

IBM<sup>®</sup> DB2<sup>®</sup> Data Links Manager



# Quick Beginnings

*Version 7*



IBM<sup>®</sup> DB2<sup>®</sup> Data Links Manager



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*Version 7*

Before using this information and the product it supports, be sure to read the general information under "Appendix F. Notices" on page 181.

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# Contents

<b>About this book</b> . . . . .	<b>vii</b>
Who should read this book . . . . .	vii
Conventions . . . . .	vii

---

## **Part 1. Introduction to DB2 Data Links . . . . . 1**

<b>Chapter 1. An Overview of DB2 Data Links Technology</b> . . . . .	<b>3</b>
Advantages of the File Paradigm . . . . .	4
<b>Chapter 2. DB2 Data Links Manager Components</b> . . . . .	<b>7</b>
Data Links Server . . . . .	7
DB2 Universal Database Server . . . . .	8
DB2 Client . . . . .	9

---

## **Part 2. Installing and Configuring DB2 Data Links for Windows NT . 13**

<b>Chapter 3. Installing and Configuring DB2 Data Links Manager for Windows NT</b> . . . . .	<b>15</b>
Before You Begin . . . . .	15
Installing DB2 Data Links Manager on Windows NT. . . . .	19
Actions performed by the setup program . . . . .	19
Post-installation tasks . . . . .	20
Choosing a Backup Method . . . . .	21
<b>Chapter 4. Verifying the Installation on Windows NT</b> . . . . .	<b>25</b>
1. Creating a test environment on the DB2 UDB server . . . . .	25
2. Creating a test environment on the DB2 Data Links server . . . . .	27
Registering the drive with the Data Links File Filter . . . . .	27
Registering the DB2 UDB database . . . . .	28
Creating a sample file. . . . .	28
3. Registering the Data Links server with the DB2 UDB database. . . . .	29
4. Verifying the sample file is controlled by DLFF . . . . .	30

5. Verifying the sample file is accessible. . . . .	31
6. Viewing the sample file . . . . .	32
Troubleshooting the configuration on Windows NT. . . . .	33

---

## **Part 3. Installing and Configuring DB2 Data Links Manager for AIX . 35**

<b>Chapter 5. Installing and Configuring DB2 Data Links Manager for AIX</b> . . . . .	<b>37</b>
Common Installation Considerations. . . . .	37
Additional Installation Considerations in JFS Environments . . . . .	39
Additional Installation Considerations in DCE-DFS Environments . . . . .	41
Installing DB2 Data Links Manager on AIX Using the db2setup Utility . . . . .	43
Actions Performed by the db2setup Utility . . . . .	44
DCE-DFS Post-installation Task . . . . .	46
Keytab file . . . . .	46
Manually installing DB2 Data Links Manager Using SMIT . . . . .	47
SMIT post-installation tasks. . . . .	48
Post-installation tasks . . . . .	50
Choosing a backup method . . . . .	51
Complete the Data Links Manager Install . . . . .	54

<b>Chapter 6. Installing and Configuring DB2 Data Links DFS Client Enabler</b> . . . . .	<b>57</b>
Installation Considerations and Prerequisites . . . . .	57
Installing a DFS Client Enabler. . . . .	58
Configuring a DFS Client Enabler. . . . .	59

<b>Chapter 7. Verifying the Installation on AIX</b> . . . . .	<b>61</b>
1. Creating a test environment on the DB2 UDB server . . . . .	61
2. Creating a test environment on the DB2 Data Links server . . . . .	63
Preparing a File System . . . . .	63
Registering the file system with the Data Links File Filter . . . . .	65
Registering the DB2 UDB database . . . . .	67
Creating a sample file. . . . .	67

3. Registering the Data Links server with the DB2 UDB database. . . . .	68
4. Verifying the sample file is controlled by DLFF . . . . .	69
5. Verifying the sample file is accessible. . . . .	70
6. Viewing the sample file . . . . .	72
Troubleshooting the configuration on AIX . . . . .	72
Workarounds in NFS environments . . . . .	73

---

## **Part 4. Installing and Configuring DB2 Data Links Manager for Solaris . . . . . 75**

<b>Chapter 8. Installing and Configuring DB2 Data Links Manager for Solaris . . . . .</b>	<b>77</b>
Before You Begin . . . . .	77
Installing DB2 Data Links Manager for Solaris using the db2setup utility . . . . .	80
Manually installing Data Links Manager for Solaris . . . . .	81
Post-Installation Tasks for Manual Installations . . . . .	82
Choosing a backup method . . . . .	84

<b>Chapter 9. Verifying the Installation on Solaris . . . . .</b>	<b>89</b>
1. Creating a test environment on the DB2 UDB server . . . . .	89
2. Creating a test environment on the DB2 Data Links server . . . . .	91
Preparing a File System . . . . .	91
Registering the file system with the Data Links File Filter . . . . .	91
Registering the DB2 UDB database . . . . .	92
Creating a sample file. . . . .	93
3. Registering the Data Links server with the DB2 UDB database. . . . .	94
4. Verifying the sample file is controlled by DLFF . . . . .	95
5. Verifying the sample file is accessible. . . . .	95
6. Viewing the sample file . . . . .	97
Troubleshooting the configuration on Solaris . . . . .	98

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## **Part 5. Working with DB2 Data Links . . . . . 99**

<b>Chapter 10. Working with the Data Links File Manager . . . . .</b>	<b>101</b>
---	------------

Starting and Stopping the Data Links File Manager . . . . .	101
Monitoring the Data Links File Manager Back-End Processes on AIX or Solaris . . . . .	102
Restarting the Data Links Manager after an Abnormal Termination . . . . .	102
Listing or Adding Registered File Systems Under the Control of a Data Links Filesystem Filter on AIX or Solaris . . . . .	102
Adding a DLFF in JFS or UFS environments . . . . .	103
Adding a DLFF in a DCE-DFS environment . . . . .	104
Performance Enhancements for Disk Backup in the DFS Environment . . . . .	106
Listing or Adding Registered Drives Under the Control of a Data Links Filesystem Filter on Windows NT . . . . .	107
Loading, Querying, and Unloading a Data Links Filesystem Filter on AIX or Solaris . . . . .	108
On AIX . . . . .	108
On Solaris . . . . .	108
On the DFS Client Enabler. . . . .	109
Mounting and Unmounting a Data Links Filesystem Filter on Windows NT . . . . .	109
Increasing the Size of a File System that is under the Control of a DLFF on AIX or Solaris . . . . .	110
Listing and Registering Databases with the Data Links Manager . . . . .	111
Starting and Stopping the DB2 Database Manager on the Data Links Server . . . . .	111
Changing the Diagnostic Level for the Error Message Log File . . . . .	112
Creating and Dropping the DB2 Database on the Data Links Server . . . . .	113
Retrieving Archive Server Information . . . . .	113

<b>Chapter 11. Recovering from a Crash on the Data Links Server . . . . .</b>	<b>115</b>
Crash and recovery overview . . . . .	115
DB2 Data Links Manager System Setup and Backup Recommendations . . . . .	116
Backing up a file system on Windows NT . . . . .	116
Restoring a file system on Windows NT . . . . .	117
Backing up a File System on AIX or Solaris . . . . .	117
Restoring a File System on AIX or Solaris . . . . .	118
Bringing the File System Directory Hierarchy to the Current Point in Time . . . . .	119

Running RECONCILE after restoring a file system . . . . .	119
DB2 Data Links Manager Recovery Scenarios	120
Components that may require recovery	121
Recovery scenarios . . . . .	121

---

**Part 6. Appendices . . . . . 125**

**Appendix A. DB2 Data Links Manager Errors and User Responses . . . . . 127**

DLFM001I . . . . .	127
DLFM101E . . . . .	127
DLFM201E . . . . .	128
DLFM301E . . . . .	130
DLFM401E . . . . .	130
DLFM501E . . . . .	131
DLFM601E . . . . .	133
DLFM701E . . . . .	134
DLFM801E . . . . .	135
DLFM9001 . . . . .	136
DLFM901E . . . . .	136
DLFM905E . . . . .	137
DLFM906E . . . . .	137
DLFM907E . . . . .	137
DLFM908E . . . . .	138

**Appendix B. CLI Example . . . . . 139**

**Appendix C. DCE-DFS Common Tasks and References . . . . . 145**

Creating a New DCE Identity . . . . .	145
Creating a DFS Fileset for DataLinks Configuration . . . . .	146
References to DCE-DFS documentation . . . . .	147

**Appendix D. An Alternative Approach to Backing up a JFS on AIX . . . . . 149**

online.sh . . . . .	149
quiesce.c . . . . .	154

**Appendix E. Using the DB2 Library . . . . . 163**

DB2 PDF Files and Printed Books . . . . .	163
DB2 Information . . . . .	163
Printing the PDF Books . . . . .	172
Ordering the Printed Books . . . . .	173
DB2 Online Documentation . . . . .	174
Accessing Online Help . . . . .	174
Viewing Information Online . . . . .	176
Using DB2 Wizards . . . . .	178
Setting Up a Document Server . . . . .	179
Searching Information Online . . . . .	180

**Appendix F. Notices . . . . . 181**

Trademarks . . . . .	184
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**Index . . . . . 187**

**Contacting IBM . . . . . 191**

Product Information . . . . .	191
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## About this book

This book will guide you through the planning, installation, and configuration of a DB2 Data Links server on Windows NT, AIX, and the Solaris Operating Environment\*\*.

Once your Data Links server is installed and configured, you will validate the installation through a scenario where you create an SQL table that has a column defined with the DATALINK data type. Next, you will link a file to data in this column. Finally, to complete the test scenario, you will retrieve and view your linked data file.

This book also describes how to work with DB2 Data Links Manager, and how to recover from a crash on your Data Links server. Error messages, their causes, and the actions you should take to remedy them are included in the Appendix. In the Appendix you will also find a Data Links Manager CLI sample program which uses the DATALINK SQL data type, and a reference section for DCE-DFS administrators.

For information on Data Links replication, please refer to the *DB2 Replication Guide and Reference*.

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## Who should read this book

This book is intended for database administrators, system administrators, IT specialists, and anyone else who needs to install, configure, or work with DB2 Data Links Manager for Windows NT, AIX, or Solaris.

You should be familiar with your operating system's general administration tasks. However, previous experience with Data Links Manager is not required to complete the procedures described in this book.

---

## Conventions

This book uses these highlighting conventions:

- **Boldface** indicates commands or graphical user interface (GUI) controls such as names of fields, folders, icons, or menu choices.
- *Italics* indicate variables that you should replace with your own value. They are also used to indicate book titles and to emphasize words.
- Monospace indicates file names, directory paths, commands, and examples of text you enter exactly as shown.



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## Part 1. Introduction to DB2 Data Links

The following chapter provides an overview to DB2 Data Links. It is intended for database administrators, information technology specialists, and others who are new to this technology.

DB2 Data Links provides referential integrity, access control, and recovery capabilities for files that physically reside on file systems external to a DB2 Universal Database. It also describes the components that make up a Data Links server, and how this server works with DB2 UDB servers and clients to provide the total DB2 Data Links solution.

If you are familiar with DB2 Data Links and want to begin installing it on your system, go to one of the following chapters:

- “Chapter 3. Installing and Configuring DB2 Data Links Manager for Windows NT” on page 15.
- “Chapter 5. Installing and Configuring DB2 Data Links Manager for AIX” on page 37.
- “Chapter 8. Installing and Configuring DB2 Data Links Manager for Solaris” on page 77.



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## Chapter 1. An Overview of DB2 Data Links Technology

Data Links technology uses the DATALINK data type, implemented as an SQL data type in DB2 Universal Database, which references an object stored external to a database. You use the DATALINK data type just like any other SQL data type to define columns in tables.

In NTFS, JFS and UFS environments the DATALINK values encode the name of a Data Links server containing the file and the filename in terms of a Uniform Resource Locator (URL). The DATALINK value is robust in terms of integrity, access control, and recovery: DB2 treats a DATALINK value as if the object were stored in the database. You register a set of known Data Links servers. The only Data Links server names that you can specify in a DATALINK value are those which have been registered to a DB2 database.

In DCE-DFS environments, the Data Links Manager is registered for the entire cell, and linked files are referred to in terms of a URL with scheme, dfs and the DFS pathname of the file.

Even though the DATALINK value represents an object that is stored outside the database system, you can use SQL queries to search parametric data to obtain the file name that corresponds to the query result. You can create indexes on files containing video, images, text, or other media formats, and store those attributes in tables along with the DATALINK value. With a central repository of files on a file server and DATALINK data types in a database, you can obtain answers to questions like, *"What do I have?"* and *"Help me find what I'm looking for"*.

Examples of applications that can use the DATALINK data type are:

- Medical applications, in which X-rays are stored on the file server and the attributes are stored in a database.
- Entertainment industry applications that perform asset management of video clips. The video clips are stored on a file server, but attributes about the clips are stored in a database. Access control is required for accessing the video clips based on database privileges of accessing the meta-information.
- World Wide Web applications that manage millions of files and allow access control based on database privileges.
- Financial applications, which require distributed capture of check images and a central location for those images.

- CAD applications, where the engineering drawings are kept as files and the attributes are stored in the database. Queries can be run against the drawing attributes.

Many of these applications need search capabilities to find the data in the files. These search capabilities, however, do not require physically bringing the data into the database system, because their raw content is not needed for the query. Typically, you would extract features of an image or a video and store them in the database for performing a search on the extracted features. An example of the features that can be extracted from an image are color, shape, and texture. The IBM DB2 Universal Database Extender for Image product supports extraction and search functions on such features.

The ability to store a *reference* to such files, along with parametric data that describes their contents is, in general, the approach used by these applications to combine the search capabilities of SQL with the advantages of working directly with files to manipulate the raw data. The DB2 relational extenders for text, voice, image (and so on) provide this functionality. The extenders allow you to specify whether the object itself is to be maintained either in or outside the database.

Currently, the DB2 relational extenders do not provide referential integrity between files on a server and their references in databases. Therefore, it is possible to independently delete either the reference or the file. Moreover, the extenders do not provide access control to the related files or coordinated backup and recovery schemes for a database and its associated files.

DB2 Data Links technology solves these problems and provides the functionality required by such applications. Future releases of the DB2 relational extenders will use Data Links technology.

---

## Advantages of the File Paradigm

There are several reasons why you might want to continue using the file paradigm to store, access and modify large data objects using Data Links technologies, instead of moving these objects to a traditional database repository:

### Performance

The *store and forward* model of data is unacceptable for performance reasons. For example, it may be unacceptable for the database manager to materialize a Binary Large Object (BLOB) into a file, and the converse, each time the data needs to be accessed as a file.

Also, data may be captured in high volumes, and you may not want to store this data in the database.

**Network considerations**

You may be accessing data directly from a file server that is physically close to a workstation. For example, the file server can be configured so that the network distance is much shorter to the user, compared to the database where all the BLOBs are stored. The number of bytes that flow for a large object are much larger than the number of bytes for an answer of an SQL query. Network distance between resources is therefore a significant consideration.

**Isochronous delivery**

You may be using an application that uses a stream server because it has real-time requirements for delivery and capture. This is known as "isochronous delivery". An example of isochronous delivery might be a video server that delivers high-quality (or "jitter-free") video to a client workstation in real time. In these kinds of applications, it is likely that such data will not be moved into or out of the database as a BLOB, but rather stay on the file server for immediate access.

**Cost** If you are considering using a database as a repository, you should consider first the expense of rewriting applications that currently use standard file I/O semantics.

Also, your applications may use existing tools that work with the file paradigm. Replacing these tools can also be expensive.





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## Chapter 2. DB2 Data Links Manager Components

This section describes the different components that make up a database system that is using DB2 Data Links technology. These components include the:

- Data Links Server
- DB2 Universal Database Server
- DB2 Client

DB2 Data Links can be installed on:

- AIX systems running a Journaled File System (JFS) or Transarc's DCE Distributed File Service (DCE-DFS).
- Solaris Operating Environments running a UNIX File System (UFS).
- Windows NT systems with an NTFS-formatted drive.

For specific operating system requirements, see the appropriate installation chapter.

---

### Data Links Server

A Data Links server consists of four components:

- Data Links File Manager (DLFM)
- Data Links Filesystem Filter (DLFF) in JFS, NTFS, or UFS environments
- Data Links Filesystem Filter DMAPP (data manager application) in DCE-DFS environments
- DB2 (Logging Manager)

#### Data Links File Manager (DLFM)

The DLFM tracks all the files on a particular Data Links server, or all the files in a DCE cell, that are linked to a DB2 database. The DLFM receives and processes *link-file* and *unlink-file* messages arising from SQL **INSERT**, **UPDATE**, and **DELETE** statements that reference a DATALINK column. For each linked file, the DLFM logically tracks the database instance, the fully qualified table name, and the column name referred to in the SQL statement.

The DLFM also tracks previously linked files, if they were linked to a DATALINK column for which the *RECOVERY=YES* option was specified, during table creation. This allows DB2 to provide point-in-time roll-forward recovery for any file that is specified by a DATALINK column. For information about attributes that you can specify for a DATALINK column, refer to the *SQL Reference*.

### **Data Links Filesystem Filter (DLFF)**

In JFS and NTFS environments, the DLFF filters operations to ensure that linked files are not deleted, renamed, and that the file's attributes are not changed. Optionally, it also filters commands to ensure that proper access authority exists for READ PERMISSION DB files. AIX and Solaris file systems under the control of a DLFF can be NFS exported. Windows NT file systems under DLFF control can be net shared.

### **Data Links File System (DLFS) DMAPP (Data Manager Application)**

In DCE-DFS environments, the DMAPP filters commands to ensure that linked files are not deleted, renamed, and that the file's attributes are not changed. The DMAPP monitors filesets residing in DMLFS aggregates that are DM-enabled. Once an aggregate has been DM-enabled, the aggregate can contain filesets that may be brought under Data Links control. The DMAPP can then manage the data within these filesets after the aggregate is exported into the namespace. DM-enabling an LFS aggregate is part of the Storage Management Toolkit (SMT) provided by Transarc.

### **DB2 (Logging Manager)**

A Logging Manager that contains the DLFM\_DB database. This database contains registration information about databases that can connect to a Data Links server. It also contains information about the mount points of the file systems on AIX or Solaris, or the sharename of the drives on Windows NT, that are managed by a DLFF. The DLFM\_DB database also contains information about files that have been linked, unlinked, or backed up on a Data Links server or in a DCE cell. This database is created during the installation of DB2 Data Links Manager.

