**

Explanation: According to the DAD, *<ancestor>* is an ancestor element of *<elem_name>* . In the XML document, one or more element *<elem_name>* does not have such an ancestor.

User Response: Ensure that the nesting of elements in the XML document conforms to what is specified in the corresponding DAD.

DXXQ045E Subtree under element *<elem_name>* **contains multiple attributes named***<attrib_name>***.**

Explanation: A subtree under *<elem_name>* in the XML document contains multiple instances of attribute*<attrib_name>* , which according to the DAD, is to be decomposed into the same row. Elements or attributes that are to be decomposed must have unique names.

User Response: Ensure that the element or attribute in the subtree has a unique name.

DXXQ046W The DTD ID was not found in the DAD.

Explanation: In the DAD, VALIDATION is set to YES, but the DTDID element is not specified. No validation check is performed.

User Response: No action is required. If validation is needed, specify the DTDID element in the DAD file.

DXXQ047E Parser error on line <mv> linenumber</mv> column *colnumber***:** *msg*

Explanation: The parser could not parse the document because of the reported error.

User Response: Correct the error in the document, consulting the XML specifications if necessary.

DXXQ048E Internal error - see trace file.

Explanation: The stylesheet processor returned an internal error. The XML document or the stylesheet might not vaild.

User Response: Ensure the XML document and the stylesheet are valid.

DXXQ049E The output file already exists.

Explanation: The specified output file already exists in this directory.

User Response: Change the output path or file name for the output document to a unique name or delete the existing file.

DXXQ050E Unable to create a unique file name.

Explanation: The UDF was unable to create a unique file name for the output document in the specified directory because it does not have access, all file names that can be generated are in use or directory might not exist.

User Response: Ensure that the UDF has access to the specified directory, change to a directory with available file names.

DXXQ051E No input or output data.

Explanation: One or more input or output parameters have no valid value.

User Response: Check the statement to see if required parameters are missing.

DXXQ052E An error occurred while accessing the DB2XML.XML_USAGE table.

Explanation: Either the database has not been enabled or the table DB2XML.XML_USAGE has been dropped.

User Response: Ensure that the database has been enabled and the table DB2XML.XML_USAGE is accessible.

DXXQ053E An SQL statement failed : *msg*

Explanation: An SQL statement generated during XML Extender processing failed to execute.DB2XML.XML_USAGE has been dropped.

User Response: Examine the trace for more details. If you cannot correct the error condition, contact your softwaresService provider. When reporting the error, be sure to include all the messages, the trace file and how to reproduce the error.

DXXQ054E Invalid input parameter: *param*

Explanation: The specified input parameter to a stored procedure or UDF is invalid.

User Response: Check the signature of the relevant stored procedure or UDF, and ensure the actual input parameter is correct.

DXXQ055E ICU error: *uerror*

Explanation: ICU error encountered during conversion operation.

User Response: Report the error to your software service provider. Include trace file, error message, and instructions to reproduce the error.

DXXQ056E Element/attribute *xmlname* **cannot be mapped to the column designated as part of the foreign key (column** *column* **in table** *table***).**

Explanation: The specified element/attribute cannot be mapped to a column that is specified as part of a foreign key. Data values for foreign keys are determined by that of the primary keys; a mapping of the specified element/attribute in the xml document to a table and column is not necessary.

User Response: Remove the RDB_node mapping to the specified column and table in the DAD.

DXXQ057E The schemabindings and dtdid tags cannot exist together in the DAD file.

Explanation: The schemabindings and dtdid tags cannot exist together in the DAD file.

User Response: Check that either the schemabindings tag or the dtdid tag exists in the DAD file, but not both.

DXXQ058E The nonamespacelocation tag inside the schemabindings tag is missing in the DAD file.

Explanation: The nonamespacelocation tag inside the schemabindings tag is missing in the DAD file.

User Response: Add the nonamespacelocation tag to the schemabindings tag.

DXXQ059E The doctype tag cannot be located inside the XCollection tag in the DAD for schema validation.

Explanation: The doctype tag cannot be located inside the XCollection tag in the DAD for schema validation.

User Response: Remove the doctype tag inside the Xcollection tag for schema validation.

DXXQ060E Attempt to find SCHEMA ID *schemaid* **failed.**

Explanation: The XML Extender could not find the SCHEMA ID while attempting to enable the column. The SCHEMA ID corresponds to the value of the location attribute of the nonamespacelocation tag which is inside the schemabindings tag in the DAD file.

User Response: Check that the correct value for the SCHEMA ID is specified in the DAD file.

DXXQ061E The format of the string is invalid.

Explanation: The format of the string representation is invalid. If the string is a date, time, or timestamp value, the syntax does not conform to its data type.

User Response: Check that the format of the date, time, or timestamp value conforms to the format for its data type.

DXXQ062E No rows of result set for *table* **are left to produce a XML value for** *element***.**

Explanation: This error condition is usually caused by a missing multi_occurrence = YES specification on the parent element_node of the given element or attribute.

User Response: Check the DAD that the value of multi_occurrence on the parent element_node correctly reflects the multiplicity of child element_nodes.

DXXQ063E The multi_occurrence attribute value on *elementname* **in the DAD file is invalid.**

Explanation: The value of the multi_occurrence attribute on the specified element_node in the document access definition (DAD) file is wrong or missing. The value must be 'yes' or 'no', case insensitive.

User Response: Ensure that the multi_occurrence attribute is specified correctly in the DAD file.

DXXQ064E Column *column* **not found in foreign table** *table***.**

Explanation: A key column specified in the join condition was not mapped to any element or attribute node.

User Response: Check to make sure the join condition specified in the DAD file is correct, and all key columns are mapped to element or attribute nodes.

DXXQ065I All triggers relating to XML enabled columns have been successfully regenerated.

Explanation: This is an informational message only.

User Response: No action required.

DXXQ066E The primary key for table *tablename* does not exist.

Explanation: XML Extender could not determine the primary key for table *tablename*. Check that the primary key for the table was not dropped after the column was enabled for XML.

User Response: Alter the table to add the primary key specified as the ROOT ID when the column was enabled for XML.

DXXQ067E Attempt to *action* failed.

Explanation: While attempting to *action*, a SQL error occurred.

User Response: Contact your Software Service Provider. When reporting the error, be sure to include the XML Extender trace file.

DXXQ068E Cannot set current SQLID to [userid]. SQLCODE = [sqlcode].

Explanation: While attempting to set current sqlid to a secondary authorization id, a SQL error occurred.

User Response: Check that you are specifying a valid secondary authorization id and that you have authorization for the id.

Appendix A. Samples

This appendix shows the sample objects that are used with examples in this book.