DB2 can provide point-in-time roll-forward recovery on the Data Links server (if the *RECOVERY=YES* option was specified during table creation) for any linked file that is specified by a DATALINK column. The files can be backed up on a disk or using Tivoli Storage Manager. The files that are linked using a DATALINK column are always backed up when your database is backed up.

---

## **DB2 Universal Database Server**

The DB2 Universal Database server is the location of the main database where the Data Links Manager is registered. In NTFS, JFS, and UFS environments, more than one Data Links Manager can be registered on a database.

In DCE-DFS environments, the DB2 server can only register one DCE cell. The database could contain tables that include columns of the DATALINK data type. Also, the DFS client must be installed on the DB2 server in order to allow access to configuration information which is stored in DFS.

On AIX and Solaris no mounts are required, and on Windows NT no sharing is required between a DB2 server and a Data Links server. All communication is done through a port reserved for communications.

The remote DB2 Universal Database server can only participate in a single-partitioned database system. DB2 Data Links Manager does not support interaction with partitioned database systems.

---

## DB2 Client

The client connects to a remote DB2 server as normal. For more information about configuring a DB2 client and server for communications, refer to your server's *Quick Beginnings* documentation.

The remote client can NFS mount a file system on AIX or Solaris, or share a drive on Windows NT, under the control of a Data Links Filesystem Filter that is installed on a Data Links server. This way, the client can directly access the files on the Data Links server.

In DCE-DFS environments on AIX systems, the client uses the DFS client. A DB2 Data Links DFS Client Enabler, also known as the DLFS cache manager or DLFS-CM, is also required to access linked files in DATALINK columns created with READ PERMISSION DB specified. For more information on the READ PERMISSION DB option, see the *SQL Reference*.

Figure 1 on page 10 shows an overview of the interaction between a DB2 server, the DB2 Data Links Manager components, the backup media, and a remote client application in NTFS and JFS environments.

## DB2 Data Links Manager

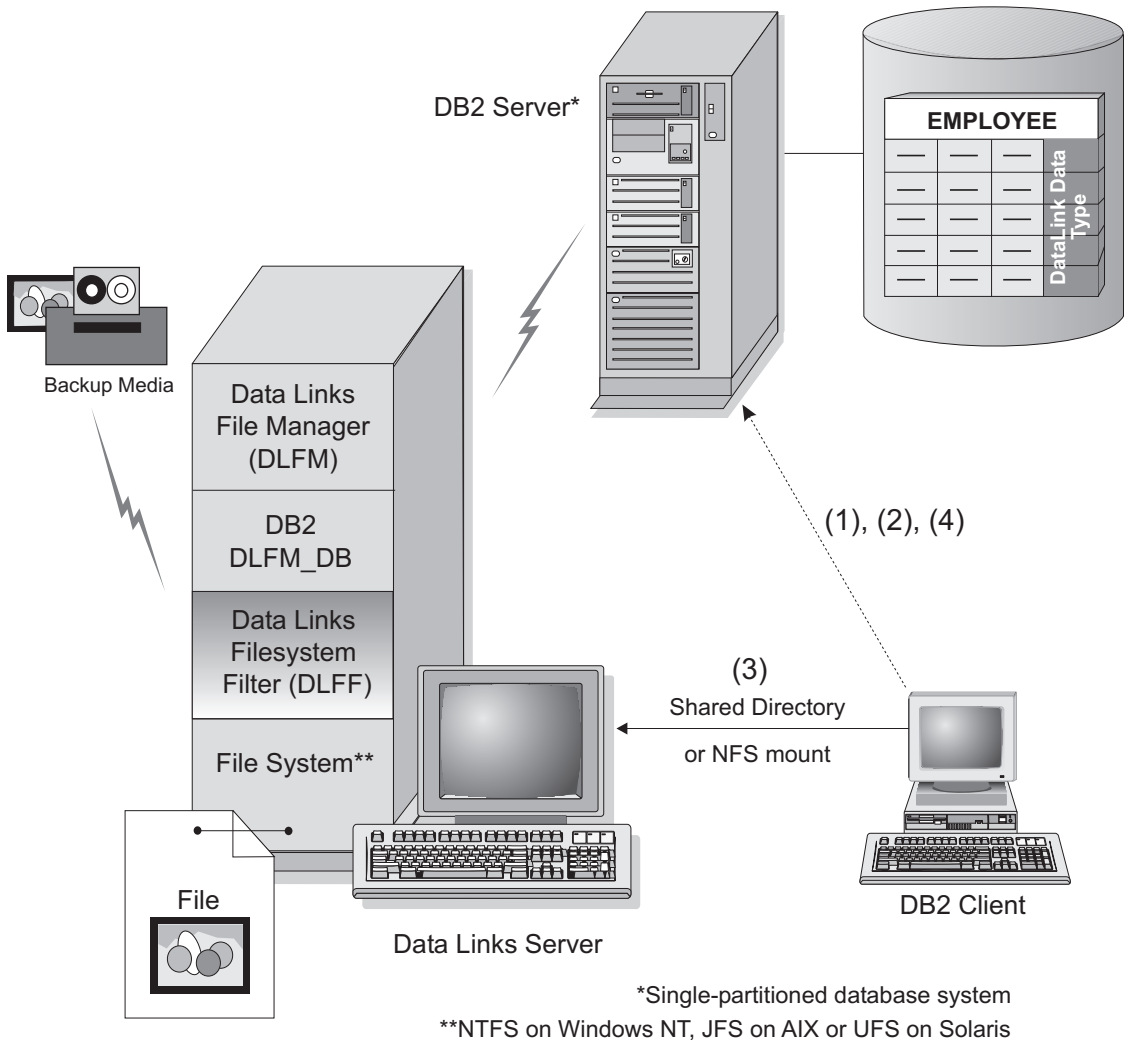


Figure 1. Overview of Data Links Manager Processing (NTFS, JFS, or UFS environments)

In this example, a client application connects to a database with a DATALINK data type, selects a DATALINK value from this database, and updates the data file as follows:

1. The client application issues a **CONNECT** statement to connect to a database on a DB2 server.
2. The application then issues a **SELECT** statement that contains a DATALINK column. For example:

```
select dlurlpath(d11) into :var_d11 from EMPLOYEE
```

3. The application then copies the `:var_d11` file to the `new_version` file over a shared drive on Windows NT or an NFS mount on AIX or Solaris.
4. Then the application edits the `new_version` file. To save the changes in the database, the application would issue an **UPDATE** statement. For example:

```
update set d11=d1value(:new_version)
```

The following diagram shows a Data Links solution implemented in a DCE-DFS environment on AIX. The numbers in the diagram correspond to the previous steps.

## DB2 Data Links Manager in One DCE-DFS Cell

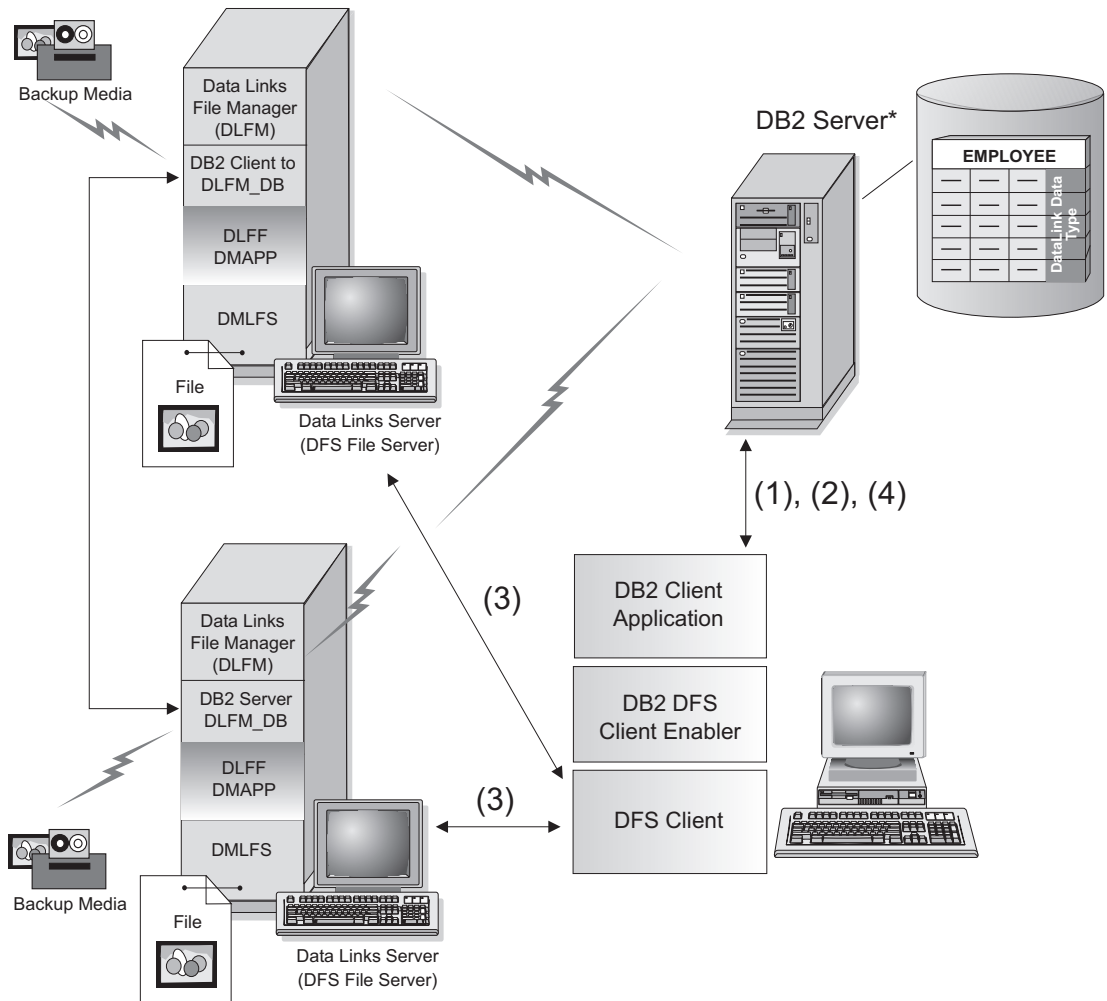


Figure 2. Overview of Data Links Manager Processing (DCE-DFS environments)

For more information about remote clients, refer to the *Installation and Configuration Supplement*. For an example of a CLI program using a DATALINK data type, see "Appendix B. CLI Example" on page 139.

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## **Part 2. Installing and Configuring DB2 Data Links for Windows NT**





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## Chapter 3. Installing and Configuring DB2 Data Links Manager for Windows NT

This chapter describes how to install DB2 Data Links Manager for Windows NT on your system.

For information on how to deploy this product using a distributed installation, refer to the *Installation and Configuration Supplement*.

---

### Before You Begin

Please read the information in this section before installing DB2 Data Links Manager.

#### System Requirements

You must be running Windows NT Version 4.0 with Service Pack 5 or later. To check the level of the operating system, double-click on **My Computer** and select **Help** → **About Windows NT** from the menu bar.

#### NTFS Formatted Drive

You must have at least one Windows NT Filesystem (NTFS) formatted drive that will be controlled by a Data Links Filesystem Filter (DLFF). Any drive that a DLFF will control must be an NTFS formatted drive. During the installation, you can select the drives that you want to be controlled by a DLFF. If you do not have a drive that was formatted for NTFS, you will not be able to perform the installation.

A separate NTFS drive is also required if you want to store backups of linked files on a local file system.

To view a list of the NTFS formatted drives on your system, click **Start** and select **Programs** → **Administration Tools (Common)** → **Disk Administrator**.

You can either convert an existing file system to NTFS, or create one. To convert an existing file system to NTFS, enter the following command:

```
convert x: /fs:ntfs
```

where *x*: is the drive that you want to convert to NTFS.

This command must be run on a drive other than the one that you are converting to NTFS.

You can create an NTFS partition using the Windows NT Disk Administrator tool. Refer to the Windows NT online help for more information.

### **Enable drive sharing**

Each drive that you plan to be controlled by a Data Links Filesystem Filter must be enabled for sharing.

To enable a drive for sharing:

1. Click **Start** and select **Programs** —> **Windows NT Explorer**.
2. Right-click on the drive that you want to share and select **Sharing**. If you are already sharing the drive that you want to be controlled by a Data Links Filesystem Filter, skip to step 5.
3. Select **Shared As**.
4. Click **New Share**.
5. Enter a share name for this drive in the **Share Name** field and click **OK**.
6. Click **Permissions**.
7. Select the **Everyone** option.
8. Click **Type of Access** and select the **Full Control Option**.
9. Click **OK** to register the new share name.

### **Memory requirements**

There must be at least 64 MB of RAM available to your system. To check the amount of memory available to your system, select **My Computer**, click the right mouse button, and select the **Properties** option.

### **Synchronize system clocks**

The system clocks on the Data Links server and the DB2 server must be, and remain, synchronized. Synchronization of clocks is essential for the Data Links token expiry interval to work correctly. The token expiry interval is a database configuration parameter. For more information, refer to the *Administration Guide*.

To set the time for a machine's system clock:

1. Click **Start** and select **Settings** —> **Control Panel**.
2. Double-click the **Date/Time** icon.
3. Set the local system time using the spin buttons in the **Time** box. Remember to set this time equal to the local system time on the DB2 server.
4. Click the **Time Zone** tab and select the appropriate time zone from the drop down box. Remember to use the same time zone setting on all servers.
5. Click **OK**.

## Version levels of DB2 Data Links and DB2 UDB

Version levels of DB2 Data Links and DB2 Universal Database can be any combination of Version 6.1 and Version 7.1. For example, DB2 UDB can be at Version 6.1 and Data Links Manager can be at Version 7.1. To check the version of DB2 that resides on a workstation, enter the **db2level** command.

## User account rights

You need to have a user account to perform the installation.

The user account you specify must:

1. Be defined on the local machine.
2. Belong to the *Local Administrators* group.
3. Have the following advanced user rights:
  - Act as part of the operating system.
  - Increase quotas.
  - Replace a process level token.
  - Create a token object.
  - Log on as a service.

## dlmadmin username

During the installation, you will be asked to provide a user account that will be used as the DB2 Data Links Manager Administrator.

By default, the setup program will set up a user account with the username *dmladmin* and password *dmladmin*. You can accept these default values, specify an existing account, or create a different user account by changing the default values.

If you accept the default *dmladmin* user account, you should ensure that you change the **Password** and **Confirm Password** fields. The *dmladmin* user account's password is *dmladmin* for any DB2 Data Links Manager installation and is therefore well-known. Using the default setting for this user account could pose a security risk to your network.

If the *dmladmin* user account already exists on your system, you must use the password that was previously set for this user account.

If you want to specify an existing user account, the account you specify must:

- Be defined on the local machine.
- Belong to the *Local Administrators* group.
- Have the "*Back up files and directories*" and the "*Restore files and directories*" user rights.
- Have the following advanced user rights:

- Act as part of the operating system.
- Increase quotas.
- Replace a process level token.
- Create a token object.
- Log on as a service.
- Have a username that is 30 characters or less.

If you want to create a new user account using the setup program, you must ensure that the username you specify is 30 characters or less.

For more information on Windows NT user rights, refer to the Windows NT online help.

### **DLFM1 user account**

In addition to the DB2 Data Links Manager Administrator user account (dlmadmin), the DLFM1 user account is also created during installation for use by the Data Links File Manager. The DLFM1 user account is the owner of all READ PERMISSION DB files.

### **TCP/IP port number**

You must have a TCP/IP port free for use by the Data Links File Manager. By default, the setup program will generate a value for you. You can use this value or provide your own. You will need to know this port number to verify the installation.

To review the TCP/IP ports that are in use on a machine, open the services file located in the `x:\winnt\system32\drivers\etc` directory (where *x*: is the drive where you installed Windows NT).

### **Determine fully qualified hostname**

You must resolve the fully qualified hostnames of your DB2 Data Links and DB2 UDB servers. You will need to know these hostnames to verify the installation.

To resolve these hostnames, enter the **hostname** command on your DB2 Data Links and UDB servers. For example, this command might return `dlnserver` on your Data Links server.

Now enter the **nslookup** *dlnserver* command, where *dlnserver* is your hostname. This command should return output similar to the following:

```
Server: dnsserv.services.com
Address: 9.21.14.135
Name: dlnserver.services.com
Address: 9.21.51.178
```

The `Name: dlnserver.services.com` entry is your fully qualified hostname name.

Repeat these steps on each DB2 Data Links Manager and DB2 UDB server.

---

## Installing DB2 Data Links Manager on Windows NT

To install DB2 Data Links Manager:

1. Log on to the system with a user account that belongs to the *Local Administrators* group.
2. Shut down any programs that are running so that the setup program can update files as required.
3. Insert the CD-ROM into the drive. The auto-run feature will automatically start the setup program. If not, run **setup.exe** from the root directory of the CD-ROM.
4. The Launchpad window opens.
5. Click **Install** and respond to the setup program's prompts. Online help is available to walk you through the remaining steps. You can invoke the online help by clicking **Help** or pressing F1 at any time.

You can click **Cancel** at any time to stop the setup program.

### Actions performed by the setup program

The setup program performs the following actions::

1. Created DB2 Data Links Manager program groups and items (or shortcuts).
2. Updated the Windows NT registry with the following entries:
  - DLFM\_PORT=*port\_number*, where *port\_number* is the port number reserved for the Data Links File Manager.
  - DLFM\_LOG\_LEVEL=LOG\_ERR
  - DB2\_RR\_TO\_RS=ON
  - DB2\_HASH\_JOIN=ON
  - DLFM\_INSTALL\_PATH=*x*:\sql1lib\bin, where *x*: is the Data Links Manager installation drive.
  - DB2INSTANCE=DLFM
  - DLFM\_BACKUP\_DIR\_NAME=*x*:\dlfmbackup, where *x*: is the Data Links Manager backup installation drive.
3. Created and registered various services.
4. Set up the required links for the Data Links Filesystem Filter.
5. Created an instance called DLFM.
6. Created a user account for the DB2 Data Links Manager Administrator, if you did not provide your own.
7. Created a user account for use by the Data Links File Manager. By default, this user account is created with the username DLFM1 and password

IBMDLFM1. Since this username and password are used for any DB2 Data Links Manager installation, this could pose a security risk to your network. We recommend that you change this password after installing DB2 Data Links Manager.

If you change the default password for the default DLFM1 user account, you must update the registry with the new password by entering the following command:

```
d1ff set dlfmaccount d1fm1
```

8. Reserved the port number you specified for use by the Data Links File Manager and added an entry to the services file that is similar to the following:

```
db2cDLFM    50100/tcp
```

9. Created a DB2 database, called DLFM\_DB, which is used to keep track of those files that are under the control of the Data Links File Manager and used in a database where tables using DATALINK columns reside. This database was automatically backed up after it was created.

---

## Post-installation tasks

Once the setup program has finished installing DB2 Data Links Manager, you must reboot your system. After rebooting, you should ensure that it successfully creates and catalogues the DLFM\_DB database.

To verify that the DLFM\_DB database was successfully created and catalogued:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Retrieve the entry for the DLFM\_DB database in the System Database Directory by entering the following command:

```
db2 list database directory
```

This command should return output similar to the following:

```
System Database Directory
```

```
Number of entries in the directory = 1
```

```
Database 1 entry:
```

```
Database alias           = DLFM_DB
Database name            = DLFM_DB
Local database directory = C:\DLFM
Database release level   = 9.00
Comment                  =
Directory entry type     = Indirect
Catalog node number      = 0
```

If this database does not exist, see “Creating and Dropping the DB2 Database on the Data Links Server” on page 113.

You are now ready to set up a DB2 Data Links Manager environment and verify the installation. Go to “Chapter 4. Verifying the Installation on Windows NT” on page 25 for more information.

## Choosing a Backup Method

Whenever a DATALINK value is inserted into a table with a DATALINK column that is defined for recovery, the corresponding DATALINK files on the Data Links server are scheduled to be backed up to an archive server. Currently, Disk Copy (the default method) and Tivoli Storage Manager are the two options that are supported for file backup to an archive server. Future releases of DB2 Data Links Manager for Windows NT will support other vendors’ backup media and software.

### Disk Copy

When you enter the **backup** command on the DB2 server, the linked files in the database are backed up on the Data Links server to the directory specified by the DLFM\_BACKUP\_DIR\_NAME environment variable. The default value for this variable is c:\dlfmbackup, where c:\ represents the Data Links Manager backup installation drive.

To set this variable to c:\dlfmbackup, enter the following command:

```
db2set -g DLFM_BACKUP_DIR_NAME=c:\dlfmbackup
```

The location specified by the DLFM\_BACKUP\_DIR\_NAME environment variable must *not* be located on a file system using a Data Links Filesystem Filter. Sufficient space must be available in the directory you specified for the backup files.

Also, ensure that the DLFM\_BACKUP\_TARGET variable is set to LOCAL by entering the following command:

```
db2set -g DLFM_BACKUP_TARGET=LOCAL
```

After setting or changing these variables, stop and restart the Data Links File Manager using the **dlfm stop** and **dlfm start** commands.

### Tivoli Storage Manager

To use Tivoli Storage Manager as an archive server:

1. Install Tivoli Storage Manager on the Data Links server. For more information, refer to your Tivoli Storage Manager product documentation.
2. Register the Data Links server client application with the Tivoli Storage Manager server. For more information, refer to your Tivoli Storage Manager product documentation.
3. Click **Start** and select **Settings** —> **Control Panel** —> **System**. The System Properties window opens. Select the **Environment** tab and enter the following environment variables and

corresponding values:

Variable	Value
DSMI_DIR	c:\tsm\baclient
DSMI_CONFIG	c:\tsm\baclient\dsm.opt
DSMI_LOG	c:\tsm\dldump

4. Ensure that the `dsm.sys` TSM system options file is located in the `c:\tsm\baclient` directory.
5. Ensure that the `dsm.opt` TSM user options file is located in the `c:\tsm\baclient` directory.
6. Set the `PASSWORDACCESS` option to generate in the `c:\tsm\baclient\dsm.sys` Tivoli Storage Manager system options file.
7. Register TSM password with the `generate` option *before* starting the Data Links File Manager for the first time. This way, you will not need to provide a password when the Data Links File Manager initiates a connection to the TSM server. For more information, refer to your TSM product documentation.
8. Set the `DLFM_BACKUP_TARGET` environment variable to TSM using the following command:

```
db2set -g DLFM_BACKUP_TARGET=TSM
```

This activates the Tivoli Storage Manager backup option. The value of the `DLFM_BACKUP_DIR_NAME` environment variable is ignored in this case.

**Notes:**

- a. If you change the setting of the `DLFM_BACKUP_TARGET` environment variable between TSM and LOCAL at run time, you should be aware that the archived files are not moved to the newly specified archive location. For example, if you start the Data Links File Manager with the `DLMF_BACKUP_TARGET` environment variable set to TSM, and change its value to LOCAL, all newly archived files are stored in the new location on the disk. The files that were previously archived to TSM are not moved to the new disk location.
  - b. To override the default TSM management class use the new environment variable called `DLFM_TSM_MGMTCLASS`. If this variable is left unset then the default TSM management class is used.
9. Stop the Data Links File Manager by entering the **`dlfm stop`** command.



10. Start the Data Links File Manager by entering the **dlfm start** command.



---

## Chapter 4. Verifying the Installation on Windows NT

This chapter describes how to verify your installation on Windows NT. You will configure a DB2 Data Links Manager environment to control files that are linked to DATALINK columns in a table of a database on a DB2 Universal Database server.

You will perform six steps to verify your installation:

- “1. Creating a test environment on the DB2 UDB server”.
- “2. Creating a test environment on the DB2 Data Links server” on page 27.
- “3. Registering the Data Links server with the DB2 UDB database” on page 29.
- “4. Verifying the sample file is controlled by DLFF” on page 30.
- “5. Verifying the sample file is accessible” on page 31.
- “6. Viewing the sample file” on page 32.

Troubleshooting information can be found in “Troubleshooting the configuration on Windows NT” on page 33.

---

### 1. Creating a test environment on the DB2 UDB server

To create a test environment on the DB2 UDB server:

1. Log on to the system with a user account that belongs to the *Local Administrators* group.
2. Create an instance on the DB2 server using the **db2icrt** command. This instance will contain a database, that you will create, where tables containing columns of the DATALINK data type will reside. For more information, refer to the *Administration Guide*.

In our example, we will create an instance called VALIDATE by entering the following command:

```
db2icrt validate
```

3. Log out.
4. Log on to the system with a valid DB2 user ID that has System Administrative (SYSADM) authority on the VALIDATE instance that you created. By default, any user that belongs to the *Local Administrators* group has SYSADM authority on an instance. For more information, refer to your server's *Quick Beginnings* manual.
5. Ensure that the VALIDATE instance is the current instance by entering the following command:

```
db2 get instance
```

This command should return the following output:

```
The current database manager instance is: VALIDATE
```

If you do not receive this output, enter the following commands:

```
set DB2INSTANCE=VALIDATE
db2 get instance
```

6. Set the DATALINKS database manager configuration parameter to *YES* in the VALIDATE instance's configuration file by entering the following command:

```
db2 update dbm cfg using datalinks yes
```

To disable DB2 Data Links Manager functionality on your DB2 server, set the DATALINKS database manager configuration parameter to *no*.

7. Start the VALIDATE instance by entering the **db2start** command.

**Note:** If you change a setting in an instance's database manager configuration file, you must ensure that you stop and restart the instance (using the **db2stop** and **db2start** commands) for the changes to take effect. In our example, we did not start the VALIDATE instance, so we only issued the **db2start** command. For more information, refer to the *Administration Guide*.

8. Create a database using the **db2 create database** command. This database will contain a table using the DATALINK data type. For more information on the **db2 create database** command, refer to the *Command Reference*.

For the example, create a database called STAFF by entering the following command:

```
db2 create database staff
```

9. Connect to the STAFF database by entering the following command:

```
db2 connect to staff
```

10. Create a table called EMPLOYEE, in the STAFF database that you just created, that has a column defined with a DATALINK data type by entering the following command:

```
db2 "create table employee (id int, fname varchar(30), lname varchar(30),
picture datalink linktype url file link control integrity all
read permission db write permission blocked recovery yes on
unlink restore)"
```

11. Terminate all connections to this database by entering the following command:

```
db2 connect reset
```

12. Log out.

---

## 2. Creating a test environment on the DB2 Data Links server

After creating a test environment on the DB2 UDB server, we must create a test environment on the DB2 Data Links server.

There are three sub-tasks involved in creating the test environment on the Data Links server:

- “Registering the drive with the Data Links File Filter”.
- “Registering the DB2 UDB database” on page 28.
- “Creating a sample file” on page 28.

### Registering the drive with the Data Links File Filter

A Data Links Filesystem Filter (DLFF) was created by the setup program on the NTFS formatted drives that you selected during the installation.

To register a drive with the DLFF:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Ensure that the Data Links File Manager started successfully as follows:
  - a. Click **Start** and select **Settings** —> **Control Panel**.
  - b. Double-click **Services**. The Services window opens.
  - c. Ensure that status for the **DB2 Data Links File Manager** service is set to **Started**.
3. Ensure that the drive you reserved for the Data Links server is under the control of a Data Links Filesystem Filter (DLFF) by entering the **dlff list** command. This command will list all the drives that are under the control of a DLFF.

For our example, this command should return the following output:

```
LogicalDrives = C:
```

4. Register the share name of a drive that is under the control of a Data Links Filesystem Filter by entering the following command:

```
dlff add c:  
dlfm add_prefix \sharename
```

where *sharename* is the shared name of the drive that is under the control of a DLFF, and *c:* is the drive that is under the control of the DLFF.

For example, register the Data Links server to use the Data Links Filesystem Filter on the *cdrive* (which is the share name of the *c:\* drive) by entering the following command:

```
dlfm add_prefix \cdrive
```

5. Log out.

## Registering the DB2 UDB database

To register a new database with the Data Links File Manager:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Register the remote DB2 UDB database where the DATALINK data type was defined by entering the following command:

```
dlfm add_db database instance hostname
```

where:

- *database* is the database alias name of the remote database.
- *instance* is the instance where *database* resides. If you are registering a Windows NT instance on an AIX or Solaris Data Links Manager, *instance* must be in uppercase.
- *hostname* is the fully qualified hostname of the DB2 UDB server where *database* resides.

The following command will register a database called STAFF, which resides in the VALIDATE instance on a DB2 UDB server with a fully qualified hostname of db2server.services.com:

```
dlfm add_db staff validate db2server.services.com
```

To list the registered database, enter the following command:

```
dlfm list registered databases
```

Do not specify the DLFM\_DB when you run this command. The DLFM\_DB is a local database that is used to keep track of files that are under the control of the Data Links File Manager.

3. Log out.

## Creating a sample file

To create a sample file:

1. Log on to the system as any user that is neither a DB2 Data Links Manager Administrator nor the DLFM1 user account created during installation for use by the Data Links File Manager. Note that the DLFM1 user is different from the DB2 Data Links Manager Administrator user account.
2. Create a directory on the drive that is under the control of a Data Links Filesystem Filter, to store files to be controlled by a DB2 server, by entering the following command:

```
md x:\directory_name
```

where:

- *x*: is the shared drive that is under the control of a DLFF.
- *directory\_name* is the name of the directory that you want to create.

The DLFM1 user account should never be the owner of any files or directories which are in a shared directory under the control of a Data Links Filesystem Filter. In our example, we will create a directory called pictures on the c: drive by entering the following commands:

```
c:
cd \
md pictures
```

The directory you create must have the **Access Type** set to Full Control. This is the default for any new directory that you create in Windows NT.

If the directory that you have created does not grant all members of the EVERYONE group Full Control, enter the following command:

```
cacls c:\pictures /p everyone:f
```

3. Create a sample file called psmith.bmp in the c:\pictures directory, to be managed by the Data Links File Manager, by entering the following command:

```
echo "This is a picture of Paul Smith" > c:\pictures\psmith.bmp
```

4. Log out.

The sample file psmith.bmp is a text file, not a bitmap as the .bmp extension implies. For the purpose of verifying your installation, this file represents an employee's picture that was inserted into a table that was defined with the DATALINKS data type.

---

### 3. Registering the Data Links server with the DB2 UDB database

To register the Data Links server with the remote DB2 UDB database where the DATALINK data type was defined earlier:

1. Log on to the system with a valid DB2 user ID that has System Administrative (SYSADM) authority on the VALIDATE instance that you created. By default, any user that belongs to the *Local Administrators* group has SYSADM authority on an instance. For more information, refer to your server's *Quick Beginnings* manual.
2. Ensure that the VALIDATE instance is the current instance by entering the following command:

```
db2 get instance
```

This command should return the following output:

```
The current database manager instance is: VALIDATE
```

If you do not receive this output, enter the following commands:

```
set DB2INSTANCE=VALIDATE
db2 get instance
```

3. Start the VALIDATE instance by entering the **db2start** command.
4. Register a Data Links server that will control the files that are linked by a DATALINK data type by entering the following command:

```
db2 "add datalinks manager for database database_alias using node hostname port port_number"
```

where:

- *database\_alias* is the database alias name of the database.
- *hostname* is the fully qualified hostname of the Data Links server.
- *port\_number* is the port number that you have reserved for communications between the Data Links server and the DB2 server. You specified this port number during the installation of DB2 Data Links Manager.

For our example, enter the following command:

```
db2 "add datalinks manager for database staff using node dlmsvr.services.com port 50100"
```

5. Connect to the STAFF database by entering the following command:

```
db2 connect to staff
```

6. Insert an entry into the EMPLOYEE table that you created by entering the following command:

```
db2 "insert into employee values (001,'Paul','Smith',==>  
    dlvalue('unc:\\unc_name\\controlled_file'))"
```

where:

- *unc\_name* is the fully qualified location of the file that is under the control of a Data Links Filesystem Filter on the Data Links server.
- *controlled\_file* is the filename of the file that you want to control on the Data Links server.

For our example, enter the following command

```
db2 "insert into employee values (001,'Paul','Smith',==>  
    dlvalue('unc:\\dlmsvr.services.com\\cdrive\\pictures\\psmith.bmp'))"
```

7. Log out.

---

## 4. Verifying the sample file is controlled by DLFF

To verify that the psmith.bmp sample file we created earlier is under the control of the Data Links File Filter:

1. Log on to the system using any user account other than the DB2 Data Links Manager Administrator or the DLFM1 user account.
2. Verify that the linked Data Links file is now controlled by the Data Links File Manager by entering the following command:

```
type \\unc_name\\controlled_file
```

where:



- *unc\_name* is the fully qualified location of the file that is under the control of a Data Links Filesystem Filter on the Data Links server.
- *controlled\_file* is the filename of the file that you want to control on the Data Links server.

For our example, enter the following command:

```
type \\dlmserver\cdrive\pictures\psmith.bmp
```

If the file is being controlled by the Data Links File Manager, you will see output similar to the following:

```
\\dlmserver\cdrive\pictures\psmith.bmp
Access is denied.
```

3. Log out.

---

## 5. Verifying the sample file is accessible

Finally, we will verify that the *psmith.bmp* sample file can be accessed while it is under the control of the Data Links File Manager. To do this, we will first need to generate an *access token* on the DB2 UDB server:

1. Log on to the system with a valid DB2 user ID that has System Administrative (SYSADM) authority on the VALIDATE instance that you created. By default, any user that belongs to the *Local Administrators* group has SYSADM authority on an instance. For more information, refer to your server's *Quick Beginnings* manual.
2. Ensure that the VALIDATE instance is the current instance by entering the following command:

```
db2 get instance
```

This command should return the following output:

```
The current database manager instance is: VALIDATE
```

If you do not receive this output, enter the following commands:

```
set DB2INSTANCE=VALIDATE
db2 get instance
```

3. Start the VALIDATE instance by entering the **db2start** command.
4. Connect to the STAFF database by entering the following command:

```
db2 connect to staff
```

5. Select the controlled file for update by issuing an SQL **SELECT** statement. For more information, refer to the *SQL Reference*.

For our example, enter the following command:

```
db2 "select dlurlpath(picture) from employee where lname = 'Smith'"
```

This command will return the full pathname with an access token of the form:

```
unc_name\access_token;controlled_filename
```

where:

- *unc\_name* is the fully qualified location of the file that is under the control of a Data Links Filesystem Filter on the Data Links server.
- *access\_token* is an encrypted key assigned by the database manager.
- *controlled\_filename* is the name of the file that is under the control of a Data Links Filesystem Filter.

For our example, the access token that you receive will be similar to the following:

```
\cdrive\pictures\HVJ5NXGC0WQ.I5KKB6;psmith.bmp
```

This key will be used to read this file on the Data Links server.

**Note:** This access token is only valid for 60 seconds. This means that once you enter this command, you have only 60 seconds to complete the remaining steps in this section (or edit any Data Links controlled file). You can change the default expiration time by changing the *DL\_EXPINT* database configuration parameter.

To change the default expiration time for an access token to 10 minutes (the value is entered in seconds), enter the following commands:

```
db2 update db cfg for staff using dl_expint 600
db2 terminate
db2 connect to database staff
```

If you change a setting for any database configuration parameter, you must always reconnect to the database for the changes to take effect. For more information on database configuration file parameters, refer to the *Administration Guide*.

6. Log out.

---

## 6. Viewing the sample file

Finally, we will use this access token to view the *psmith.bmp* file:

1. Log on to the system using any user account other than the DB2 Data Links Manager Administrator or the DLFM1 user account.
2. Verify that you can access the file that is under the control of the Data Links File Manager.

For our example, enter the following command:

```
type "\\dlmsvr\cdrive\pictures\token_key;psmith.bmp"
```

where *token\_key* is the encrypted key that you recorded in “5. Verifying the sample file is accessible” on page 31.

You should receive the following output from this command:

```
"This is a picture of Paul Smith."
```

If you did not receive an error, you have access to this file and you have installed and configured DB2 Data Links Manager correctly. For information on commands that are used in the day-to-day operations of a DB2 Data Links Manager environment, go to “Chapter 10. Working with the Data Links File Manager” on page 101.

If you received a error, go to “Troubleshooting the configuration on Windows NT”.

For more information on the SQL commands used to verify the installation, refer to the *SQL Reference*.