- “XML DTD sample”
- “XML document sample: getstart.xml”
- “Document access definition files” on page 294
  - “Sample DAD file: XML column” on page 294
  - “Sample DAD file: XML collection: SQL mapping” on page 296
  - “Sample DAD file: XML: RDB_node mapping” on page 297

XML DTD sample

The following DTD is used for the `getstart.xml` document that is referenced throughout this book.

```
<!xml encoding="US-ASCII"?>

<!ELEMENT Order (Customer, Part+)>
<!ATTLIST Order key CDATA #REQUIRED>
<!ELEMENT Customer (Name, Email)>
<!ELEMENT Name (#PCDATA)>
<!ELEMENT Email (#PCDATA)>
<!ELEMENT Part (key, Quantity, ExtendedPrice, Tax, Shipment+)>
<!ELEMENT key (#PCDATA)>
<!ELEMENT Quantity (#PCDATA)>
<!ELEMENT ExtendedPrice (#PCDATA)>
<!ELEMENT Tax (#PCDATA)>
<!ATTLIST Part color CDATA #REQUIRED>
<!ELEMENT Shipment (ShipDate, ShipMode)>
<!ELEMENT ShipDate (#PCDATA)>
<!ELEMENT ShipMode (#PCDATA)>
```

Figure 15. Sample XML DTD: `getstart.dtd`

XML document sample: getstart.xml

The following XML document, `getstart.xml`, is the sample XML document that is used in examples throughout this book. It contains XML tags to form a purchase order.

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```
<?xml version="1.0"?>
<!DOCTYPE Order SYSTEM "dxx_install/samples/db2xml/dtd/getstart.dtd">
<Order key="1">
  <Customer>
    <Name>American Motors</Name>
    <Email>parts@am.com</Email>
  </Customer>
  <Part color="black ">
    <key>68</key>
    <Quantity>36</Quantity>
    <ExtendedPrice>34850.16</ExtendedPrice>
    <Tax>6.000000e-02</Tax>
    <Shipment>
      <ShipDate>1998-08-19</ShipDate>
      <ShipMode>BOAT  </ShipMode>
    </Shipment>
    <Shipment>
       <ShipDate>1998-08-19</ShipDate>
       <ShipMode>AIR   </ShipMode>
    </Shipment>
  </Part>
  <Part color="red   ">
    <key>128</key>
    <Quantity>28</Quantity>
    <ExtendedPrice>38000.00</ExtendedPrice>
    <Tax>7.000000e-02</Tax>
    <Shipment>
      <ShipDate>1998-12-30</ShipDate>
      <ShipMode>TRUCK </ShipMode>
    </Shipment>
  </Part>
</Order>
```

Figure 16. Sample XML document: getstart.xml

Document access definition files

The following sections contain document access definition (DAD) files that map XML data to DB2 UDB relational tables, using either XML column or XML collection access modes.

- “Sample DAD file: XML column”
- “Sample DAD file: XML collection: SQL mapping” on page 296 shows a DAD file for an XML collection using SQL mapping.
- “Sample DAD file: XML: RDB_node mapping” on page 297 show a DAD for an XML collection that uses RDB_node mapping.

Sample DAD file: XML column

This DAD file contains the mapping for an XML column, and it definines the table, side tables, and columns that are to contain the XML data.

```
<?xml version="1.0"?>
<!DOCTYPE Order SYSTEM  "dxx_install/samples/db2xml/dtd/dad.dtd">
<DAD>
   <dtdid> "dxx_install/samples/db2xml/dtd/getstart.dtd"
   </dtdid>
   <validation>YES</validation>

   <Xcolumn>
     <table name="order_side_tab">
         <column name="order_key"
            type="integer"
            path="/Order/@key"
            multi_occurrence="NO"/>
         <column name="customer"
            type="varchar(50)"
            path="/Order/Customer/Name"
            multi_occurrence="NO"/>
     </table>
     <table name="part_side_tab">
         <column name="price"
            type="decimal(10,2)"
            path="/Order/Part/ExtendedPrice"
            multi_occurrence="YES"/>
     </table>
     <table name="ship_side_tab">
         <column name="date"
            type="DATE"
            path="/Order/Part/Shipment/ShipDate"
            multi_occurrence="YES"/>
     </table>

   </Xcolumn>

</DAD>
```

Figure 17. Sample DAD file for an XML column: getstart_xcolumn.dad

Sample DAD file: XML collection: SQL mapping

This DAD file contains an SQL statement that specifies the DB2 UDB tables, columns, and conditions that are to contain the XML data.

```
<?xml version="1.0"?>
<!DOCTYPE DAD SYSTEM "dxx_install/samples/db2xml/dtd/dad.dtd">
<DAD>
<validation>NO</validation>
<Xcollection>
<SQL_stmt>SELECT o.order_key, customer_name, customer_email, p.part_key, color,
   quantity, price, tax, ship_id, date, mode from order_tab o, part_tab p,
   table(select db2xml.generate_unique()
     as ship_id, date, mode, part_key from ship_tab) s
               p.price > 20000 and
               p.order_key = o.order_key and
               s.part_key = p.part_key
         ORDER BY order_key, part_key, ship_id</SQL_stmt>
<prolog>?xml version="1.0"?</prolog>
<doctype>!DOCTYPE Order SYSTEM "dxx_install/samples/db2xml/dtd/getstart.dtd
"</doctype>
```

Figure 18. Sample DAD file for an XML collection using SQL mapping: order_sql.dad (Part 1 of 2)

```
<root_node>
<element_node name="Order">
  <attribute_node name="key">
    <column name="order_key"/>
  </attribute_node>
  <element_node name="Customer">
    <element_node name="Name">
      <text_node><column name="customer_name"/></text_node>
    </element_node>
    <element_node name="Email">
      <text_node><column name="customer_email"/></text_node>
    </element_node>
  </element_node>
  <element_node name="Part">
    <attribute_node name="color">
      <column name="color"/>
    </attribute_node>
    <element_node name="key">
      <text_node><column name="part_key"/></text_node>
    </element_node>
    <element_node name="Quantity">
      <text_node><column name="quantity"/></text_node>
    </element_node>
    <element_node name="ExtendedPrice">
      <text_node><column name="price"/></text_node>
    </element_node>
    <element_node name="Tax">
      <text_node><column name="tax"/></text_node>
    </element_node>
    <element_node name="Shipment" multi_occurrence="YES">
      <element_node name="ShipDate">
        <text_node><column name="date"/></text_node>
      </element_node>
      <element_node name="ShipMode">
        <text_node><column name="mode"/></text_node>
      </element_node>
    </element_node>
  </element_node>
</element_node>
</root_node>
</Xcollection>
</DAD>
```

Figure 18. Sample DAD file for an XML collection using SQL mapping: order_sql.dad (Part 2 of 2)

Sample DAD file: XML: RDB_node mapping

This DAD file uses <RDB_node> elements to define the DB2 UDB tables, columns, and conditions that are to contain XML data.