---

## Troubleshooting the configuration on Windows NT

If you received an error when you attempted to access the `psmith.bmp` test file, use the following checklist and go through the configuration instructions again, verifying each item as you go:

### At the Data Links server:

- Ensure that you correctly registered the drive that is being used to store any linked files.
- Ensure that the DB2 database was registered correctly.
- Ensure that the Data Links File Manager was started.
- Start the Windows NT Task Manager and verify that the following processes are running:
  - `dlfm_chownd.exe`
  - `dlfm_copyd.exe`
  - `dlfm_delgrp.exe`
  - `dlfm_gcd.exe`
  - `dlfm_retrieved.exe`
  - `dlfm_upcall.exe`
  - `dlfmd.exe`

### At the DB2 server:

- The *DATALINKS* database manager configuration parameter is set to *YES*.

- The Data Links server was registered correctly using the **db2 add datalinks manager** command. To verify that the Data Links server was registered correctly, enter the following command:

```
db2 list datalinks managers for database database-alias
```

For information on any error messages that you may encounter on the DB2 Data Links Manager, see “Appendix A. DB2 Data Links Manager Errors and User Responses” on page 127. For information on any error messages that you may encounter on the DB2 server, refer to the *Message Reference*.

---

## **Part 3. Installing and Configuring DB2 Data Links Manager for AIX**



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## Chapter 5. Installing and Configuring DB2 Data Links Manager for AIX

This chapter describes how to install DB2 Data Links Manager for AIX using the `db2setup` utility or AIX's System Management Interface Tool (SMIT).

---

### Common Installation Considerations

Please read this information carefully before installing DB2 Data Links Manager. The information in this section is common to installations in both JFS and DCE-DFS environments. Specific JFS and DCE-DFS information follows this section.

#### Should I use the `db2setup` utility or SMIT?

We strongly recommend that you use the `db2setup` utility if you are installing DB2 Data Links Manager in JFS or DCE-DFS environments. The `db2setup` utility performs almost all Data Links Manager setup and configuration tasks for you. If you want to install DB2 Data Links Manager using SMIT, you will have to set up and configure your Data Links Manager system manually.

#### Disk space requirements

Ensure that there is at least 85 MB of free disk space in the `/usr/lpp` directory. To check available free disk space, enter the `df -k /usr/lpp` command.

#### Memory requirements

Ensure that there is at least 256 MB of memory available to your system. To check available memory, enter the `lsattr -l sys0 -E -a realmem` command.

#### Migrating from previous versions

Different levels of DB2 Data Links Manager instances cannot exist on the same machine. If you have a pre-Version 7.1 Data Links instance on your system, you must migrate the instance to the Version 7.1 format using the `db2imigr` command. For more information, refer to the *DB2 for UNIX Quick Beginnings*.

Registry variables offer more function and flexibility than environment variables. However, because of this, it is possible that migration will not be performed exactly as expected. The registry variables should be checked using the `db2set` command after migration. You do not need to check these variables if you are migrating from Version 6.1 to Version 7.1.

## Migrating from DB2 File Manager Version 5.2 to DB2 Data Links Manager Version 7

If you are migrating from DB2 File Manager Version 5.2 to DB2 Data Links Manager Version 7.1, you should perform the following steps:

1. Prepare your DB2 and DLFM databases for migration. For more information see "Migrating from Previous Versions of DB2" in Chapter 1 of the *Quick Beginnings for UNIX* manual.
2. Install DB2 Version 7 on your DB2 server and DLFM server machines. These tasks are detailed below.
3. As a user with root authority on the DLFM server machine, run the `/usr/lpp/db2_07_01/adm/db2dlmmg` command.

When you migrate from DB2 File Manager to DB2 Data Links Manager, the following environment variables will be converted to DB2 registry variables:

```
DLFM_INSTALL_PATH
DLFM_PORT
DLFM_LOG_LEVEL
DB2_RR_TO_RS
DLFM_BACKUP_DIR_NAME (1)
DLFM_BACKUP_TARGET (2)
DLFM_BACKUP_TARGET_LIBRARY (3)
```

### Notes:

1. This variable is used if a local file system is the backup target.
2. Used to indicate the type backup target used. Possible values for this variable are LOCAL, TSM, or XBSA.
3. Used to indicate the XBSA support code library if the DLFM\_BACKUP\_TARGET is set to XBSA. The support code library must be fully qualified and must include the shared object name, for example `/u/dmcinnis/Legato/libxdb2.a(bsashr10.o)`. The name of the shared object, in this case `bsashr10.o`, is available from the vendor supplying the XBSA compliant shared library.

### TCP/IP port number

You must have a TCP/IP port available for use by the Data Links File Manager. By default, the `db2setup` utility will generate a value for you. You can use this value or provide your own. You will need to know this port number to verify the installation.

If you want to specify your own port number, review the TCP/IP ports that are already in use on a machine by opening the `/etc/services` file. You will need to specify this port during the installation.

Once you have selected a TCP/IP port number for use by the DLFM, the value should not be changed.



### **New registry variable**

A new registry variable, `DLFM_FS_ENVIRONMENT`, will be set up during install. This variable will be set to `DFS` or `NATIVE` (for JFS), depending on the file system you select when you install DB2 Data Links Manager.

### **Synchronize system clocks**

Ensure that the system clocks on the Data Links server and the remote DB2 server are synchronized and remain synchronized.

Synchronization of clocks is essential for the Data Links token expiry interval to work correctly. The token expiry interval is a database configuration parameter. To check the system time and date, enter the **date** command. For more information on synchronizing system clocks, refer to your *AIX Administration Guide*.

Depending on the file system (JFS or DCE-DFS) you plan to use with your DB2 Data Links solution, there are additional installation considerations you should take into account before you begin installing DB2 Data Links Manager on your AIX system.

---

## **Additional Installation Considerations in JFS Environments**

If you plan to deploy DB2 Data Links Manager in a Journaled File System (JFS) environment, you should also take the following information into consideration:

### **Operating system level**

Ensure that you are running AIX Version 4.2.1 or later. To check the level of the operating system, enter the **oslevel** command.

### **Version levels of DB2 Data Links and DB2 Universal Database**

DB2 Universal Database and DB2 Data Links Manager can be any combination of Version 6.1 and Version 7.1. For example, DB2 UDB can be at Version 6.1 and Data Links Manager can be at Version 7.1. To check the version of DB2 that resides on a workstation, enter the **db2level** command.

### **DLMADMIN username**

During installation, you will be given the option to create the DB2 Data Links Manager Administrator (DLMADMIN) user. These installation instructions assume that you select this option.

When you select to create the DLMADMIN username, the `db2setup` utility will create this user with the username `dlfm` and password `ibmdb2`. You can accept these default values, specify an existing username, or create a different username by changing the default values. For security reasons, we recommend that you specify your own username and password because the default values are used in

every DB2 Data Links installation and therefore are well known. The DLMADMIN username will also be the name of the Data Links Manager instance.

If you want to specify your own existing username, the account you specify:

- Must *not* have its home directory reside on a file system that is using a Data Links Filesystem Filter.
- Must have a username that is eight characters or less.
- Must *not* be a user with root authority.

To create a username for use as the DB2 Data Links Manager Administrator (DLMADMIN):

1. Log in as a user with root authority.
2. Create the a group for the DB2 Data Links Administrator (for example, `d1fmgrp`) and username (for example, `d1fm`), using the `/home/d1fm` directory as the home directory of the DLMADMIN, by entering the following commands:

```
mkgroup d1fmgrp
mkuser pgrp='d1fmgrp' groups='d1fmgrp' home='/home/d1fm' d1fm
```

3. Assign a password to this username by entering the **passwd** **username** command, where **username** is the username that you created.

The DB2 Data Links Manager Administrator (DLMADMIN) should never own files or directories on a file system that is under the control of a Data Links Filesystem Filter. The DLMADMIN should only be used to administer the Data Links File Manager.

If you create a different username by changing the default values, you must ensure that the username you specify is eight characters or less.

### Disk space requirements for DLMADMIN user

Ensure that there is at least 70 MB of free disk space in the home directory where the DB2 Data Links Manager Administrator's home directory will reside. To check available free disk space, enter the **df -k INSTHOME** command, where *INSTHOME* is the home directory of the DLMADMIN user.

### Determine fully qualified hostnames

You must resolve the fully qualified hostnames of your DB2 Data Links and DB2 UDB servers. You will need to know these hostnames to verify the installation.

When connecting to the DB2 Data Links File Manager, the DB2 UDB server sends the following information to the DLFM:

- Database name.

- Instance name.
- Hostname.

The DLFM then verifies this information to decide if a connection from this particular DB2 server should be allowed. The subroutine that obtains hostname information on the DB2 server, `gethostbyname`, looks for `/etc/resolv.conf`. If this file exists, the subroutine queries the domain name server. If the request to the DNS times out, the `gethostbyname` routine checks the local `/etc/hosts` file. To connect successfully to the DLFM, the name registered on the DLFM must be the one which is obtained by the `gethostbyname` routine on the DB2 UDB server.

To resolve the hostnames of your DB2 Data Links and DB2 UDB servers, enter the **hostname** command on each system. For example, this command might return `dlmsvr` on your Data Links server.

Now enter the **host** `dlmsvr` command, where `dlmsvr` is your hostname. This command should return output similar to the following:

```
dlmsvr.services.com is 9.11.302.341, Aliases: dlmsvr
```

`dlmsvr.services.com` is your fully qualified hostname name.

Repeat these steps on each DB2 Data Links and DB2 UDB server.

---

## Additional Installation Considerations in DCE-DFS Environments

DB2 Data Links Manager Version 7.1 supports linked files stored using Transarc's DCE Distributed File System (DCE-DFS) file server Version 3.1.

If you plan to deploy DB2 Data Links Manager in a DCE-DFS environment, you should also take the following information into consideration:

### Installation prerequisites

DCE-DFS Version 3.1 must be installed on your system before you install DB2 Data Links Manager. DCE-DFS Version 3.1 requires AIX 4.2.1, AIX 4.3.1, AIX 4.3.2 or AIX 4.3.3. Also, ensure that the DFS Storage Management Runtime (`dfs.sm.rte`) is installed.

A DFS Client Version 3.1 must be installed on any DB2 server which used `ADD DATALINKS MANAGER` to register a DCE-DFS cell. Use of the DCE slim client is not supported on the DB2 server. The DFS Client must be running before you install the Data Links Manager. See "Chapter 6. Installing and Configuring DB2 Data Links DFS Client Enabler" on page 57 for more information.

You must also install either an e-fix for DFS 3.1, or PTF set 1 when it becomes available. The e-fix is available from:

[http://www.transarc.com/Support/dfs/datalinks/efix\\_dfs31\\_main\\_page.html](http://www.transarc.com/Support/dfs/datalinks/efix_dfs31_main_page.html)

### DCE identity

Request that your cell administrator create a new DCE identity which will be used by the Data Links Manager Administrator. Do not use an existing identity. This identity, which involves creating a new DCE group and new DCE user, will also own any READ PERMISSION DB files on the DFS nodes. This group ID and user ID should not be used for any other purpose. Also, you should ask your cell administrator to create `/:/DataLinks`.

**Note:** You must ensure that the new DCE identity and `/:/DataLinks` are created with the properties described in “Appendix C. DCE-DFS Common Tasks and References” on page 145.

### Operating system level

Ensure that you are running AIX Version 4.2.1, Version 4.3.2 or Version 4.3.3. To check the level of the operating system, enter the `oslevel` command.

### Version levels of DB2 Data Links and DB2 Universal Database

If DB2 Universal Database is already installed on any machine that will participate in your Data Links environment, ensure that the version is DB2 Universal Database Version 7.1. The version of DB2 UDB on the DB2 server and the DB2 Data Links Manager server *must* be at the same level. To check the version of DB2 UDB that resides on a workstation, enter the `db2level` command.

### DCE-DFS functional restrictions

- DB2 Universal Database is restricted to linking to files stored in one DCE cell.
- DCE-DFS and JFS Data Links Managers cannot coexist on the same system.
- Files on a DCE-DFS file server must be stored in a DMLFS, which is a LFS that has been DM-enabled using the `dmaggr` command.
- A DB2 Data Links Manager must be installed at each node on which a DMLFS fileset that you want to monitor physically resides.
- Filesset move and replication are not currently supported.
- In the DCE cell, the junction to the DFS filespace must be `/.../cellname/fs .`

### Database registration of Data Links Manager servers

A DB2 database on an AIX platform can register Data Links Manager servers running in either the native JFS or NTFS environments, provided that the DB2 clients which access the files are running on

the same platform as the DLM servers. For example, if the DLM server is running on Windows NT, the DB2 client which access the files must be running on Windows NT as well. If the DLM server is running on AIX, the DB2 client which access the files must be running on AIX.

A DB2 database on an AIX platform can also register DLM servers running in the DCE-DFS environment. However, this database cannot, at the same time, register DLM servers running in native JFS or NTFS environments.

### **Data Links File Manager "servers" and "clients"**

In DCE-DFS environments, two separate Data Links components can be installed: the Data Links Manager and the DB2 Data Links DFS Client Enabler. The Data Links Manager server must be installed before any of the Data Links Manager clients.

The **Data Links Manager** can be set up as a server or a client. In a DCE cell, one node will contain the DLFM\_DB and is known as the DLFM server node. All other nodes on which Data Links Manager is installed must be configured as DLFM client nodes.

The **DB2 DataLinks DFS Client Enabler**, also known as the DLFM Cache Manager or DLFM-CM, is installed on DB2 Universal Database clients and is needed for any DB2 client using a DATALINK datatype which has been set up as READ PERMISSION DB. The DFS Client Enabler should not be installed as part of the Data Links Manager.

For an graphical overview of Data Links components in a DCE-DFS environment, see Figure 2 on page 12.

### **Backup directory**

If the backup method is to a local file system, the directory must be a DFS file set. Ensure that this DFS file set has been created by a DFS administrator. This should not be a DMLFS file set.

---

## **Installing DB2 Data Links Manager on AIX Using the db2setup Utility**

The db2setup utility is the recommended method for installing all DB2 products on UNIX-based operating systems. This utility can perform all of the tasks required to install DB2 Data Links Manager. If you prefer not to use the db2setup utility, see "Manually installing DB2 Data Links Manager Using SMIT" on page 47.

To install and configure DB2 Data Links Manager using the db2setup utility:

1. Log in as a user with root authority. In DCE-DFS environments, you will also need to dce\_login as DLMADMIN.
2. Insert and mount your product CD-ROM.

3. Change to the directory where the CD-ROM is mounted by entering the **cd /cdrom** command where **cdrom** is the mount point of your product CD-ROM.
4. Enter the **./db2setup** command. After a few moments the DB2 Setup Utility window opens. Follow the on-screen instructions to begin the installation process.

The db2setup utility automatically generates an installation log in `/tmp/db2setup.log`. If you want to generate a trace file to record any installation errors in greater detail, enter the **./db2setup -d** command. This generates a trace file in `/tmp/db2setup.trc`.

5. Press **Tab** to move between available options and fields. Press **Enter** to select or deselect an option. Selected options are denoted by an asterisk. When you select to install a DB2 product, you can choose the product's **Customize** option to view and change the optional components that will be installed.

If you are installing in a DCE-DFS environment, one node in the cell will contain the DLFM\_DB and must be set up as the DB2 server. All other nodes on which Data Links Manager is installed must be set up as DB2 clients for the DLFM\_DB.

## Actions Performed by the db2setup Utility

After installation is complete and before you exit the db2setup utility, you can select **View Log** to review the installation process. You can also review the `/tmp/db2setup.log` file for more detailed information. If you ran the **./db2setup -d** command to capture any installation errors, you can review the trace log in `/tmp/db2setup.trc`.

The following actions are performed by the db2setup utility:

### Installation directory

DB2 Data Links Manager and DB2 Universal Database are installed in the `/usr/1pp/db2_07_01` directory. DB2 Data Links Manager uses DB2 UDB to maintain logged information for the linked files.

### Group and user IDs

A group ID (gid) and user ID (uid) are created for the DB2 Data Links Manager Administrator (DLMADMIN), if you selected to do so during installation. In the DCE-DFS environment, ensure that the uid, user name, gid, and group name match the DCE identity which was created for DLMADMIN.

### Instance creation

An instance for the Data Link File Manager is created. The default instance, associated with the default group and user ID, is called DLFM.

### Registry variables

The following registry variables are set:

```

DLFM_PORT=port_number
DLFM_LOG_LEVEL=LOG_ERR
DB2_RR_TO_RS=ON
DB2_HASH_JOIN=ON
DLFM_INSTALL_PATH=$HOME/sql1ib/bin
DLFM_INSTANCE_NAME=instance_name
DB2INSTANCE=DLFM_INSTANCE_NAME
DLFM_BACKUP_DIR_NAME=$HOME/d1fmbackup //JFS only
DLFM_BACKUP_DIR_NAME=/:/d1fmbackup //DCE-DFS only
DLFM_BACKUP_TARGET=LOCAL
DLFM_FS_ENVIRONMENT=file_system

```

where:

- *port\_number* is the port number reserved for the Data Links File Manager.
- *instance\_name* is the name of the Data Links File Manager instance.
- *file\_system* is NATIVE in JFS environments or DFS in DCE-DFS environments. The default setting is NATIVE.

### **PATH variables**

The following variables are set in the DB2 Data Links Manager Administrator's db2profile or db2cshrc script file:

```

(for bash, Bourne, or Korn shell)
export PATH=$PATH:$HOME/sql1ib/bin:$HOME/sql1ib/adm:$HOME/sql1ib/misc
(for C shell)
setenv PATH=${PATH}:${HOME}/sql1ib/bin:${HOME}/sql1ib/adm:${HOME}/sql1ib/misc

```

To run the DB2 Data Links Manager Administrator's db2profile or db2cshrc script file each time this user logs on to the system, add the following entry to the DB2 Data Links Manager Administrator's .profile script file:

```

. INSTHOME/sql1ib/db2profile (for bash, Bourne, or Korn shell)
source INSTHOME/sql1ib/db2cshrc (for C shell)

```

where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator.

### **Virtual File System number**

In JFS environments, the following entry is added to the /etc/vfs file:

```

d1fs 12 /usr/lpp/db2_07_01/bin/d1fs_mnthlp /usr/lpp/db2_07_01/bin/d1fs_fshe1per

```

If the vfs number 12 is already in use, the db2setup utility will specify a different number between 8-15 for use by the Virtual File System (VFS).

### **DB2 database DLFM\_DB created**

In DCE-DFS environments, a DLFM\_DB database is not created on the

DLFM server node and must be done as a post-installation step. On the DLFM client nodes, a remote database catalog entry to the DLFM\_DB is created.

In JFS environments, a DLFM\_DB database is created on the node containing DB2 DataLinks Manager.

### DCE-DFS pre-start registration for DMAPP

In a DCE-DFS environment, a data manager application (DMAPP) is installed. This DMAPP prevents file renaming and deletion. DB2 Data Links Manager can only start if the DMAPP is up and running, and the DMAPP has to be started as part of DFS start-up. This is accomplished by installing a DFS pre-start script. The db2setup utility does this for you by performing the following actions:

1. The db2setup utility checks if /opt/dcelocal/tcl/user\_cmd.tcl exists. If it does not exist, the db2setup utility creates it.
2. Commands are added to /opt/dcelocal/tcl/user\_cmd.tcl to ensure that the DMAPP is started when DFS is started.
3. A link is created from \$HOME/sql1lib/adm/dlfsdmap\_prestart.dfs to /usr/bin/dlfsdmap\_prestart.dfs.

---

## DCE-DFS Post-installation Task

The db2setup utility performs almost every required setup and configuration task needed to get your Data Links Manager system up and running. The only additional task you must perform in DCE-DFS environments is setting up the DFS disk archive directory. Detailed instructions can be found in “SMIT post-installation tasks” on page 48.

### Keytab file

DLFM daemons must become DCE network root to access the DFS filesets. To be able to do this the DCE network root has to create a DCE keytab file so that the daemons can take on network root privileges and refresh their credentials periodically.

This keytab file, which contains the principal and password information, should be called `data link.ktb` and should be stored under the `$INSTHOME/sql1lib/security/` directory. This file should have its permissions set to read only by the local root user and should be available on the DLFM server node and all DLFM client nodes.

To create a keytab file:

1. Enter the **rgy\_edit** command. A `rgy_edit` prompt similar to the following should appear:  

```
rgy_edit==>
```
2. Enter the **cta** command as follows:



```
kta[dd] -p principal [-r[registry]][-a | -pw password][-f keyfile]
```

For example, you might enter a command similar to the following:

```
kta -p root -f /u/dlfm/sql/lib/security/dataLink.ktb
```

If you enter the **kta** command without the `-pw password` option, you will be prompted to enter a password.

---

## Manually installing DB2 Data Links Manager Using SMIT

We recommend that you use the `db2setup` utility to install DB2 Data Links Manager for AIX. If you prefer not to use this utility, you can manually install the DB2 Data Links Manager software bundle using the AIX System Management Interface Tool (SMIT).

Unless otherwise noted, these steps are the same for DB2 Data Links installations in Journaled File System (JFS) and DCE-DFS environments on AIX.

To install a DB2 Data Links Manager software bundle using SMIT:

1. Log in as a user with root authority.
2. Insert and mount the appropriate CD-ROM.
3. Enter the **smit** command.
4. Select **Software Installation and Maintenance** → **Install and Update Software** → **Install Software Bundle (Easy Install)**.
5. Specify the input device or directory for the installation media, or click **List** to display all input devices or directories.
6. Select the CD-ROM drive you mounted, then press Enter.
7. Select the DB2V7DLNK bundle and press Enter. The Install Software Bundle window opens.
8. Review the bundle installation parameters. In particular, make sure that **COMMIT software updates** and **AUTOMATICALLY install requisite software** are set to **yes**. Click **OK** again to begin installation.
9. If you did not install the DB2 Media-Defined software bundle on this system, use the following procedure to install it:
  - a. In the **Bundle to Install** menu, select the **Media-Defined** option, then press Enter.
  - b. In the **Install Bundle Contents** menu, press Enter to continue with the installation. Messages may appear to indicate the status of the installation. Press Enter to continue.
  - c. Press F3 to return to the **Install Bundle Contents** menu.

- d. Press F4 to re-display the list of software bundles. Select the bundle you want to install and press Enter to begin the installation process. DB2 will be installed in the `/usr/lpp/db2_07_01/` directory.

## SMIT post-installation tasks

After manually installing the Data Links Manager software bundle, you must perform several additional configuration tasks. If you used the `db2setup` utility to install your product all of these tasks, *except* step 3 (setting up a DFS disk archive directory), were performed for you.

Unless otherwise noted, these tasks apply to Data Links Manager installations in native JFS and DCE-DFS environments.

**Note:** In DCE-DFS environments, the following tasks assume you have already created a DCE identity for use by the Data Links File Manager. The examples below assume that the DLFM username you created is `dlfmuser`. For more information on creating and administering DCE identities, see “Appendix C. DCE-DFS Common Tasks and References” on page 145 or refer to your Transarc DCE-DFS product documentation.

To complete your manual DB2 Data Links Manager installation:

1. As a user with root authority on the DLFM server, run the `/usr/lpp/db2_07_01/instance/dlfcrt` command to create a DLFM instance.
2. **DCE-DFS only:** On the DLFM server and each DLFM client, set the `DLFM_FS_ENVIRONMENT` registry variable to DFS as follows:  
`db2set DLFM_FS_ENVIRONMENT=DFS`
3. **DCE-DFS only in installations performed using `db2setup` or SMIT:** On the DLFM server and each DLFM client, set up the disk archive directory.

Consider the following scenario:

- Your DCE *cellname* is `dln1.almaden.ibm.com`.
- You have two nodes in the cell: `node1.almaden.ibm.com` (known as *node1*), and `node2.almaden.ibm.com` (known as *node2*).
- There are two prefixes registered with the DFS File Manager:
  - `/.../dln1.almaden.ibm.com/fs/prfx1`. This prefix is native to *node1*. The prefix is `prfx1`. The fileset name is `fileset1`.
  - `/.../dln1.almaden.ibm.com/fs/prfx2`. This prefix is native to *node2*. The prefix is `prfx2`. The fileset name is `fileset2`.

**The archive directory must be a DFS fileset.** For example, you may use `/.../dln1.almaden.ibm.com/fs/dlfm_backup/` as your archive directory.

In this scenario, you would set the `DLFM_BACKUP_DIR_NAME` registry variable on the DLFM server and each DLFM client as follows:

```
db2set DLFM_BACKUP_DIR_NAME=../../dln1.almaden.ibm.com/fs/dlfm_backup
```

For files that reside in `prfx1`, the archive will be made by the copy daemon running on `node1` to the `../../dln1.almaden.ibm.com/fs/dlfm_backup/node1/_prfx1/` directory. For files in `prfx2`, the archive will be made to the `../../dln1.almaden.ibm.com/fs/dlfm_backup/node2/_prfx2/` directory.

The directories `../../dln1.almaden.ibm.com/fs/dlfm_backup/node*` and `../../dln1.almaden.ibm.com/fs/dlfm_backup/node*/_prfx1/` will be created when you issue the **dlfm start** command, below.

4. **DCE-DFS only:** If you are installing a DLFM server or client, edit the `/etc/services` files at each node. Add two consecutive port numbers for the service name, `srv_dlfm`. For example, if the service name is `data1srv`, you would add `data1srv` and `data1srv_i` to `/etc/services`.
5. Set the `DLFM_PORT` registry variable to an unused port number by entering the following command:

```
db2set DLFM_PORT=port_number
```

where *port\_number* is any unused communications port number. We recommend you also add this entry to your `/etc/services` file so that no other services use this port.

6. **DCE-DFS only:** If you are installing a DLFM server, `dce_login` as the `DLMADMIN` user and run the **dlfm server\_conf** `srv_dlfm` command, where `srv_dlfm` is the service name of the Data Links Manager server. This will automatically create the `dlnnodes.cfg` and `d1fs.cfg` files.  
The `dlnnodes.cfg` file contains a header and entries for each node. The header contains the name of the file, version number, number of nodes, entry number of the Data Links Manager server node, and a checksum. The node entries each contain the node name, port number, and node type (either server or client).  
The `d1fs.cfg` file contains configuration information about the `DLMADMIN` user and the DCE cell.
7. Run the **dlfm setup** command. The **dce\_login\_root** command must be issued before the **dlfm setup** command. **DCE-DFS only:** Run this command on the DLFM server only.
8. **DCE-DFS only:** If you are installing a DLFM *client* on a DCE-DFS node, `dce_login` as the `DLMADMIN` user and run the **dlfm client\_conf** `srv_dlfm node_alias remote_server` command, where:
  - `srv_dlfm` is the service name of the Data Links Manager client on this node.

- *node\_alias* is the alias to be used for this node.
- *remote\_server* is the name of the Data Links Manager server node in this DCE cell.

This will automatically add an entry for this node in the `dlmnodes.cfg` file on the server.

9. **DCE-DFS only:** If you are installing DLFM clients, edit each client's `/etc/services` file. Add two consecutive port numbers for the service name, *srv\_dlfm*, you specified in the previous step. For example, if the service name is `dataclt`, you would add `dataclt` and `dataclt_i` to `/etc/services`.
10. **DCE-DFS only:** On the DLFM server, back up any files under `:/DataLinks`.
11. Create the keytab file as outlined in "Keytab file" on page 46.
12. As root, enter the following commands to start the DMAPP:

```
stop.dfs all
start.dfs all
```

To run the DB2 Data Links Manager Administrator's `db2profile` or `db2cshrc` script file each time this user logs on to the system, add the following entry to the DB2 Data Links Manager Administrator's `.profile` script file:

```
. INSTHOME/sqllib/db2profile (for bash, Bourne, or Korn shell)
source INSTHOME/sqllib/db2cshrc (for C shell)
```

where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator.

When you install DB2 Data Links File Manager using the software bundle feature, the DB2 Product Library (HTML) filesets are not automatically installed. Also, the DB2 Product Messages, other than in English, are not installed. You must install these filesets separately. For more information on how to install these filesets, refer to the DB2 for AIX server installation chapter in the *DB2 for UNIX Quick Beginnings* manual.

---

## Post-installation tasks

Once the `db2setup` utility has finished installing DB2 Data Links Manager on your system, you should ensure that it successfully created and catalogued the `DLFM_DB` database by listing the contents of the System Database Directory. Once you have verified that this database exists, you need to set up a backup and recovery scheme to aid in crash recovery and protect the integrity of your data.

To verify that the `DLFM_DB` database was successfully created and catalogued:

1. Run the `db2profile` or `db2cshrc` script as follows:

```
. INSTHOME/sql1lib/db2profile    (for bash, Bourne or Korn shell)
source INSTHOME/sql1lib/db2cshrc (for C shell)
```

where *INSTHOME* is the home directory of the instance owner.

2. Retrieve the entry for the DLFM\_DB database in the System Database Directory by entering the following command:

```
db2 list database directory
```

This command returns output similar to the following:

```
System Database Directory

Number of entries in the directory = 1

Database 1 entry:

Database alias           = DLFM_DB
Database name           = DLFM_DB
Local database directory = /home/dlfm

Database release level  = 9.00
Comment                 =
Directory entry type    = Indirect (1)
Catalog node number     = 0
```

On the DLFM server node in a DCE-DFS environment, the **db2 list database directory** command returns output similar to the above example. On DLFM client nodes, this command returns output similar to the above example *except* that Directory entry type is Remote. If this database does not exist, see “Creating and Dropping the DB2 Database on the Data Links Server” on page 113.

## Choosing a backup method

Whenever a DATALINK value is inserted into a table with a DATALINK column that is defined for recovery, the corresponding DATALINK files on the Data Links server are scheduled to be backed up to an archive server. Currently, Disk Copy (the default method) and Tivoli Storage Manager are the two options that are supported for file backup to an archive server. Future releases of DB2 Data Links Manager will support other vendors’ backup media and software.

### Disk Copy

When the **backup** command is entered on the DB2 server, it ensures that the linked files in the database are backed up on the Data Links server to the directory specified by the *DLFM\_BACKUP\_DIR\_NAME* registry variable.

The default setting for this registry variable is to set the backup directory to *INSTHOME*/dlfm\_backup in JFS environments, where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator.

In DCE-DFS environments, the default setting for this registry variable is to set the backup directory to *:/dlfm\_backup*. This directory must be a DFS fileset. For more information, see “Performance Enhancements for Disk Backup in the DFS Environment” on page 106.

Use the **db2set** command to change the setting of the *DLFM\_BACKUP\_DIR\_NAME* registry variable.

For example, to set the *DLFM\_BACKUP\_DIR\_NAME* registry variable so that backup files are stored in the */home/backup* directory, enter the following commands:

```
mkdir /home/backup
chown dlfmid.dlfmgroup /home/backup
db2set DLFM_BACKUP_TARGET=LOCAL
db2set DLFM_BACKUP_DIR_NAME=/home/backup
dlfm stop
dlfm start
```

If you choose to change the location specified by the *DLFM\_BACKUP\_DIR\_NAME* registry variable, you must ensure that the directory you specify is *not* located on a file system using a Data Links Filesystem Filter and that the required space is available in the directory you specified for the backup files.

We do not recommend that you specify a directory that is NFS mounted. If you do specify a directory that is NFS mounted, you must ensure that any username with root authority on this file server has read and write access to this mounted directory. The DB2 Data Links Manager Administrator’s username must also exist on the machine from where this directory was NFS mounted and exported.

### **Tivoli Storage Manager**

You can also use Tivoli Storage Manager (TSM) for backing up files that reside on a Data Links server.

To use Tivoli Storage Manager as an archive server:

1. Install Tivoli Storage Manager on the Data Links server. For more information, refer to your Tivoli Storage Manager product documentation.
2. Register the Data Links server client application with the Tivoli Storage Manager server. For more information, refer to your Tivoli Storage Manager product documentation.

3. Add the following environment variables to the Data Links Manager Administrator's db2profile or db2cshrc script files:
 

```

      (for Bash, Bourne, or Korn shell)
      export DSMI_DIR=/usr/lpp/tsm/bin
      export DSMI_CONFIG=${HOME}/tsm/dsm.opt
      export DSMI_LOG=${HOME}/dldump
      export PATH=${PATH}:/usr/lpp/tsm/bin

      (for C shell)
      setenv DSMI_DIR /usr/lpp/tsm/bin
      setenv DSMI_CONFIG ${HOME}/tsm/dsm.opt
      setenv DSMI_LOG ${HOME}/dldump
      setenv PATH=${PATH}:/usr/lpp/tsm/bin
      
```
4. Ensure that the dsm.sys TSM system options file is located in the /usr/lpp/tsm/bin directory.
5. Ensure that the dsm.opt TSM user options file is located in the *INSTHOME*/tsm directory, where *INSTHOME* is the home directory of the Data Links Manager Administrator.
6. Set the *PASSWORDACCESS* option to generate in the /usr/lpp/tsm/bin/dsm.sys Tivoli Storage Manager system options file.
7. Register your TSM password with the generate option *before* starting the Data Links File Manager for the first time. This way, you will not need to provide a password when the Data Links File Manager initiates a connection to the TSM server. For more information, refer to your TSM product documentation.
8. Set the *DLFM\_BACKUP\_TARGET* registry variable to TSM. This activates the Tivoli Storage Manager backup option. The value of *DLFM\_BACKUP\_DIR\_NAME* registry variable is ignored in this case.

**Notes:**

- a. If you change the setting of the *DLFM\_BACKUP\_TARGET* registry variable between TSM and LOCAL at run time, the archived files are not moved to the newly specified archive location. For example, if you start the Data Links File Manager with the *DLMF\_BACKUP\_TARGET* registry value set to TSM, and change the registry value LOCAL, all newly-archived files are stored in the new location on the disk. The files that were previously archived to TSM are not be moved to the new disk location.
- b. To override the default TSM management class there is a new registry variable called *DLFM\_TSM\_MGMTCLASS*. If this registry variable is left unset then the default TSM management class is used.

9. Stop the Data Links File Manager by entering the **dlfm stop** command.
10. Start the Data Links File Manager by entering the **dlfm start** command.

### **XBSA Archive Server**

To use an XBSA storage manager as an archive server:

1. Install an XBSA client on the Data Links server. For more information, refer to your XBSA vendor product documentation.
2. Register the Data Links server client application with the XBSA server. For more information, refer to your XBSA vendor server documentation.
3. Add the required environment variables to the DB2 Data Links Manager Administrator's db2profile or db2cshrc script files. For example, Legato requires the following:
 

```
(for bash, Bourne, or Korn shell)
export NSR_SERVER=fully_qualified_server_hostname

(for C shell)
setenv NSR_SERVER=fully_qualified_server_hostname
```
4. Set the DLFM\_BACKUP\_TARGET registry variable to XBSA and set the DLFM\_BACKUP\_TARGET\_LIBRARY to the fully-qualified shared library supplied by the vendor. The value of DLFM\_BACKUP\_DIR\_NAME registry variable will be ignored in this case. This will activate the XBSA backup option.

**Note:** The library name must also specify which shared object in the library is to be used. For example, with Legato:

```
db2set DLFM_BACKUP_TARGET_LIBRARY=/usr/lib/libxdb2.a(bsashr10.0)
```

Please contact your XBSA vendor for the specific settings required.

5. Stop the Data Links File Manager by entering the **dlfm stop** command.
6. Start the Data Links File Manager by entering the **dlfm start** command.

### **Complete the Data Links Manager Install**

On the Data Links Manager server, perform the following steps to complete the installation:

1. Create the keytab file as described in "Keytab file" on page 46.
2. As root, enter the following commands to start the DMAPP:

```
stop.dfs all
start.dfs all
```



3. Run **dlfm setup** using dce root credentials as follows:
  - a. Login as the Data Links Manager administrator, DLMADMIN.
  - b. As root, issue `dce_login`.
  - c. Enter the **dlfm setup** command.

On the Data Links Manager client, perform the following steps to complete the installation:

1. Create the keytab file as described in “Keytab file” on page 46.
2. As root, enter the following commands to start the DMAPP:

```
stop.dfs all  
start.dfs all
```

You are now ready to set up a DB2 Data Links Manager environment and verify the installation. Go to “Chapter 7. Verifying the Installation on AIX” on page 61 for more information.



---

## Chapter 6. Installing and Configuring DB2 Data Links DFS Client Enabler

This chapter describes how to install and configure a DB2 Data Links DFS Client Enabler, also known as the Data Links File System Cache Manager or DLFS-CM. The DFS Client Enabler is installed on DB2 Universal Database clients and is used to access linked files in DATALINK columns created with READ PERMISSION DB specified.