```
<?xml version="1.0"?>
<!DOCTYPE DAD SYSTEM "SQLLIB/samples/db2xml/dtd/dad.dtd>
<DAD>
 <dtdid>E:\dtd\lineItem.dtd</dtdid>
 <validation>YES</validation>
 <Xcollection>
 <prolog>?xml version="1.0"?</prolog>
 <doctype>!DOCTYPE Order SYSTEM
                  "SQLLIB/samples/db2xml/dtd/getstart.dtd"</doctype>
 <root_node>
 <element_node name="Order">
 <RDB_node>
 <table name="order_tab"/>
```

```
<table name="part_tab"/>
<table name="ship_tab"/>
<condition>order_tab.order_key=part_tab.order_key AND
             part_tab.part_key=ship_tab.part_key </condition>
</RDB_node>
<attribute_node name="Key">
<RDB_node>
<table name="order_tab"/>
<column name="order_key"/>
</RDB_node>
</attribute_node>
<element_node name="Customer">

       <element_node name="Name">
           <text_node>
              <RDB_node>
                 <table name="order_tab"/>
                 <column name="customer_name"/>
               </RDB_node>
          </text_node>
       </element_node>
       <element_node name="Email">
          <text_node>
              <RDB_node>
                  <table name="order_tab"/>
                  <column name="customer_email"/>
              </RDB_node>
          </text_node>
       </element_node>
 </element_node>
     <element_node name="Part">
         <attribute_node name="Key">
               <RDB_node>
                   <table name="part_tab"/>
                   <column name="part_key"/>
               </RDB_node>
         </attribute_node>
         <element_node name="ExtendedPrice">
               <text_node>
                  <RDB_node>
                     <table name="part_tab"/>
                     <column name="price"/>
                     <condition>price > 2500.00</condition>
                  </RDB_node>
                </text_node>
          </element_node>
          <element_node name="Tax">
               <text_node>
                  <RDB_node>
                      <table name="part_tab"/>
                      <column name="tax"/>
                  </RDB_node>
               </text_node>
          </element_node>

          <element_node name="Quantity">
               <text_node>
                  <RDB_node>
                      <table name="part_tab"/>
                      <column name="qty"/>
                  </RDB_node>
               </text_node>
         </element_node>
         <element_node name="Shipment" multi_occurrence="YES">
              <element_node name="ShipDate">
                  <text_node>
                     <RDB_node>
```

```
                          <table name="ship_tab"/>
                          <column name="date"/>
                          <condition>date > '1966-01-01'</condition>
                      </RDB_node>
                   </text_node>
               </element_node>
               <element_node name="ShipMode">
                   <text_node>
                      <RDB_node>
                          <table name="ship_tab"/>
                          <column name="mode"/>
                      </RDB_node>
                    </text_node>
               </element_node>
               <element_node name="Comment">
                    <text_node>
                      <RDB_node>
                          <table name="ship_tab"/>
                          <column name="comment"/>
                      </RDB_node>
                    </text_node>
               </element_node>
         </element_node> <!-- end of element Shipment-->
      </element_node> <!-- end of element Part -->
    </element_node> <!-- end of element Order -->
</root_node>

</Xcollection>

</DAD>
```

Appendix B. Code page considerations

XML documents and other related files must be encoded properly for each client or server that accesses the files. The XML Extender makes some assumptions when processing a file, you need to understand how it handles code page conversions. The primary considerations are:

- Ensuring that the actual code page of the client retrieving an XML document from DB2 UDB matches the encoding of the document.
- Ensuring that, when the document is processed by an XML parser, the encoding declaration of the XML document is also consistent with the document's actual encoding.
- Determining how parsers and other tools handle line endings and determining how to present files so that they are processed.

The following topics describe the issues for these considerations, how you can prepare for possible problems, and how the XML Extender and DB2 UDB support code pages when documents are passed from client to server, and to the database.

Terminology for XML code pages

The following terms are used in the topics about XML code pages:

document encoding
The code page of an XML document.

document encoding declaration
The name of the code page specified in the XML declaration. For example, the following encoding declaration specifies `ibm-1047`:

```
<?xml version="1.0" encoding="ibm-1047"?>
```

consistent document
A document in which the code page matches the encoding declaration.

inconsistent document
A document in which the code page does not match the encoding declaration.

client code page
The application code page. The default client code page is the value of the operating system locale on a Windows or UNIX client.

server code page, or server operating system locale code page
The operating system locale of the HFS file system on USS, that is in the same OS/390 system as the XML-enabled database. The XML Extender uses the `nl_langinfo` environment option to determine the value of the server code page.

database code page
The encoding of the stored data, determined at database create time. This value defaults to the server operating system locale.

DB2 and XML Extender code page assumptions

When DB2 UDB sends or receives an XML document, it does not check the encoding declaration. Rather, it checks the code page for the client to see if it matches the database code page. If they are different, DB2 UDB converts the data in the XML document to match the code page of:

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- The database, when importing the document, or a document fragment, into a database table.
- The database, when decomposing a document into one or more database tables.
- The client, when exporting the document from the database and presenting the document to the client.
- The server, when processing a file with a UDF that returns data in a file on the server's file system.

Assumptions for importing an XML document

When an XML document is imported into the database, it is generally imported as an XML document to be stored in an XML column, or for decomposition for an XML collection, where the element and attribute contents will be saved as DB2 UDB data. When a document is imported, DB2 UDB converts the document encoding to that of the database. DB2 UDB assumes that the document is in the code page specified in the "Source code page" column in the table below. Table 95 summarizes the conversions that DB2 UDB makes when importing an XML document.

Table 95. Using UDFs and stored procedures when the XML file is imported into the database

Task	**This is the source code page for conversion**	**This is the target code page for conversion**	**Comments**
Inserting DTD file into DTD_REF table	Client code page	Database code page	
Enabling a column or enabling a collection with stored procedures, or using administration commands that import DAD files	Client code page (the code page used to bind DXXADMIN during installation), when enabling in USS.	Database code page	
Using user-defined functions: • XMLVarchar FromFile() • XMLCLOB FromFile() • Content(): retrieve from XMLFILE to a CLOB	Server code page	Database code page	The database code page is converted to the client code page when the data is presented to the client
Using stored procedures for decomposition	Client code page	Database code page	• Document to be decomposed is assumed to be in client code page. Data from decomposition is stored in tables in database code page • Use the CCSID option for DAD and XML files when the calling application runs in USS.

Assumptions for exporting an XML document

When an XML document is exported from the database, it is exported based on a client request to present one of the following objects:

- An XML document from an XML column
- The query results of XML documents in an XML column
- A composed XML document from an XML collection

When a document is exported, DB2 UDB converts the document encoding to that of the client or server, depending on where the request originated and where the data is to be presented. Table 96 summarizes the conversions that DB2 UDB makes when exporting an XML document.

Table 96. Using UDFs and stored procedures when the XML file is exported from the database

Task	DB2 converts the ...	Comments
Using user-defined functions: • XMLFileFromVarchar() • XMLFileFromCLOB() • Content(): retrieve from XMLVARCHAR to an external server file	Database code page to the server code page	
Composing XML documents with a stored procedure that are stored in a result table, which can be queried and exported.	Database code page to the client code page when the result set is presented to the client	• When composing documents, XML Extender copies the encoding declaration specified by the tag in the DAD, to the newly created document. It should match the client code page when presented. • Use the CCSID option for DAD files when the calling application runs in USS.

Encoding declaration considerations for XML Extender

The *encoding declaration* specifies the code page of the XML document's encoding and appears on the XML declaration statement. When using XML Extender, it is important to ensure that the encoding of the document matches the code page of the client or the server, depending on where the file is located.

Legal encoding declarations

You can use any encoding declaration in XML documents, within some guidelines. In this section, these guidelines are defined, along with the supported encoding declarations.

If you use the encodings listed in Table 97 on page 304, your application can be ported between IBM operating systems. If you use other encodings, your data is less likely to be portable.

For all operating systems, the following encoding declarations are supported. The following list describes the meaning of each column:

- **Encoding** specifies the encoding string to be used in the XML declaration.

- **Category** shows the operating system on which DB2 UDB supports the given code page.
- **Code page** shows the IBM-defined code page associated with the given encoding

Table 97. Encoding declarations supported by XML Extender

Category	Encoding	Code page
Unicode	UTF-8	1208
	UTF-16	1200
EBCDIC	ibm-037	37
	ibm-273	273
	ibm-277	277
	ibm-278	278
	ibm-280	280
	ibm-284	284
	ibm-297	297
	ibm-500	500
	ibm-1047	1047
	ibm-1140	1140
ASCII	iso-8859-1	819
	ibm-1252	1252
	iso-8859-2	912
	iso-8859-5	915
	iso-8859-6	1089
	iso-8859-7	813
	iso-8859-8	916
	iso-8859-9	920

The encoding string must be compatible with the code page of the document's destination. If a document is being returned from a server to a client, then its encoding string must be compatible with the client's code page. See "Consistent encodings and encoding declarations" for the consequences of incompatible encodings. See the following Web address for a list of code pages supported by the XML parser used by XML Extender:

`http://www.ibm.com/software/data/db2/extenders/xmlext/moreinfo/encoding.html`

Consistent encodings and encoding declarations

When an XML document is processed or exchanged with another system, it is important that the encoding declaration corresponds to the actual encoding of the document. Ensuring that the encoding of a document is consistent with the client is important because XML tools, like parsers, generate an error for an entity that includes an encoding declaration other than that named in the declaration.

Figure 19 on page 305 shows that clients have consistent code pages with the document encoding and declared encoding.

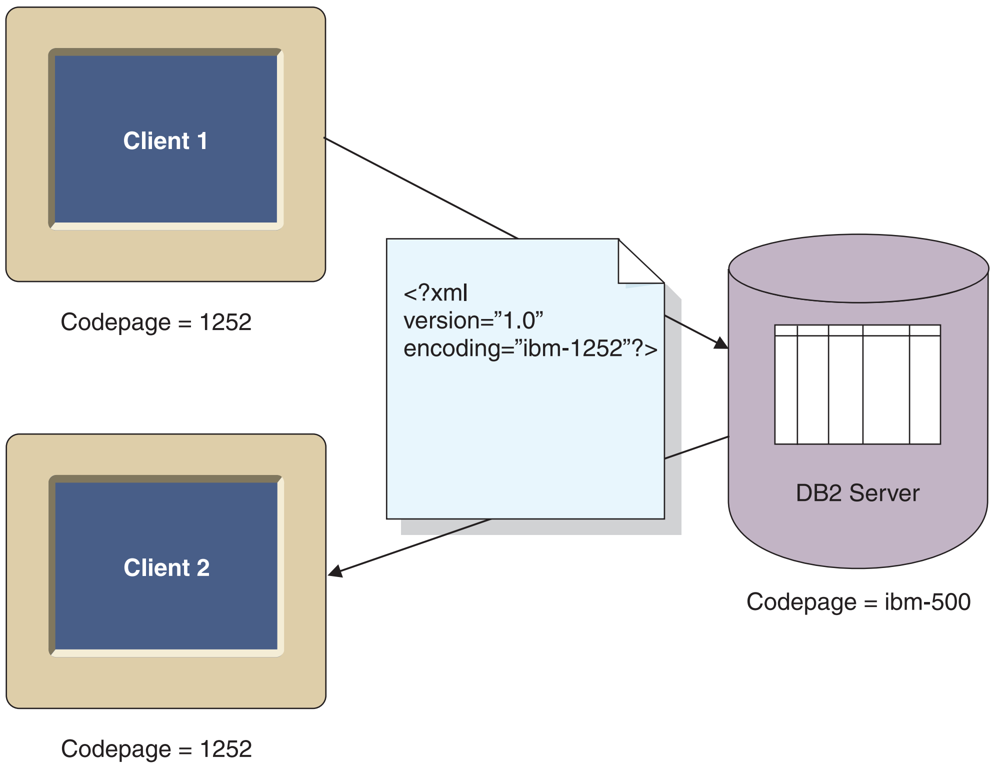

Figure 19. Clients have matching code pages

The consequences of having different code pages are the following possible situations:

- A conversion in which data is lost might occur, particularly if the source code page is Unicode and the target code page is not Unicode. Unicode contains the full set of characters. If a file is converted from UTF-8 to a code page that does not support all the characters used in the document, then data might be lost during the conversion.
- The declared encoding of the XML document might no longer be consistent with the actual document encoding, if the document is retrieved by a client with a different code page than the declared encoding of the document.

Figure 20 on page 306 shows an environment in which the code pages of the clients are inconsistent.

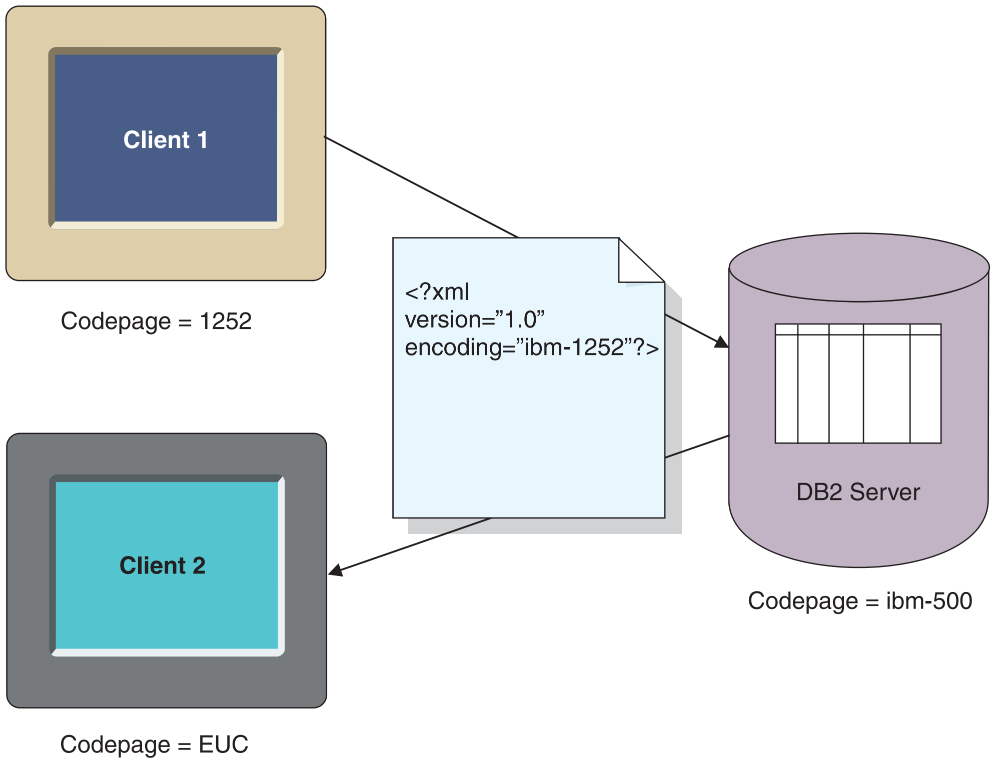

Figure 20. Clients have mismatching code pages

Client 2 receives the document in EUC, but the document will have an encoding declaration of ibm-1252.

Consistent encodings in USS

When running applications in USS, there are two considerations:

- When you enable an XML column or collection, and specify a DAD file that is stored in HFS, bind the DXXADM package with the ENCODING option and specify the actual code page of the DAD file. The bind step for DXXADM is included in the DXXGPREP JCL job. For example, if the DAD file has a code page of 1047, specify this value on the ENCODING option:
```
BIND PACKAGE (DB2XML) MEMBER(DXXADM) ENCODING(1047);
```
- When DAD files stored in HFS are used in a calling application, declare a host variable in the calling program with the coded character set identifier (CCSID) of the actual code page of the DAD file. If the file is created in HFS, the code page is that of HFS. If the file has been imported into HFS in binary mode, the code page might be different. This declaration ensures that DB2 UDB converts the DAD code page, to the database code page. For example, if a DAD file is in 1047, use the following variable declaration:
```
EXEC SQL DECLARE :dadobj VARIABLE CCSID 1047;
```
- When XML files stored in HFS are used in a calling application for decomposition, declare a host variable in the calling program with the CCSID of the actual code page of the XML file. If the file is created in HFS, the code page is that of HFS. If the file has been imported into HFS in binary mode, the code page might be different. This declaration ensures that DB2 UDB converts the XML file code page, to the database code page. For example, if a DAD file is in 1047, use the following variable declaration:
```
EXEC SQL DECLARE :xmlobj VARIABLE CCSID 1047;
```

Declaring an encoding

The default value of the encoding declaration is UTF-8, and the absence of an encoding declaration means the document is in UTF-8.

To declare an encoding value:

In the XML document declaration specify the encoding declaration with the name of the code page of the client. For example:

```
<?xml version="1.0" encoding="ibm-1047" ?>
```

Conversion scenarios

The XML Extender processes XML documents when:

- Storing and retrieving XML column data, using the XML column storage and access method
- Composing and decomposing XML documents

Documents undergo code page conversion when passed from a client or server, to a database. Inconsistencies or damage of XML documents is most likely to occur during conversions from code pages of the client, server, and database. When choosing the encoding declaration of the document, as well as planning what clients and servers can import or export documents from the database, consider the conversions described in the above tables, and the scenarios described below.

The following scenarios describe common conversion scenarios that can occur:

Scenario 1: This scenario is a configuration with consistent encodings, no DB2 UDB conversion, and a document imported from the server. The document encoding declaration is ibm-1047, the server is ibm-1047, and the database is ibm-1047. DB2 UDB does not need to convert the document because the server code page and database code page are identical. The encoding and declaration are consistent.

1. The document is imported into DB2 UDB using the XMLClobfromFile UDF.
2. The document is extracted to the server.

Scenario 2: This scenario is a configuration with consistent encodings, DB2 UDB conversion, and a document imported from server and exported to client. The document encoding and declaration is ibm-1047 the client and server code pages are ibm-1047, and the database code pages are ibm-500.

1. The document is imported into DB2 UDB using XMLClobfromfile UDF from the server. DB2 converts the document from ibm-1047 and stores it in ibm-500. The encoding declaration and encoding are inconsistent in the database.
2. A client using ibm-1047 requests the document for presentation at the Web browser. DB2 UDB converts the document to ibm-1047, the client's code page. The document encoding and the declaration are now consistent at the client.

Scenario 3: This scenario is a configuration with inconsistent encodings, DB2 UDB conversion, a document imported from the server and exported to a client. The document encoding declaration is for the incoming document. The server code page is ibm-1047 and the client and database are ibm-500.

1. The document is imported into the database using a storage UDF. DB2 UDB converts the document to ibm-500 from ibm-1047. The encoding and declaration are inconsistent.

2. A client with a ibm-500 code page requests the document for presentation at a Web browser. DB2 does not convert because the client and the database code pages are the same. The document encoding and declaration are inconsistent because the declaration is ibm-1047 and the encoding is ibm-500. The document cannot be processed by an XML parser or other XML processing tools.

Recommendations for preventing inconsistent XML documents

The above sections have discussed how an XML document can have an inconsistent encoding, that is, the encoding declaration conflicts with the document's encoding. Inconsistent encodings can cause the loss of data and or unusable XML documents.

Use one of the following recommendations for ensuring that the XML document encoding is consistent with the client code page, before handing the document to an XML processor, such as a parser:

- When exporting a document from the database using the XML Extender UDFs, try one of the following techniques (assuming XML Extender has exported the file, in the server code page, to the file system on the server):
  - Convert the document to the declared encoding code page
  - Override the declared encoding, if the tool has an override facility
  - Manually change the encoding declaration of the exported document to the document's actual encoding (that is, the server code page)
- When exporting a document from the database using the XML Extender stored procedures, try one of the following techniques (assuming the client is querying the result table, in which the composed document is stored):
  - Convert the document to the declared encoding code page
  - Override the declared encoding, if the tool has an override facility
  - Before running the stored procedure, have the client set the CCSID variable to force the client code page to a code page that is compatible with the encoding declaration of the XML document.
  - Manually change the encoding declaration of the exported document to the document's actual encoding (that is, the client code page)

Limitation when using Unicode and a Windows NT client: On Windows NT, the operating system locale cannot be set to UTF-8. Use the following guidelines when importing or exporting documents:

- When importing files and DTDs encoded in UTF-8, set the client code page to UTF-8, using:
  ```
  db2set DB2CODEPAGE=1208
  ```
  Use this technique when:
  - Inserting a DTD into the DB2XML.DTD_REF table
  - Enabling a column or collection
  - Decomposing stored procedures
- When using the Content() or XMLFromFile UDFs to import XML documents, documents must be encoded in the code page of the server's operating system locale, which cannot be UTF-8.
- When exporting an XML file from the database, set the client code page with the following command to have DB2 UDB encode the resulting data in UTF-8:
  ```
  db2set DB2CODEPAGE=1208
  ```

Use this technique when:
  – Querying the result table after composition
  – Extracting data from an XML column using the extract UDFs
- When using the Content() or XMLxxxfromFile UDFs to export XML documents to files on the server file system, resulting documents are encoded in the code page of the server's operating system locale, which cannot be UTF-8.

Line ending considerations

When storing XML and DAD files, consider that the file can be treated inconsistently by editors and parsers because DB2 UDB for OS/390 and z/OS stores files with the `NL` as the line ending. Many tools do not recognize the `NL` line endings.

DB2 uses the `NL` line ending because:
- DB2 uses Character Data Representation Architecture (CDRA) as the basis for data conversions across systems through Distributed Relational Database Architecture (DRDA).
- DB2 files are routinely accessed across operating systems

For example, SQL procedures source code, held in the DB2 UDB catalog, is stored with [LF] as its line ending. In general files or documents can contain the following line endings: [CR], [CRLF], or [LF], as well as [NL], as in the following example:

```
This is line 1 of a UNIX document [LF] ....
This is line 1 of an Apple Macintosh document [CR] ....
This is line 1 of a DOS/Windows document [CR][LF] ....
This is line 1 of an OS/390 and z/OS USS file [NL].....
```

Most workstation tools recognize [LF], [CR], and [CR][LF], but not [NL], which is used by OS/390 and z/OS. Different line endings can appear together in one document.

Processing XML documents with the linebrk utility

Use the linebrk utility to convert [NL] line endings [LF} line endings, or the reverse.

Download the utility from the DB2 UDB XML Extender Web site:

```
http://www.ibm.com/software/data/db2/extenders/xmlext/downloads.html
```

Syntax:

```
►►──linebrk──input_file_name──output_file_name──┬─-nl─┬──┬────┬──────────────►◄
                                                └─-f──┘  └─-v─┘
```

Where:

input_file_name
: Specifies the name of the file to be processed.

output_file_name
: Specifies the name of the resulting file.

-nl Specifies that the file is to be converted from LF to NL.

-f Specifies that the file is to be converted from NL to LF.

-v Specifies the verbose option, which provides information as the command processes the file.

Appendix C. XML Extender limits

This topic describes the limits for:

- XML Extender objects
- Values returned by user-defined functions
- Stored procedures parameters
- Administration support table columns
- Composition and decomposition

The following table describes the limits for XML Extender objects.

Table 98. Limits for XML Extender objects

Object	Limit
Maximum number of rows in a table in a decomposition XML collection	10240 rows from each decomposed XML document
Maximum bytes in XML file path name specified as a parameter value	512 bytes
Length of the sql_stmt element in a DAD file for SQL composition	Windows and UNIX operating systems: 32,765 bytes. OS/390 and iSeries operating systems: 16,380 bytes.
Maximum number of columns for one table that are specified for one table in the DAD file for RDB_node decomposition	500 columns (columns for a table) are specified by text_node and attribute_node elements in a DAD file.

The following table describes the limits values returned by XML Extender user-defined functions.

Table 99. Limits for user-defined function value

User-defined functions returned values	Limit
Maximum bytes returned by an extractCHAR UDF	254 bytes
Maximum bytes returned by an extractCLOB UDF	2 gigabytes
Maximum bytes returned by an extractVARCHAR UDF	4 kilobytes

The following table describes the limits for parameters of XML Extender stored procedures.

Table 100. Limits for stored procedure parameters

Stored procedure parameters	Limit
Maximum size of an XML document CLOB[1]	1 MB
Maximum size of a Document Access Definition (DAD) CLOB[1]	100 KB
Maximum size of *collectionName*	30 bytes
Maximum size of *colName*	30 bytes
Maximum size of *dbName*	8 bytes

Table 100. Limits for stored procedure parameters (continued)

Stored procedure parameters	Limit
Maximum size of *defaultView*	128 bytes
Maximum size of *rootID*	30 bytes
Maximum size of *resultTabName*	18 bytes
Maximum size of *tablespace*	8 bytes
Maximum size of *tbName*[2]	18 bytes
Maximum size of *resultColumn*	30 bytes
Maximum size of *validColumn*	30 bytes
Maximum size of *varchar_value*	16366 bytes

Notes:

1. This size can be changed for dxxGenXMLClob and dxxRetrieveXMLCLOB.
2. If the value of the *tbName* parameter is qualified by a schema name, the entire name (including the separator character) must be no longer than 128 bytes.

The following table describes the limits for the DB2XML.DTD_REF table.

Table 101. XML Extender limits

DB2XML.DTD_REF table columns	Limit
Size of AUTHOR column	128 bytes
Size of CREATOR column	128 bytes
Size of UPDATOR column	128 bytes
Size of DTDID column	128 bytes
Size of CLOB column	100 KB

Names can undergo expansion when DB2 UDB converts them from the client code page to the database code page. A name might fit within the size limit at the client, but exceed the limit when the stored procedure gets the converted name.

The following table describes limits for composition and decomposition.

Table 102. Limits for XML Extender composition and decomposition

Object	Limit
Maximum number of rows inserted into a table in a decomposition XML collection	10240 rows from each decomposed XML document
Maximum length of the name attribute in elements_node or attribute_node within a DAD	63 bytes
Maximum bytes in XMLFile path name specified as a parameter value	512 bytes

DB2DXX_MIN_TMPFILE_SIZE environment variable:

XML Extender places large documents in temporary files to avoid using too much memory during processing. On systems with large amounts of physical memory, it is possible to avoid moving documents to temporary files, reducing the amount of Input/Output activity. The environment variable DB2DXX_MIN_TMPFILE_SIZE instructs XML Extender to use memory buffers, rather than temporary files, for processing documents smaller than the specified value. The variable is applicable only on the server, not on a client. If multiple physical nodes participate in a multi-node partition, the variable may be set differently on each node, accurately reflecting the amount of memory installed on each machine. If the environment variable is not set, documents larger than 128KB will automatically be placed into temporary files during processing, while documents smaller than 128K will be processed in memory.

Glossary

XML Extender glossary

absolute location path. The full path name of an object. The absolute path name begins at the highest level, or ″root″ element, which is identified by the forward slash (/) or back slash (\) character.

access and storage method. Associates XML documents to a DB2 UDB database through two major access and storage methods: XML columns and XML collections. See also *XML column* and *XML collection*.

access function. A user-provided function that converts the data type of text stored in a column to a type that can be processed by Text Extender.

administration. The task of preparing text documents for searching, maintaining indexes, and getting status information.

administrative support table. One of the tables that are used by a DB2 UDB extender to process user requests on image, audio, and video objects. Some administrative support tables identify user tables and columns that are enabled for an extender. Other administrative support tables contain attribute information about objects in enabled columns. Also called a *metadata table*.

administrative support tables. A tables used by a DB2 UDB extender to process user requests on XML objects. Some administrative support tables identify user tables and columns that are enabled for an extender. Other administrative support tables contain attribute information about objects in enabled columns. Synonymous with metadata table.

analyze. To calculate numeric values for the features of an image and add the values to a QBIC catalog.

API. See *application programming interface*.

application programming interface (API).

(1) A functional interface supplied by the operating system or by a separately orderable licensed program. An API allows an application program that is written in a high-level language to use specific data or functions of the operating system or the licensed programs.

(2) In DB2, a function within the interface, for example, the get error message API.

(3) The DB2 UDB extenders provide APIs for requesting user-defined functions, administrative operations, display operations, and video scene change detection.and display operations.The DB2 text extender provides APIs for requesting user-defined functions, administrative operations, and information retrieval services.In DB2, a function within the interface. For example, the get error message API.

attribute. See *XML attribute*.

attribute_node. A representation of an attribute of an element.

binary large object (BLOB). A binary string whose length can be up to 2 GB. Image, audio, and video objects are stored in a DB2 database as BLOBs.

Boolean search. A search in which one or more search terms are combined using Boolean operators.

bound search. A search in Korean documents that respects word boundaries.

browse. To view text displayed on a computer monitor.

browser. A Text Extender function that enables you to display text on a computer monitor.See *Web browser*.

B-tree indexing. The native index scheme provided by the DB2 UDB engine. It builds index entries in the B-tree structure. Supports DB2 base data types.

cast function. A function that is used to convert instances of a (source) data type into instances of a different (target) data type. In general, a cast function has the name of the target data type. It has one single argument whose type is the source data type; its return type is the target data type.

catalog view. A view of a system table created by Text Extender for administration purposes. A catalog view contains information about the tables and columns that have been enabled for use by Text Extender.

CCSID. Coded Character Set Identifier.

character large object (CLOB). A character string of single-byte characters, where the string can be up to 2 GB. CLOBs have an associated code page. Text objects that contain single-byte characters are stored in a DB2 UDB database as CLOBs.

CLOB. Character large object.

code page. An assignment of graphic characters and control function meanings to all code points. For example, assignment of characters and meanings to 256 code points for an 8-bit code.

column data. The data stored inside of a DB2 UDB column. The type of data can be any data type supported by DB2.

command line processor. A program called DB2TX that:

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Allows you to enter Text Extender commands

Processes the commands

Displays the result.

compose. To generate XML documents from relational data in an XML collection.

condition. A specification of either the criteria for selecting XML data or the way to join the XML collection tables.

DAD. See *Document access definition*.

data interchange. The sharing of data between applications. XML supports data interchange without needing to go through the process of first transforming data from a proprietary format.