---

### Installation Considerations and Prerequisites

Please read this information carefully before installing a DB2 Data Links DFS Client Enabler.

#### DCE-DFS Client Version 3.1

You must install a DCE-DFS Client Version 3.1 on any machine that will run a DFS Client Enabler. Use of the DCE slim client is not supported.

#### Should I use the db2setup utility or SMIT?

We strongly recommend that you use the db2setup utility if you are installing a DFS Client Enabler. The db2setup utility performs almost all setup and configuration tasks for you. If you want to install the DFS Client Enabler fileset using SMIT, you will have to set up and configure your system manually.

#### Operating system level

Ensure that you are running AIX Version 4.2.1, Version 4.3.1 Version 4.3.2 or Version 4.3.3. To check the level of the operating system, enter the `oslevel` command.

#### Disk space requirements

The DFS Client Enabler is an optional component that you can select during DB2 Universal Database client or server installation. You cannot install a DFS Client Enabler without installing a DB2 Universal Database client or server product, even though the DFS Client Enabler runs on its own without the need for a DB2 UDB client or server. In addition to the 2 MB of disk space required for the DFS Client Enabler code, you should set aside an additional 40 MB if you are installing the DFS Client Enabler as part of a DB2 Run-Time Client installation. You will need more disk space if you install the DFS Client Enabler as part of a DB2 Administration Client or DB2 server installation. For more information about disk space requirements for DB2 Universal Database products, refer to the *DB2 for UNIX Quick Beginnings* book.

## Synchronize system clocks

Ensure that your system clocks are synchronized and remain synchronized. Synchronization of clocks is essential for the Data Links token expiry interval to work correctly. The token expiry interval is a database configuration parameter. To check the system time and date, enter the **date** command. For more information on synchronizing system clocks, refer to your *AIX Administration Guide*.

---

## Installing a DFS Client Enabler

A DFS Client Enabler can be installed using the `db2setup` utility, which is the recommended installation method, or it can be installed manually using `SMIT`.

To install a DFS Client Enabler using the `db2setup` utility:

1. Follow the instructions in “Installing DB2 Data Links Manager on AIX Using the `db2setup` Utility” on page 43 to start the installation process.
2. When the DB2 Setup Utility window appears, select the **Install** option and press Enter. The Install DB2 V7 window opens.
3. Highlight any DB2 client product and select **Customize**.
4. Select **DFS Client Enabler** from the list of components and press Enter to continue.

To install a DFS Client Enabler manually using `SMIT`:

1. Log in as a user with root authority.
2. Insert and mount the appropriate CD-ROM.
3. Enter the `smit` command.
4. Select **Software Installation and Maintenance** —> **Install and Update Software** —> **Install and Update from LATEST Available Software**.
5. Specify the input device or directory for the installation media, or click **List** to display all input devices or directories.
6. Click **LIST** next to the **SOFTWARE to install** field to display a list of filesets. The Multi-select List window opens.
7. Select the DFS Client Enabler fileset (`db2_07_01.dfsc`) and click **OK**.
8. Click **OK** again to begin the installation process.

After installation finishes, you must run the following command:

```
/usr/lpp/db2_07_01/bin/dlfscl_setup
```

You do *not* have to run this command if you used the `db2setup` utility to install your DFS Client Enabler.

---

## Configuring a DFS Client Enabler

After installing a DFS Client Enabler, you must perform the following configuration tasks:

1. Inform your DCE administrator that the `self` DCE identity for the DFS Client Enabler machine needs to be added to the DCE DLMADMIN group.
2. After completing step 1, log in as a user with root authority on the machine where the DFS Client Enabler is installed and enter the following commands:

```
dcecp -c secval deactivate
```

```
dcecp -c secval activate
```

Performing the `secval` commands usually completes the configuration. However, it may be necessary to reboot the machine as well. If you have problems accessing READ PERMISSION DB files, reboot the machine where the DB2 DFS Client Enabler has just been installed.

To verify that `self` is now in the DLMADMIN DCE group, issue the `klist` DCE command. The DLMADMIN group should be listed under *Local Groups*.



---

## Chapter 7. Verifying the Installation on AIX

This chapter describes how to verify your installation on AIX by configuring a DB2 Data Links Manager environment to control files that are linked to DATALINK columns on a DB2 Universal Database server.

There are six procedures involved in verifying your installation:

- “1. Creating a test environment on the DB2 UDB server”.
- “2. Creating a test environment on the DB2 Data Links server” on page 63.
- “3. Registering the Data Links server with the DB2 UDB database” on page 68.
- “4. Verifying the sample file is controlled by DLFF” on page 69.
- “5. Verifying the sample file is accessible” on page 70.
- “6. Viewing the sample file” on page 72.

Troubleshooting information can be found in “Troubleshooting the configuration on AIX” on page 72. Workarounds for known issues in NFS environments can be found in “Workarounds in NFS environments” on page 73.

---

### 1. Creating a test environment on the DB2 UDB server

To create a test environment on the DB2 UDB server:

1. Log on to the system as a user with root authority.
2. Create an instance on the DB2 server using the **db2icrt** command. This instance will contain a database where tables containing columns of the DATALINK data type will reside. For more information on creating instances, refer to the *Administration Guide: Planning*.

In our example, we will create an instance called VALIDATE by entering the following commands:

```
mkggroup testers
mkuser pgrp='testers' groups='testers' home='/home/validate' validate
/usr/lpp/db2_07_01/instance/db2icrt -u validate validate
```

3. Log out.
4. Log on to the system with a valid DB2 user ID that has System Administrative (SYSADM) authority on the VALIDATE instance that you created. By default, any user that belongs to the primary group of the instance owner has SYSADM authority on an instance. For more information, refer to your server's *Quick Beginnings* manual.

5. Ensure that the VALIDATE instance is the current instance by entering the following command:

```
db2 get instance
```

This command should return the following output:

```
The current database manager instance is: VALIDATE
```

If you do not receive this output, enter the following commands:

```
set DB2INSTANCE=VALIDATE
db2 get instance
```

6. Set the DATALINKS database manager configuration parameter to *YES* in the VALIDATE instance's configuration file by entering the following command:

```
db2 update dbm cfg using datalinks yes
```

To disable DB2 Data Links Manager functionality on your DB2 server, set the DATALINKS database manager configuration parameter to *no*.

7. Start the VALIDATE instance by entering the **db2start** command.

**Note:** If you change a setting in an instance's database manager configuration file, you must ensure that you stop and restart the instance (using the **db2stop** and **db2start** commands) for the changes to take effect. In our example, we did not start the VALIDATE instance, so we only issued the **db2start** command. For more information, refer to the *Administration Guide*.

8. Create a database using the **db2 create database** command. This database will contain a table using the DATALINK data type. For more information on the **db2 create database** command, refer to the *Command Reference*.

For the example, create a database called STAFF by entering the following command:

```
db2 create database staff
```

9. Connect to the STAFF database by entering the following command:

```
db2 connect to staff
```

10. Create a table called EMPLOYEE, in the STAFF database that you just created, that has a column defined with a DATALINK data type by entering the following command:

```
db2 "create table employee (id int, fname varchar(30), lname varchar(30),
picture datalink linktype url file link control integrity all
read permission db write permission blocked recovery yes on
unlink restore)"
```

11. Terminate all connections to this database by entering the following command:

```
db2 connect reset
```



12. Log out.

---

## 2. Creating a test environment on the DB2 Data Links server

After creating a test environment on the DB2 UDB server, we must create a test environment on the DB2 Data Links server.

There are four sub-tasks involved in creating the test environment on the Data Links server:

- “Preparing a File System”.
- “Registering the file system with the Data Links File Filter” on page 65.
- “Registering the DB2 UDB database” on page 67.
- “Creating a sample file” on page 67.

### Preparing a File System

You can choose to create a Journaled File System (JFS) or a DCE-DFS file system to test your Data Links Manager installation.

#### Creating a Journaled File System (JFS) on the DB2 Data Links server:

To create a JFS on the DB2 Data Links server:

1. Log in as a user with root authority.
2. Prepare a JFS to use a Data Links Filesystem Filter as follows:
  - a. Create a Journaled File System (JFS) using the **smitt manfs** command and set the *Mount AUTOMATICALLY at system restart?* option to *no*. You can also use an existing JFS file system. For more information, refer to your *AIX Administration Guide*.
  - b. Open the `/etc/filesystems` file, record the current setting for the *vfs* entry, and edit its stanza such that:

```
mount      = false
vfs        = dlfs
```
  - c. Add the following attribute to the stanza of the `/etc/filesystems` file:

```
nodename = -
```

**Note:** You must ensure that there are no blank spaces after the null character (-) for this entry.
  - d. Edit the stanza for the `/etc/filesystems` file for your file system and set the *Basefs* parameter, in the options attribute, to the value that you recorded for the *vfs* entry in step 2b. For example, the entry would be similar to the following:

```
options = rw,Basefs=jfs
```
3. Modify the properties of a file system so that it comes under the control of the Data Links Filesystem Filter, and mount it by entering the following command:

```
/usr/lpp/db2_07_01/instance/dlffmsmd dlfm_mountpoint
```

where *dlfm\_mountpoint* is the mount point of the JFS file system you are using.

To continue with the example, enter the following command:

```
/usr/lpp/db2_07_01/instance/dlffmsmd /test
```

4. Log out.

### Creating a DCE-DFS file system on the DB2 Data Links Server

To create a DCE-DFS file system on the DB2 Data Links server:

1. Log in as root and *dce\_login* as a DFS administrator.
2. Create a logical volume by entering the following command:

```
mklv -y aggregate_name -t aggregate_type lfs rootvg 1
```

where *aggregate\_name* represents the name of the logical volume, *aggregate\_type* represents the aggregate type, *rootvg* represents the logical volume type, and 1 represents the number of logical partitions.

3. Create an aggregate in the logical volume by entering the following command:

```
newaggr -aggregate /dev/dmtest -block 8192 -frag 1024 -overwrite
```

where */dev/dmtest* represents the aggregate name, given as a device file. Note that if this aggregate name already exists, the *-overwrite* option will delete all data in the aggregate.

4. Initialize and export the aggregate by entering the following command:

```
mkdfsdfs -d /dev/dmtest -n dmtest
```

where */dev/dmtest* is the device name for the aggregate.

5. Create the filesets in the aggregate by entering the following command:

```
mkdfsdfs -f dmtest1.ft -m :/dmtest/dmtest1 -n dmtest
```

where *:/dmtest/dmtest1* represents the mountpoint in the DFS namespace and *dmtest* represents the name of the aggregate.

**Note:** You must have a valid *dce\_login* and the authority to create directories in the DFS namespace.

6. Edit the */opt/dcelocal/var/dfs/dfstab* file and change the entry for the aggregate you just created from *lfs* to *dmlfs*. For example, this file will have entries for each aggregate similar to the following:

```
# blkdev agname agtype aggid [UFS fsid]
/dev/aggrdev1 aggrname1 lfs 1
/dev/aggrdev2 aggrname2 lfs 2
```

Change `aggtype` to `dmlfs` for all aggregates that are to be brought under Data Links control. Save and close the file.

**Notes:**

- a. When you create an aggregate using SMIT, you can also specify an aggregate id. However, the default id is the next available higher integer value.
  - b. If the aggregate has already been exported, you must unexport it before performing this and the following step.
7. Enable DFS SMT on the aggregate by running the following command:
- ```
dmaggr -aggregate name [{-on | -off}] [{-needapp | -noneedapp}] [-help]
```

We recommend you always use the `-needapp` option when running this command.

8. Export the aggregate so that it can be controlled by the Data Links Filesystem Filter.
9. Register a file system that is under the control of a Data Links Filesystem Filter by entering the following command:

```
dlfm add_prefix prefix_path
```

where *prefix\_path* is the location of the file system that is under the control of a DLFF.

10. To register a DCE-DFS fileset, you can either use the `dlfm add_prefix /test` command or you can use one of the following variations:

```
dlfm add_prefix for dfs rwpath prefix_path
```

This command specifies a read-only path for DCE-DFS.

```
dlfm add_prefix for dfs rwpath prefix_path localpath local_mount_point
```

where *local\_mount\_point* represents the native file system mount point of the prefix. The native file system mount point can be used to improve the performance of the archival and retrieval of files. For more information, see “Performance Enhancements for Disk Backup in the DFS Environment” on page 106.

**Note:** You must issue all `dlfm add_prefix` commands from the node on which the DFS fileset resides. After issuing this command, you must issue a `dlfm start` command on the same node.

## Registering the file system with the Data Links File Filter

To register the `/test` filesystem with the DLFF:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Run the `db2profile` or `db2cshrc` script as follows:

```
. INSTHOME/sqllib/db2profile    (for bash, Bourne or Korn shell)
source INSTHOME/sqllib/db2cshrc (for C shell)
```

where *INSTHOME* is the home directory of the instance owner.

3. Start the Data Links File Manager by entering the **dlfm start** command.
4. Ensure that the Data Links File Manager started successfully by entering the **dlfm see** command.

If the Data Links File Manager back-end processes started successfully and are running, you will receive output similar to the following:

```

      PID   PPID   PGID   RUSER   EUSER   ETIME  COMMAND
      7624  49852  55994   dl_fm   dl_fm   02:44  dl_fm
      49852     1  55994   dl_fm   dl_fm   02:44  dl_fm
      ⋮
      56510 49852  55994   dl_fm   root    02:44  dl_fm_chownd
```

5. Ensure that you successfully mounted the Journaled File System that is under the control of a DLFF by entering the following command:

```
lsfs -v dlfs
```

For the example, this command returns output similar to the following:

| Name      | Nodename | Mount Pt | VFS  | Size | Options       |
|-----------|----------|----------|------|------|---------------|
| /dev/d1lv | -        | /test    | dlfs | --   | rw,Basefs=jfs |
| /dev/lv04 | -        | /dlinks2 | dlfs | --   | rw,Basefs=jfs |

To verify that a DFS file server is under the control of a DLFF, enter the following command:

```
dfsexport | grep dmlfs
```

The output from this command should be similar to the following:

```
/dev/dlfs_test dlfs_test dmlfs 4
```

6. Register a file system that is under the control of a Data Links Filesystem Filter by entering the following command:

```
dlfm add_prefix prefix_path
```

where *prefix\_path* is the location of the file system that is under the control of a DLFF.

For example, register the Data Links server to use the Data Links Filesystem Filter on the test file system by entering the following command:

```
dlfm add_prefix /test
```

To update an existing prefix, enter one of the following commands:

```
dlfm update_prefix prefix_path //JFS
dlfm update_prefix prefix_path for dfs localpath local_mount_point //DFS
```

## Registering the DB2 UDB database

To register a new database with the Data Links File Manager:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Register the remote DB2 UDB database where the DATALINK data type was defined by entering the following command:

```
dlfm add_db database instance hostname
```

where:

- *database* is the database alias name of the remote database.
- *instance* is the instance where *database* resides. If you are registering a Windows NT instance on an AIX or Solaris Data Links Manager, *instance* must be in uppercase.
- *hostname* is the fully qualified hostname of the DB2 UDB server where *database* resides.

The following command will register a database called STAFF, which resides in the VALIDATE instance on a DB2 UDB server with a fully qualified hostname of db2server.services.com:

```
dlfm add_db staff validate db2server.services.com
```

To list the registered database, enter the following command:

```
dlfm list registered databases
```

Do not specify the DLFM\_DB when you run this command. The DLFM\_DB is a local database that is used to keep track of files that are under the control of the Data Links File Manager.

3. Log out.

## Creating a sample file

To create a sample file:

1. Log on to the system as any user that is *not* a DB2 Data Links Manager Administrator. In DCE-DFS environments, use your dce\_login.
2. Create a directory on the file system that is under the control of a Data Links Filesystem Filter (DLFF), to store files to be controlled by a DB2 server, by entering the following command:

```
mkdir filesystem_name/directory_name
```

where:

- *filesystem\_name* is the name of the file system that is under the control of a DLFF.
- *directory\_name* is the name of the directory that you created.

The DB2 Data Links Manager Administrator should never be the owner of any files or directories which are in a file system under the control of a

Data Links Filesystem Filter. For example, the following command will create the directory called pictures on the file system /test:

```
mkdir /test/pictures
```

3. Change the permissions for the pictures directory that you just created so that any user can create a file in it by entering the following command:

```
chmod 777 /test/pictures
```

4. Create a file called psmith.bmp in the /test/pictures directory, to be managed by the Data Links File Manager, by entering the following command:

```
echo "This is a picture of Paul Smith." > /test/pictures/psmith.bmp
```

5. Log out.

The sample file psmith.bmp is a text file, not a bitmap as the .bmp extension implies. For the purpose of verifying your installation, this file represents an employee's picture that was inserted into a table that was defined with the DATALINKS data type.

---

### 3. Registering the Data Links server with the DB2 UDB database

Register the Data Links server with the remote DB2 UDB database where the DATALINK data type was defined earlier:

1. Log on to the system with a valid DB2 user ID that has System Administrative (SYSADM) authority on the VALIDATE instance that you created. By default, any user that belongs to the primary group of the instance owner has SYSADM authority on an instance. For more information, refer to your server's *Quick Beginnings* manual.
2. Run the db2profile or db2cshrc script as follows:

```
. $INSTHOME/sql1lib/db2profile    (for bash, Bourne or Korn shell)
source $INSTHOME/sql1lib/db2cshrc (for C shell)
```

where *INSTHOME* is the home directory of the instance owner.

3. Start the VALIDATE instance by entering the **db2start** command.
4. Register a Data Links server that will control the files that are linked by a DATALINK data type by entering one of the following commands:

```
db2 "add datalinks manager for database database_alias==>
    using node hostname port port_number" //JFS
-OR-
db2 "add datalinks manager for database database_alias using==>
    cell cell-name dlinstance instance-name" //DCĒ-DFS
```

where:

- *database\_alias* is the database alias name of the database.
- *hostname* is the fully qualified hostname of the Data Links server.

- *port\_number* is the port number that you have reserved for communications between the Data Links server and the DB2 server. You specified this port number during the installation of DB2 Data Links Manager.
- *cell-name* is the name of the DCE cell where Data Links has been installed.
- *instance-name* is the name of the DLMADMIN instance for this DCE cell.