data source. A local or remote relational or nonrelational data manager that is capable of supporting data access via an ODBC driver that supports the ODBC APIs.

data stream. Information returned by an API function, comprising text (at least one paragraph) containing the term searched for, and information for highlighting the found term in that text.

data type. An attribute of columns and literals.

database partition. A part of the database that consists of its own user data, indexes, configuration files, and transaction logs. Sometimes called a node or database node.

database partition server. Manages a *database partition*. A database partition server is composed of a database manager and the collection of data and system resources that it manages. Typically, one database partition server is assigned to each machine.

DBCLOB. Double-byte character large object.

DBCS. Double-byte character support.

decompose. Separates XML documents into a collection of relational tables in an XML collection.

default casting function. Casts the SQL base type to a UDT.

default view. A representation of data in which an XML table and all of its related side tables are joined.

disable. To restore a database, a text table, or a text column, to its condition before it was enabled for XML Extender by removing the items created during the enabling process.

distinct type. See *user-defined type*.

document. See *text document*.

Document Access Definition (DAD). Used to define the indexing scheme for an XML column or mapping scheme of an XML collection. It can be used to enable an XML Extender column of an XML collection, which is XML formatted.

Document type definition (DTD). A set of declarations for XML elements and attributes. The DTD defines what elements are used in the XML document, in what order they can be used, and which elements can contain other elements. You can associate a DTD with a document access definition (DAD) file to validate XML documents.

double-byte character large object (DBCLOB). A character string of double-byte characters, or a combination of single-byte and double-byte characters, where the string can be up to 2 GB. DBCLOBs have an associated code page. Text objects that include double-byte characters are stored in a DB2 UDB database as DBCLOBs.

DTD. (1) . (2) See *Document type definition*.

DTD reference table (DTD_REF table). A table that contains DTDs, which are used to validate XML documents and to help applications to define a DAD. Users can insert their own DTDs into the DTD_REF table. This table is created when a database is enabled for XML.

DTD_REF table. DTD reference table.

DTD repository. A DB2 UDB table, called DTD_REF, where each row of the table represents a DTD with additional metadata information.

EDI. Electronic Data Interchange.

Electronic Data Interchange (EDI). A standard for electronic data interchange for business-to-business (B2B) applications.

element. See *XML element*.

element_node. A representation of an element. An element_node can be the root element or a child element.

embedded SQL. SQL statements coded within an application program. See *static SQL*.

enable. To prepare a database, a text table, or a text column, for use by XML Extender.

escape character. A character indicating that the subsequent character is not to be interpreted as a *masking character*.

expand. The action of adding to a search term additional terms derived from a thesaurus.

Extensible Stylesheet language (XSL). A language used to express stylesheets. XSL consists of two parts:

a language for transforming XML documents, and an XML vocabulary for specifying formatting semantics.

Extensible Stylesheet Language Transformation (XSLT). A language used to transform XML documents into other XML documents. XSLT is designed for use as part of XSL, which is a stylesheet language for XML.

external file. A text document in the form of a file stored in the operating system's file system, rather than in the form of a cell in a table under the control of DB2. A file that exists in a file system external to DB2.

file reference variable. A programming variable that is useful for moving a LOB to and from a file on a client workstation.

foreign key. A key that is part of the definition of a referential constraint and that consists of one or more columns of a dependent table.

function. See *access function*.

gigabyte (GB). One billion (10^9) bytes. When referring to memory capacity, 1 073 741 824 bytes.

host variable. A variable in an application program that can be referred to in embedded SQL statements. Host variables are the primary mechanism for transmitting data between a database and application program work areas.

image. An electronic representation of a picture.

index. To extract significant terms from text, and store them in a *text index*.A set of pointers that are logically ordered by the values of a key. Indexes provide quick access to data and can enforce uniqueness on the rows in the table.

Java Database Connectivity (JDBC). An application programming interface (API) that has the same characteristics as Open Database Connectivity (ODBC) but is specifically designed for use by Java database applications. Also, for databases that do not have a JDBC driver, JDBC includes a JDBC to ODBC bridge, which is a mechanism for converting JDBC to ODBC; JDBC presents the JDBC API to Java database applications and converts this to ODBC. JDBC was developed by Sun Microsystems, Inc. and various partners and vendors.

JDBC. Java Database Connectivity.

join. A relational operation that allows for retrieval of data from two or more tables based on matching column values.

joined view. A DB2 UDB view created by the ″CREATE VIEW″ statement which join one more tables together.

kilobyte (KB). One thousand (10^3) bytes. When referring to memory capacity, 1024 bytes.

large object (LOB). A sequence of bytes, where the length can be up to 2 GB. A LOB can be of three types: *binary large object* (BLOB), *character large object (CLOB)*, or *double-byte character large object (DBCLOB)*.

linguistic index. A *text index* containing terms that have been reduced to their base form by linguistic processing. "Mice", for example, would be indexed as "mouse". See also *precise index*, *Ngram index*, and *dual index*.

LOB. Large object.

LOB locator. A small (4-byte) value stored in a host variable that can be used in a program to refer to a much larger LOB in a DB2 UDB database. Using a LOB locator, a user can manipulate the LOB as if it was stored in a regular host variable, and without the need to transport the LOB between the application on the client machine and the database server.

local file system. A file system that exists in DB2

location path. Location path is a sequence of XML tags that identify an XML element or attribute. The location path identifies the structure of the XML document, indicating the context for the element or attribute. A single slash (/) path indicates that the context is the whole document. The location path is used in the extracting UDFs to identify the elements and attributes to be extracted. The location path is also used in the DAD file to specify the mapping between an XML element, or attribute, and a DB2 UDB column when defining the indexing scheme for XML column. Additionally, the location path is used by the Text Extender for structural-text search.

locator. A pointer which can be used to locate an object. In DB2, the large object block (LOB) locator is the data type which locates LOBs.

mapping scheme. A definition of how XML data is represented in a relational database. The mapping scheme is specified in the DAD. The XML Extender provides two types of mapping schemes: *SQL mapping* and *relational database node (RDB_node) mapping*.

megabyte (MB). One million (10^6) bytes. When referring to memory capacity, 1 048 576 bytes.

metadata table. See *administrative support table*.

multiple occurrence. An indication of whether a column element or attribute can be used more than once in a document. Multiple occurrence is specified in the DAD.

object. In object-oriented programming, an abstraction consisting of data and the operations associated with that data.

ODBC. Open Database Connectivity.

Open Database Connectivity. A standard application programming interface (API) for accessing data in both relational and nonrelational database management systems. Using this API, database applications can access data stored in database management systems on a variety of computers even if each database management system uses a different data storage format and programming interface. ODBC is based on the call level interface (CLI) specification of the X/Open SQL Access Group and was developed by Digital Equipment Corporation (DEC), Lotus, Microsoft, and Sybase. Contrast with *Java Database Connectivity*.

overloaded function. A function name for which multiple function instances exist.

path expression. See *location path*.

predicate. An element of a search condition that expresses or implies a comparison operation.

primary key. A unique key that is part of the definition of a table. A primary key is the default parent key of a referential constraint definition.

procedure. See *stored procedure*.

QBIC catalog. A repository that holds data about the visual features of images.