For the JFS example, enter the following command:

```
db2 "add datalinks manager for database staff using==>
node dlmsvr.services.com port 50100"
```

For the DCE-DFS example, enter the following command:

```
db2 "add datalinks manager for database staff using==>
cell services.com dlminstance dlmadmin"
```

5. Connect to the STAFF database by entering the following command:

```
db2 connect to staff
```

6. Insert an entry into the EMPLOYEE table by entering the following command:

```
db2 "insert into employee values (001,'Paul','Smith',==>
dlvalue('http://hostname/controlled_file'))"
```

where:

- *hostname* is the fully qualified hostname of the Data Links server.
- *controlled\_file* is the full pathname of the file that you want to control on the Data Links server.

In DCE-DFS environments, replace the URL used in these examples with `dfs://.../cellname/fs/...`. In our example, enter the following command:

```
db2 "insert into employee values (001,'Paul','Smith',==>
dlvalue('dfs://.../services.com/test/pictures/psmith.bmp'))"
```

7. Log out.

---

#### 4. Verifying the sample file is controlled by DLFF

To verify that the `psmith.bmp` sample file we created earlier is under the control of the Data Links File Filter (in DCE-DFS environments, perform these steps from a client node):

1. Log on to the system as any user *except* as a user with root authority or as the DB2 Data Links Manager Administrator. In DCE-DFS environments, log in with your DCE user ID.
2. Verify that the `psmith.bmp` file is now controlled by the Data Links File Manager by entering the following command:

```
cat controlled_file
```

where *controlled\_file* is the full pathname of the file that is controlled by the Data Links server.

For the example, enter the following command:

```
cat /test/pictures/psmith.bmp
```

**Note:** We are using the **cat** command here because *psmith.bmp* is really a text file. Running the **cat** command on a true binary file would return garbage output.

If this file is being controlled by the Data Links File Manager, you will receive the following error:

```
Cannot open /test/pictures/psmith.bmp
```

3. Log out.

---

## 5. Verifying the sample file is accessible

The next step is to verify that the *psmith.bmp* sample file can be accessed while it is under the control of the Data Links File Manager. To do this, you first need to generate an *access token* on the DB2 Universal Database server.

In DCE-DFS environments, you should perform these steps from a machine where the DFS Client Enabler is installed.

1. Log on to the system with a valid DB2 user ID that has System Administrative (SYSADM) authority on the VALIDATE instance that you created. By default, any user that belongs to the primary group of the instance owner has SYSADM authority on an instance. For more information, refer to your server's *Quick Beginnings* manual.
2. Run the *db2profile* or *db2cshrc* script as follows:

```
. INSTHOME/sql1lib/db2profile    (for bash, Bourne or Korn shell)
source INSTHOME/sql1lib/db2cshrc (for C shell)
```

where *INSTHOME* is the home directory of the instance owner.

3. Start the VALIDATE instance by entering the **db2start** command.
4. Connect to the STAFF database by entering the following command:

```
db2 connect to staff
```
5. Select the controlled file for update by issuing an SQL SELECT statement. For more information, refer to the *SQL Reference*.

For our example, enter the following command:

```
db2 "select dlurlpath(picture) from employee where lname = 'Smith'"
```

This command returns the full pathname with an access token of the form:

```
controlled_filepath/access_token;controlled_filename
```



where:

- *controlled\_filepath* is the fully qualified path of the controlled file
- *access\_token* is an encrypted key assigned by the database manager.
- *controlled\_filename* is the name of the file that is under the control of a Data Links Filesystem Filter.

For example, you will receive an access token that is similar to the following:

```
/test/pictures/HVJ5NXGC0WQ.I5KKB6;psmith.bmp
```

This access token will be used to read this file on the Data Links server.

**Note:** This access token is only valid for 60 seconds. This means that once you enter this command, you have only 60 seconds to complete the remaining steps in this section (or edit any Data Links controlled file). You can change the default expiration time by changing the *DL\_EXPINT* database configuration parameter.

To change the default expiration time for an access token to 10 minutes (the value is entered in seconds), enter the following commands:

```
db2 update db cfg for staff using dl_expint 600
db2 terminate
db2 connect to database staff
```

If you change a setting for any database configuration parameter, you must always reconnect to the database for the changes to take effect. For more information on database configuration file parameters, refer to the *Administration Guide*.

## 6. Log out.

If you did not receive an error, you have access to this file and you have installed and configured DB2 Data Links Manager correctly. For information on commands that are used in the day-to-day operations of a DB2 Data Links Manager environment, go to “Chapter 10. Working with the Data Links File Manager” on page 101.

If you received a error, go to “Troubleshooting the configuration on AIX” on page 72.

For more information on the SQL commands used to verify the installation, refer to the *SQL Reference*.

---

## 6. Viewing the sample file

Finally, you will use this access token to view the `psmith.bmp` file.

In DCE-DFS environments, you should perform these steps from a machine where the DFS Client Enabler is installed.

1. Log on to the system as any user *except* as a user with root authority or as the DB2 Data Links Manager Administrator. In DCE-DFS environments, log in with your DCE user ID.
2. Verify that you can access the file that is under the control of the Data Links File Manager.

Enter the following command:

```
cat "/test/pictures/access_token;psmith.bmp"
```

where `access_token` is the encrypted key that you recorded in the previous step.

You should receive the following output from this command:

```
"This is a picture of Paul Smith."
```

If you did not receive an error, you have access to this file and you have installed and configured DB2 Data Links Manager correctly. For information on commands that are used in the day-to-day operations of a DB2 Data Links Manager environment, go to “Chapter 10. Working with the Data Links File Manager” on page 101.

If you received a error, go to “Troubleshooting the configuration on AIX”.

For more information on the SQL commands used to verify the installation, refer to the *SQL Reference*.

---

## Troubleshooting the configuration on AIX

If you received an error when you attempted to access the `psmith.bmp` test file, use the following checklist and go through the configuration instructions again, verifying each item as you go:

### At the Data Links server:

- Ensure that you correctly registered the file system that is being used to store any linked files.
- In native JFS environments, ensure that the file system that is being used to store linked files is mounted as `d1fs`.
- In DCE-DFS environments, ensure that the DFS Client is running and `/...` is mounted.
- Ensure that the DB2 database was registered correctly.

- Ensure that the directory where the linked file is stored was *not* created by the DB2 Data Links Manager Administrator username or a username with root authority.
- Ensure that the Data Links File Manager was started by entering the **dlfm see** command.

**At the DB2 server:**

- The *DATALINKS* database manager configuration parameter is set to *YES*.
- The Data Links Manager was registered correctly using the **db2 add datalinks manager** command.
- In DCE-DFS environments, ensure that the DFS Client is running and */...* is mounted.

**At the DFS Client Enabler (in DCE-DFS environments only)**

Ensure that */...* is mounted as *d1fscm* on the machine where the DFS Client Enabler is installed.

For information on error messages on the DB2 Data Links Manager, see “Appendix A. DB2 Data Links Manager Errors and User Responses” on page 127. For information on error messages on the DB2 server, refer to the *Message Reference*.

## Workarounds in NFS environments

This section describes workarounds to known problems when running DB2 Data Links Manager for AIX in NFS environments. These problems are NFS-specific and have nothing to do with DB2 Data Links Manager or DB2 Universal Database.

**Access tokens may not expire as expected**

If you are using an NFS client to access files, you may find that the access token does not expire appropriately. This can be due to caching done by the NFS client. Using file names greater than 12 characters may solve this problem.

**Client-side file permissions do not reflect changes after a file is linked**

NFS client-side file permissions may not immediately reflect changes after a file is linked on the server with READ PERMISSION DB. This delay is due to attribute caching done by NFS. As a result, file permissions may *appear* to be different on the client. These cached attributes have an expiry time limit after which they are automatically invalidated. After expiration, file attributes are obtained from the server on the next access.

**File appears to be readable without a valid access token**

When a file is first accessed by a user from a NFS client, the directory

name lookup entry is cached in NFS. Subsequent lookups of the file by the same user from the client are serviced from this cache. If the file is then linked on the server, that user will still be able to open the file with READ PERMISSION DB, and the newly linked file may *appear* to be readable without a valid access token. However, since the file has been linked on the server, the user who accessed the linked file via the cache will not be able to modify, rename or remove it in any way.

On AIX 4.2, you can prevent the second and third problems by using the `noac` option when you are remotely mounting your Data Links File System via NFS:

```
mount -o noac yourserver:/datalink /datalink
```

This workaround does not appear to work on AIX 4.3.x. To ensure the directory name lookup cache in NFS is refreshed on these systems after linking files, you might want to perform an operation that updates the directory modification timestamp for the parent directory of the linked files. For example, you might use the **touch** command to create a zero-length file in the parent directory immediately after linking files.

---

## **Part 4. Installing and Configuring DB2 Data Links Manager for Solaris**



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## Chapter 8. Installing and Configuring DB2 Data Links Manager for Solaris

This chapter describes how to install DB2 Data Links Manager for the Solaris Operating Environment.

---

### Before You Begin

Read this information carefully before installing DB2 Data Links Manager.

#### Supported operating systems, kernel levels and kernel architectures

Ensure that you are running Solaris Version 2.6 or Solaris 7 with a 32-bit kernel. Kernel architectures sun4d and sun4m are not supported.

To check the operating system level, enter the **uname -r** command. To check the kernel level, enter the **isainfo -v** command. The **isainfo** command should return 32-bit sparc applications.

To boot your system with a 32-bit kernel, enter the **setenv boot-file kernel/unix** command at the **OK** prompt. Then, enter the **boot** command to start the boot process.

#### Disk space requirements

Ensure that there is at least 85 MB of free disk space in the `/opt/IBMDB2` directory. To check available free disk space, enter the **df -k /opt/IBMDB2** command.

#### Disk space requirements for DLMADMIN user

Ensure that there is at least 70 MB of free disk space in the home directory where the DB2 Data Links Manager Administrator's home directory will reside. To check available free disk space, enter the **df -k *INSTHOME*** command, where *INSTHOME* is the home directory of the DLMADMIN user.

#### Memory requirements

Ensure that there is at least 256 MB of memory available to your system. To check available memory, enter the **/usr/bin/dmesg | grep -i "avail mem"** command.

#### Updating kernel parameters

Before installing your DB2 for Solaris product using the **db2setup** utility or the **db2\_install** and **pkgadd** commands, you may need to update your system's kernel configuration parameters. The values in Table 1 on page 78 are the recommended Solaris kernel configuration parameters.

**Note:** You must reboot your machine after updating any kernel configuration parameters.

Table 1. Solaris Kernel Configuration Parameters (Recommended Values)

| Kernel Parameter      | Physical Memory |               |               |              |
|-----------------------|-----------------|---------------|---------------|--------------|
|                       | 64MB - 128MB    | 128MB - 256MB | 256MB - 512MB | 512MB+       |
| msgsys:msginfo_msgmax | 65535(1)        | 65535(1)      | 65535(1)      | 65535(1)     |
| msgsys:msginfo_msgmnb | 65535(1)        | 65535(1)      | 65535(1)      | 65535(1)     |
| msgsys:msginfo_msgmap | 130             | 258           | 258           | 258          |
| msgsys:msginfo_msgmni | 128             | 256           | 256           | 256          |
| msgsys:msginfo_msgssz | 16              | 16            | 16            | 16           |
| msgsys:msginfo_msgtql | 256             | 512           | 1024          | 1024         |
| msgsys:msginfo_msgseg | 8192            | 16384         | 32767(2)      | 32767(2)     |
| shmsys:shminfo_shmmax | 67108864        | 134217728(2)  | 268435456(3)  | 536870912(3) |
| shmsys:shminfo_shmseg | 50              | 50            | 50            | 50           |
| shmsys:shminfo_shmmni | 300             | 300           | 300           | 300          |
| semsys:seminfo_semgni | 128             | 256           | 512           | 1024         |
| semsys:seminfo_semmap | 130             | 258           | 514           | 1026         |
| semsys:seminfo_semmns | 256             | 512           | 1024          | 2048         |
| semsys:seminfo_semmnu | 256             | 512           | 1024          | 2048         |
| semsys:seminfo_semume | 50              | 50            | 50            | 50           |
| dlfsdrv:glob_mod_pri  | 0x100800        | 0x100800      | 0x100800      | 0x100800     |
| dlfsdrv:glob_mesg_pri | 0xff            | 0xff          | 0xff          | 0xff         |
| dlfsdrv:ConfigDlfsUid | 9727            | 9727          | 9727          | 9727         |

### Version levels of DB2 Data Links and DB2 Universal Database

DB2 Universal Database can be any combination of Version 6.1 and Version 7.1. For example, DB2 UDB can be at Version 6.1 or Version 7.1 and Data Links Manager can be at Version 7.1. To check the version of DB2 that resides on a workstation, enter the **db2level** command.

### DLMADMIN username

During installation, you are given the option to create the DB2 Data Links Manager Administrator (DLMADMIN) user. These installation instructions assume that you select this option.

When you create the DLMADMIN username, the `db2setup` utility adds this user with the username `dlfm` and the password `ibmdb2`. You can accept these default values, specify an existing username, or create a different username by changing the default values. For security reasons, we recommend that you specify your own username and password because the default values are used in every DB2 Data Links installation and therefore are well-known. The DLMADMIN username is also used for the Data Links Manager instance.



If your machine is an NIS client, you will need to specify your own existing username. The existing username you specify:

- Must *not* have its home directory reside on a file system that uses a Data Links Filesystem Filter.
- Must have a username that is eight characters or less.
- Must *not* be a user with root authority.

To create a username for the DB2 Data Links Manager Administrator (DLMADMIN):

1. Log in as a user with root authority.
2. Create the group for the DB2 Data Links Administrator (for example, `d1fmgrp`) and username (for example, `d1fm`), using the `/home/d1fm` directory as the home directory of the DLMADMIN. Enter the following commands:

```
groupadd d1fmgrp
useradd -g d1fmgrp -d /home/d1fm d1fm
```

3. Assign a password to this username by entering the `passwd username` command, where *username* is the account that you created.

The DB2 Data Links Manager Administrator (DLMADMIN) should never own files or directories on a file system that is under the control of a Data Links Filesystem Filter. The DLMADMIN should only be used to administer the Data Links File Manager.

If you create a different username by changing the default values, you must ensure that the username you specify is eight characters or less.

### **TCP/IP port number**

You must have a TCP/IP port available for use by the Data Links File Manager. By default, the `db2setup` utility generates a value for you. You can use this value or provide your own. You will need to know this port number to verify the installation.

If you want to specify your own port number, review the TCP/IP ports that are already in use on a machine by opening the `/etc/services` file. You will need to specify this port during the installation.

Once you have selected a TCP/IP port number for use by the DLFM, the value should not be changed.

### **Determine fully qualified hostnames**

You must resolve the fully qualified hostnames of your DB2 Data Links and DB2 UDB servers. You will need to know these hostnames to verify the installation.

When connecting to the DB2 Data Links File Manager, the DB2 UDB server sends the following information to the DLFM:

- Database name.
- Instance name.
- Hostname.

The DLFM then verifies this information to decide if a connection from this particular DB2 server should be allowed. The subroutine that obtains hostname information on the DB2 server, `gethostbyname`, looks for `/etc/resolv.conf`. If this file exists, the subroutine queries the domain name server. If the request to the DNS times out, the `gethostbyname` routine checks the local `/etc/hosts` file. To connect successfully to the DLFM, the name registered on the DLFM must be the one which is obtained by the `gethostbyname` routine on the DB2 UDB server.

To resolve the hostnames of your DB2 Data Links and DB2 UDB servers, enter the `grep 'hostname' /etc/hosts` command on each system. This command should return output similar to the following:

```
9.11.302.341 dlmservr dlmservr.services.com loghost
```

where `dlmservr.services.com` is your fully qualified hostname name.

Repeat these steps on each DB2 Data Links and DB2 UDB server.

### Synchronize system clocks

Ensure that the system clocks on the Data Links server and the remote DB2 server are synchronized and remain synchronized.

Synchronization of clocks is essential for the Data Links token expiry interval to work correctly. The token expiry interval is a database configuration parameter. To check the system time and date, enter the `date` command. For more information on synchronizing system clocks, refer to your *Solaris Administration Guide*.

---

## Installing DB2 Data Links Manager for Solaris using the `db2setup` utility

After updating your Solaris kernel configuration parameters, you can begin installing DB2 Data Links Manager. The `db2setup` utility is the recommended method for installing DB2 Data Links Manager for Solaris. If you prefer not to use the `db2setup` utility, see “Manually installing Data Links Manager for Solaris” on page 81.

To install the DB2 Data Links Manager for Solaris using the `db2setup` utility:

1. Log in as a user with root authority.
2. Insert and mount your DB2 product CD-ROM. For information on how to mount a CD-ROM, see the *DB2 for UNIX Quick Beginnings* manual.

3. Change to the directory where the CD-ROM is mounted by entering the **cd /cdrom** command where **cdrom** is the mount point of your product CD-ROM.
4. Enter the **./db2setup** command. The DB2 Setup Utility window opens.
5. Select **Install** and press Enter. The Install DB2 V7 window opens.
6. Select the products you want and are licensed to install. Press Tab to move between available options and fields. Press Enter to select or deselect an option. Selected options are denoted by an asterisk.

When you select to install a DB2 product, you can choose the product's **Customize** option to view and change the components that will be installed.

Select **OK** to continue the installation process or **Cancel** to go back to a previous window. Select **Help** for more information or assistance during the installation of any DB2 product.

When installation is complete, DB2 Data Links Manager will be installed in the `/opt/IBMDB2/V7.1/` directory.

You can use the `db2setup` utility at any time to create another instance or install additional DB2 products or components. Log in as a user with root authority and run the **./db2setup** command from your DB2 product CD-ROM.

---

## Manually installing Data Links Manager for Solaris

To install DB2 Data Links Manager for Solaris using the **db2\_install** command:

1. Log in as a user with root authority.
2. Insert and mount the appropriate CD-ROM.
3. If the Volume Manager is *not* running on your system, enter the following commands to mount the CD-ROM:

```
mkdir -p /cdrom/unnamed_cdrom
mount -F hsfs -o ro /dev/dsk/c0t6d0s2 /cdrom/unnamed_cdrom
```

where `/cdrom/unnamed_cdrom` represents the CD-ROM mount directory and `/dev/dsk/c0t6d0s2` represents the CD-ROM drive device.