query object. An object that specifies the features, feature, values, and feature weights for a QBIC query. The object can be named and saved for subsequent use in a QBIC query. Contrast with query string

RDB_node. Relational database node.

RDB_node mapping. The location of the content of an XML element, or the value of an XML attribute, which are defined by the RDB_node. The XML Extender uses this mapping to determine where to store or retrieve the XML data.

relational database node (RDB_node). A node that contains one or more element definitions for tables, optional columns, and optional conditions. The tables and columns are used to define how the XML data is stored in the database. The condition specifies either the criteria for selecting XML data or the way to join the XML collection tables.

result set. A set of rows returned by a stored procedure.

result table. A table which contains rows as the result of an SQL query or an execution of a stored procedure.

root element. The top element of an XML document.

root ID. A unique identifier that associates all side tables with the application table.

SBCS. Single-byte character support.

scalar function. An SQL operation that produces a single value from another value and is expressed as a function name, followed by a list of arguments enclosed in parentheses.

schema. A collection of database objects such as tables, views, indexes, or triggers. It provides a logical classification of database objects.

search argument. The conditions specified when making a search, consisting of one or several search terms, and search parameters.

section search. Provides the text search within a section which can be defined by the application. To support the structural text search, a section can be defined by the Xpath's abbreviated location path.

shot catalog. A database table or file that is used to store data about shots, such as the starting and ending frame number for a shot, in a video clip. A user can access a view of the table through an SQL query, or access the data in the file.

side table. Additional tables created by the XML Extender to improve performance when searching elements or attributes in an XML column.

simple location path. A sequence of element type names connected by a single slash (/).

SQL mapping. A definition of the relationship of the content of an XML element or value of an XML attribute with relational data, using one or more SQL statements and the XSLT data model. The XML Extender uses the definition to determine where to store or retrieve the XML data. SQL mapping is defined with the SQL_stmt element in the DAD.

static SQL. SQL statements that are embedded within a program, and are prepared during the program preparation process before the program is executed. After being prepared, a static SQL statement does not change, although values of host variables specified by the statement might change.

stored procedure. A block of procedural constructs and embedded SQL statements that is stored in a database and can be called by name. Stored procedures allow an application program to be run in two parts. One part runs on the client and the other part runs on the server. This allows one call to produce several accesses to the database.

structural text index. To index text keys based on the tree structure of the XML document, using the DB2 UDB Text Extender.

subquery. A full SELECT statement that is used within a search condition of an SQL statement.

table space. An abstraction of a collection of containers into which database objects are stored. A table space provides a level of indirection between a database and the tables stored within the database. A table space:

- Has space on media storage devices assigned to it.
- Has tables created within it. These tables will consume space in the containers that belong to the table space. The data, index, long field, and LOB portions of a table can be stored in the same table space, or can be individually broken out into separate table spaces.

terabyte. A trillion (10^{12}) bytes. Ten to the twelfth power bytes. When referring to memory capacity, 1 099 511 627 776 bytes.

text_node. A representation of the CDATA text of an element.

text table. A DB2 UDB table containing *text columns*.

top element_node. A representation of the root element of the XML document in the DAD.

tracing. The action of storing information in a file that can later be used in finding the cause of an error.

trigger. The definition of a set of actions to be taken when a table is changed. Triggers can be used to perform actions such as validating input data, automatically generating a value for a newly inserted row, reading from other tables for cross-referencing purposes, or writing to other tables for auditing purposes. Triggers are often used for integrity checking or to enforce business rules.

trigger. A mechanism that automatically adds information about documents that need to be indexed to a *log table* whenever a document is added, changed, or deleted from a text column.

UDF. See *user-defined function*.

UDT. See *user-defined type*.

uniform resource locator (URL). An address that names an HTTP server and optionally a directory and file name, for example: http://www.ibm.com/software /data/db2/extenders.

UNION. An SQL operation that combines the results of two select statements. UNION is often used to merge lists of values that are obtained from several tables.

URL. Uniform resource locator.

user-defined distinct type (UDT). A data type created by a user of DB2, in contrast to a data type provided by DB2 UDB such as LONG VARCHAR.

user-defined function (UDF). A function that is defined by a user to DB2. Once defined, the function can be used in SQL queries. and video objects. For example, UDFs can be created to get the compression format of a video or return the sampling rate of an audio. This provides a way of defining the behavior of objects of a particular type.

user-defined function (UDF). An SQL function created by a user of DB2, in contrast to an SQL function provided by DB2. Text Extender provides search functions, such as CONTAINS, in the form of UDFs.

user-defined type (UDT). A data type that is defined by a user to DB2. UDTs are used to differentiate one LOB from another. For example, one UDT can be created for image objects and another for audio objects. Though stored as BLOBs, the image and audio objects are treated as types distinct from BLOBs and distinct from each other.

user-defined function (UDF). A function that is defined to the database management system and can be referenced thereafter in SQL queries. It can be one of the following functions:

- An external function, in which the body of the function is written in a programming language whose arguments are scalar values, and a scalar result is produced for each invocation.
- A sourced function, implemented by another built-in or user-defined function that is already known to the DBMS. This function can be either a scalar function or column (aggregating) function, and returns a single value from a set of values (for example, MAX or AVG).

user-defined type (UDT). A data type that is not native to the database manager and was created by a user. See *distinct type*.

user table. A table that is created for and used by an application.

validation. The process of using a DTD to ensure that the XML document is valid and to allow structured searches on XML data. The DTD is stored in the DTD repository.

valid document. An XML document that has an associated DTD. To be valid, the XML document cannot violate the syntactic rules specified in its DTD.

video. Pertaining to the portion of recorded information that can be seen.

video clip. A section of filmed or videotaped material.

video index. A file that the Video Extender uses to find a specific *shot* or frame in a video clip.

Web browser. A client program that initiates requests to a Web server and displays the information that the server returns.

well-formed document. An XML document that does not contain a DTD. Although in the XML specification, a document with a valid DTD must also be well-formed.

wildcard character. See *masking character*.

WLM. Work Load Manager

XML. eXtensible Markup Language.

XML attribute. Any attribute specified by the ATTLIST under the XML element in the DTD. The XML Extender uses the location path to identify an attribute.

XML collection. A collection of relation tables which presents the data to compose XML documents, or to be decomposed from XML documents.

XML column. A column in the application table that has been enabled for the XML Extender UDTs.

XML element. Any XML tag or ELEMENT as specified in the XML DTD. The XML Extender uses the location path to identify an element.

XML object. Equivalent to an XML document.

XML Path Language. A language for addressing parts of an XML document. XML Path Language is designed to be used by XSLT. Every location path can be expressed using the syntax defined for XPath.

XML table. An application table which includes one or more XML Extender columns.

XML tag. Any valid XML markup language tag, mainly the XML element. The terms tag and element are used interchangeably.

XML UDF. A DB2 UDB user-defined function provided by the XML Extender.

XML UDT. A DB2 UDB user-defined type provided by the XML Extender.

XPath. A language for addressing parts of an XML document.

XPath data model. The tree structure used to model and navigate an XML document using nodes.

XSL. XML Stylesheet Language.

XSLT. XML Stylesheet Language Transformation.

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