**Note:** If you are mounting the CD-ROM drive from a remote system using NFS, the CD-ROM file system on the remote machine must be exported with root access. You must also mount that file system with root access on the local machine.

If the Volume Manager (`vold`) *is* running on your system, the CD-ROM is automatically mounted as:

```
/cdrom/unnamed_cdrom
```

4. Run the **db2\_install** command as follows:

```
/cdrom/unnamed_cdrom/db2_install
```

The **db2\_install** command prompts for one or more of the following to be installed, and for the base directory where the product files are to be installed. The products are listed by keyword and product description.

#### **DB2.DLNK**

DB2 Data Links Manager for Solaris

The command displays the following prompt: Specify one or more of the keywords separated by spaces.

5. Type the keyword of the product to be installed when prompted.
6. Type the name of the base directory when prompted. The default base directory is `/opt`.

If the default base directory is used, all files will be installed in the `/opt/IBMdb2/V7.1` directory.

7. Enter Yes to start the product installation.

---

## **Post-Installation Tasks for Manual Installations**

After manually installing Data Links Manager using SMIT, you must perform several additional configuration tasks. If you used the `db2setup` utility to install your product all of these tasks were performed for you.

To complete your manual DB2 Data Links Manager installation:

1. As a user with root authority on the DLFM server, run the `/opt/IBMdb2/V7.1/instance/dlfmcr` command to create a DLFM instance.
2. Set the `DLFM_PORT` registry variable to a an unused port number by entering the following command:

```
db2set DLFM_PORT=port_number
```

where *port\_number* is any unused communications port number. We recommend you also add this entry to your `/etc/services` file so that no other services use this port.

3. Run the **dlfm setup** command.

To run the DB2 Data Links Manager Administrator's `db2profile` or `db2cshrc` script file each time this user logs on to the system, add the following entry to the DB2 Data Links Manager Administrator's `.profile` script file:

```
. INSTHOME/sqllib/db2profile (for bash, Bourne, or Korn shell)  
source INSTHOME/sqllib/db2cshrc (for C shell)
```

where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator.

When you manually install DB2 Data Links File Manager, the DB2 Product Library (HTML) filesets are not automatically installed. Also, the DB2 Product Messages, other than in English, are not installed. You must install these filesets separately. For more information on how to install these filesets, refer to the DB2 for Solaris server installation chapter in the *Quick Beginnings for UNIX* manual.

Once the `db2setup` utility has finished installing DB2 Data Links Manager on your system, you should ensure that it successfully created and catalogued the `DLFM_DB` database by listing the contents of the System Database Directory. Once you have verified that this database exists, you need to set up a backup and recovery scheme to aid in crash recovery and protect the integrity of your data.

To verify that the `DLFM_DB` database was successfully created and catalogued:

1. Run the `db2profile` or `db2cshrc` script as follows:  
    `. INSTHOME/sql1lib/db2profile` (for bash, Bourne or Korn shell)  
    `source INSTHOME/sql1lib/db2cshrc` (for C shell)

where *INSTHOME* is the home directory of the instance owner.

2. Retrieve the entry for the `DLFM_DB` database in the System Database Directory by entering the following command:  
    `db2 list database directory`

This command should return output similar to the following:

```
System Database Directory

Number of entries in the directory = 1

Database 1 entry:

Database alias           = DLFM_DB
Database name           = DLFM_DB
Local database directory = /home/dlfm

Database release level  = 9.00
Comment                 =
Directory entry type    = Indirect (1)
Catalog node number     = 0
```

If this database does not exist, see “Creating and Dropping the DB2 Database on the Data Links Server” on page 113.

## Choosing a backup method

Whenever a DATALINK value is inserted into a table with a DATALINK column that is defined for recovery, the corresponding DATALINK files on the Data Links server are scheduled to be backed up to an archive server. Currently, disk copy (the default method) and Tivoli Storage Manager are the two options that are supported for file backup to an archive server. Future releases of DB2 Data Links Manager will support other vendors' backup media and software.

### Disk Copy

When the **backup** command is entered on the DB2 server, it ensures that the linked files in the database are backed up on the Data Links server to the directory specified by the *DLFM\_BACKUP\_DIR\_NAME* registry variable.

The default setting for this registry variable is to set the backup directory to *INSTHOME/dl\_fm\_backup* in UFS environments, where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator.

Use the **db2set** command to change the setting of the *DLFM\_BACKUP\_DIR\_NAME* registry variable.

For example, to set the *DLFM\_BACKUP\_DIR\_NAME* registry variable so that backup files are stored in the */home/backup* directory, enter the following commands:

```
mkdir /home/backup
chown dlfmid.dlfmgroup /home/backup
db2set DLFM_BACKUP_TARGET=LOCAL
db2set DLFM_BACKUP_DIR_NAME=/home/backup
dlfm stop
dlfm start
```

If you choose to change the location specified by the *DLFM\_BACKUP\_DIR\_NAME* registry variable, you must ensure that the directory you specify is *not* located on a file system using a Data Links Filesystem Filter and that the required space is available in the directory you specified for the backup files.

We do not recommend that you specify a directory that is NFS mounted. If you do specify a directory that is NFS mounted, you must ensure that any username with *root* authority on this file server has read and write access to this mounted directory. The DB2 Data Links Manager Administrator's username must also exist on the machine from which this directory was NFS mounted and exported.

## Tivoli Storage Manager

You can also use Tivoli Storage Manager (TSM) for backing up files that reside on a Data Links server.

To use Tivoli Storage Manager as an archive server:

1. Install Tivoli Storage Manager on the Data Links server. For more information, refer to your Tivoli Storage Manager product documentation.
2. Register the Data Links server client application with the Tivoli Storage Manager server. For more information, refer to your Tivoli Storage Manager product documentation.
3. Add the following environment variables to the Data Links Manager Administrator's `db2profile` or `db2cshrc` script files:

```
(for Bash, Bourne, or Korn shell)
export DSMI_DIR=/opt/tsm/bin
export DSMI_CONFIG=$HOME/tsm/dsm.opt
export DSMI_LOG=$HOME/dldump
export PATH=$PATH:/opt/tsm/bin
```

```
(for C shell)
setenv DSMI_DIR /opt/tsm/bin
setenv DSMI_CONFIG ${HOME}/tsm/dsm.opt
setenv DSMI_LOG ${HOME}/dldump
setenv PATH=${PATH}:/opt/tsm/bin
```

4. Ensure that the `dsm.sys` TSM system options file is located in the `/opt/tsm/bin` directory.
5. Ensure that the `dsm.opt` TSM user options file is located in the `INSTHOME/tsm` directory, where `INSTHOME` is the home directory of the Data Links Manager Administrator.
6. Set the `PASSWORDACCESS` option to generate in the `/opt/tsm/bin/dsm.sys` Tivoli Storage Manager system options file.
7. Register TSM password with the `generate` option *before* starting the Data Links File Manager for the first time. This way, you will not need to provide a password when the Data Links File Manager initiates a connection to the TSM server. For more information, refer to your TSM product documentation.
8. Set the `DLFM_BACKUP_TARGET` registry variable to TSM. The value of `DLFM_BACKUP_DIR_NAME` registry variable will be ignored in this case. This will activate the Tivoli Storage Manager backup option.

### Notes:

- a. If you change the setting of the `DLFM_BACKUP_TARGET` registry variable between TSM and disk at run time, you should be aware that the archived files are not moved to the

newly specified archive location. For example, if you start the Data Links File Manager with the `DLFM_BACKUP_TARGET` registry value set to TSM, and change the registry value to a disk location, all newly archived files will be stored in the new location on the disk. The files that were previously archived to TSM will not be moved to the new disk location.

- b. To override the default TSM management class there is a new registry variable called `DLFM_TSM_MGMTCLASS`. If this registry variable is left unset then the default TSM management class will be used.
9. Stop the Data Links File Manager by entering the **`dlfm stop`** command.
10. Start the Data Links File Manager by entering the **`dlfm start`** command.

### XBSA Archive Server

To use an XBSA storage manager as an archive server:

1. Install an XBSA client on the Data Links server. For more information, refer to your XBSA vendor product documentation.
2. Register the Data Links server client application with the XBSA server. For more information, refer to your XBSA vendor server documentation.
3. Add the required environment variables to the DB2 Data Links Manager Administrator's `db2profile` or `db2cshrc` script files. For example, Legato requires the following:  
(for bash, Bourne, or Korn shell)  
`export NSR_SERVER=fully_qualified_server_hostname`  
  
(for C shell)  
`setenv NSR_SERVER=fully_qualified_server_hostname`
4. Set the `DLFM_BACKUP_TARGET` registry variable to XBSA and set the `DLFM_BACKUP_TARGET_LIBRARY` to the fully-qualified shared library supplied by the vendor. The value of `DLFM_BACKUP_DIR_NAME` registry variable will be ignored in this case. This will activate the XBSA backup option.

**Note:** The library name must also specify which shared object in the library is to be used. For example, with Legato:

```
db2set DLFM_BACKUP_TARGET_LIBRARY=/opt/lib/libxdb2.a(bsashr10.0)
```

Please contact your XBSA vendor for the specific settings required.

5. Stop the Data Links File Manager by entering the **`dlfm stop`** command.



6. Start the Data Links File Manager by entering the **dlfm start** command.

You are now ready to set up a DB2 Data Links Manager environment and verify the installation. Go to “Chapter 9. Verifying the Installation on Solaris” on page 89 for more information.



---

## Chapter 9. Verifying the Installation on Solaris

This chapter describes how to verify your installation on Solaris. It helps you configure a DB2 Data Links Manager environment to control files that are linked to DATALINK columns on a DB2 Universal Database server.

You need to perform six steps to verifying your installation:

- “1. Creating a test environment on the DB2 UDB server”.
- “2. Creating a test environment on the DB2 Data Links server” on page 91.
- “3. Registering the Data Links server with the DB2 UDB database” on page 94.
- “4. Verifying the sample file is controlled by DLFF” on page 95.
- “5. Verifying the sample file is accessible” on page 95.
- “6. Viewing the sample file” on page 97.

Troubleshooting information can be found in “Troubleshooting the configuration on Solaris” on page 98.

---

### 1. Creating a test environment on the DB2 UDB server

To create a test environment on the DB2 UDB server:

1. Log on to the system as a user with root authority.
2. Create an instance on the DB2 server using the **db2icrt** command. This instance will contain a database where tables containing columns of the DATALINK data type will reside. For more information on creating instances, refer to the *Administration Guide: Planning*.

In our example, we will create an instance called VALIDATE by entering the following commands:

```
groupadd testers
useradd pgrp='testers' groups='testers' home='/home/validate' validate
/opt/IBMdbs2/V7.1/instance/db2icrt -u validate validate
```

3. Log out.
4. Log on to the system with a valid DB2 user ID that has System Administrative (SYSADM) authority on the VALIDATE instance that you created. By default, any user that belongs to the primary group of the instance owner has SYSADM authority on an instance. For more information, refer to your server's *Quick Beginnings* manual.
5. Ensure that the VALIDATE instance is the current instance by entering the following command:

```
db2 get instance
```

This command should return the following output:

```
The current database manager instance is: VALIDATE
```

If you do not receive this output, enter the following commands:

```
set DB2INSTANCE=VALIDATE
db2 get instance
```

6. Set the DATALINKS database manager configuration parameter to *YES* in the VALIDATE instance's configuration file by entering the following command:

```
db2 update dbm cfg using datalinks yes
```

To disable DB2 Data Links Manager functionality on your DB2 server, set the DATALINKS database manager configuration parameter to *no*.

7. Start the VALIDATE instance by entering the **db2start** command.

**Note:** If you change a setting in an instance's database manager configuration file, you must ensure that you stop and restart the instance (using the **db2stop** and **db2start** commands) for the changes to take effect. In our example, we did not start the VALIDATE instance, so we only issued the **db2start** command. For more information, refer to the *Administration Guide*.

8. Create a database using the **db2 create database** command. This database will contain a table using the DATALINK data type. For more information on the **db2 create database** command, refer to the *Command Reference*.

For the example, create a database called STAFF by entering the following command:

```
db2 create database staff
```

9. Connect to the STAFF database by entering the following command:

```
db2 connect to staff
```

10. Create a table called EMPLOYEE, in the STAFF database that you just created, that has a column defined with a DATALINK data type by entering the following command:

```
db2 "create table employee (id int, fname varchar(30), lname varchar(30),
picture datalink linktype url file link control integrity all
read permission db write permission blocked recovery yes on
unlink restore)"
```

11. Terminate all connections to this database by entering the following command:

```
db2 connect reset
```

12. Log out.

---

## 2. Creating a test environment on the DB2 Data Links server

After creating a test environment on the DB2 UDB server, create a test environment on the DB2 Data Links server.

To create the test environment on the Data Links server, you need to perform four sub-tasks:

- “Preparing a File System”.
- “Registering the file system with the Data Links File Filter”.
- “Registering the DB2 UDB database” on page 92.
- “Creating a sample file” on page 93.

### Preparing a File System

You can create a UNIX File System (UFS) to test your Data Links Manager installation.

#### Creating a UNIX File System (UFS) on the DB2 Data Links server:

To create a UFS on the DB2 Data Links server:

1. Log in as a user with root authority.
2. Prepare a UFS to use a Data Links Filesystem Filter as follows:
  - a. Create a UFS file system using the **newfs** utility. You can also use an existing UFS file system. For more information on the options for creating a new file system, refer to your Solaris product documentation.
  - b. Open the `/etc/vfstab` file, record the entries as:

```
/dev/dsk/c0t0d0s6 /dev/rdisk/c0t0d0s6 /dlfs dlfs - yes Basefs=ufs
```

where `c0t0d0s6` is a sample value for this example.

3. Modify the properties of a file system, so that it comes under the control of the Data Links Filesystem Filter, and mount it by entering the following command:

```
/opt/IBMdb2/V7.1/instance/dlfmfsmd dlfm_mountpoint
```

where `dlfm_mountpoint` is the mount point of the UFS you are using.

For our example, enter the following command:

```
/opt/IBMdb2/V7.1/instance/dlfmfsmd /test
```

4. Log out.

### Registering the file system with the Data Links File Filter

To register our `/test` filesystem with the Data Links File Filter:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Run the `db2profile` or `db2cshrc` script as follows:

```
. INSTHOME/sql/lib/db2profile    (for bash, Bourne or Korn shell)
source INSTHOME/sql/lib/db2cshrc (for C shell)
```

where *INSTHOME* is the home directory of the instance owner.

3. Start the Data Links File Manager by entering the **dlfm start** command.
4. Ensure that the Data Links File Manager started successfully by entering the **dlfm see** command.

If the Data Links File Manager back-end processes started successfully and are running, you will receive output similar to the following:

```

      PID   PPID   PGID   RUSER   EUSER   ETIME  COMMAND
      7624  49852  55994   dl_fm   dl_fm   02:44  dl_fm
      49852     1   55994   dl_fm   dl_fm   02:44  dl_fm
      ⋮
      56510 49852  55994   dl_fm   root    02:44  dl_fm_chownd
```

5. Ensure that you successfully mounted the UFS that is under the control of a Data Links Filesystem Filter (DLFF) by entering the following command:

```
/sbin/mount -v | awk '$5 == "dlfs"'
```

For our example, this command should return output similar to the following:

```
/dev/dsk/c0t1d0s0 on /dlfstest type dlfs rw/suid/Basefs=ufs on Sat May 27 12:39:34 2000
/dev/dsk/c0t2d0s0 on /dlfstest type dlfs rw/suid/Basefs=ufs on Sat May 27 12:39:34 2000
```

6. Register the share name of a drive that is under the control of a Data Links Filesystem Filter by entering the following command:

```
dlfm add_prefix prefix_path
```

where *prefix\_path* is location of the filesystem that is under the control of a DLFF.

The following command registers the Data Links server to use the Data Links Filesystem Filter on the test filesystem:

```
dlfm add_prefix /test
```

## Registering the DB2 UDB database

To register a new database with the Data Links File Manager:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Register the remote DB2 UDB database where the DATALINK data type was defined by entering the following command:

```
dlfm add_db database instance hostname
```

where:

- *database* is the database alias name of the remote database.

- *instance* is the instance where *database* resides. If you are registering a Windows NT instance on an AIX or Solaris Data Links Manager, *instance* must be in uppercase.
- *hostname* is the fully qualified hostname of the DB2 UDB server where *database* resides.

The following command will register a database called STAFF, which resides in the VALIDATE instance on a DB2 UDB server with a fully qualified hostname of db2server.services.com:

```
dlfm add_db staff validate db2server.services.com
```

To list the registered database, enter the following command:

```
dlfm list registered databases
```

Do not specify the DLFM\_DB when you run this command. The DLFM\_DB is a local database that is used to keep track of files that are under the control of the Data Links File Manager.

3. Log out.

To list the registered prefixes, enter the following command:

```
dlfm list registered prefixes
```

## Creating a sample file

To create a sample file:

1. Log on to the system as any user that is *not* a DB2 Data Links Manager Administrator.
2. Create a directory on the file system that is under the control of a Data Links Filesystem Filter (DLFF), to store files to be controlled by a DB2 server, by entering the following command:

```
mkdir filesystem_name/directory_name
```

where:

- *filesystem\_name* is the name of the file system that is under the control of a DLFF.
- *directory\_name* is the name of the directory that you created.

The DB2 Data Links Manager Administrator should never be the owner of any files or directories that are in a file system under the control of a Data Links Filesystem Filter. Enter the following command to create the directory called pictures on the file system /test:

```
mkdir /test/pictures
```

3. Change the permissions for the pictures directory that you just created so that any user can create a file in it by entering the following command:

```
chmod 777 /test/pictures
```

4. Create a file called `psmith.bmp` in the `/test/pictures` directory, to be managed by the Data Links File Manager, by entering the following command:  

```
echo "This is a picture of Paul Smith." > /test/pictures/psmith.bmp
```
5. Log out.

The sample file `psmith.bmp` is a text file, not a bitmap as the `.bmp` extension implies. For the purpose of verifying your installation, this file represents an employee's picture that was inserted into a table that was defined with the `DATALINKS` data type.

---

### 3. Registering the Data Links server with the DB2 UDB database

Register the Data Links server with the remote DB2 UDB database where the `DATALINK` data type was defined earlier:

1. Log on to the system with a valid DB2 user ID that has System Administrative (SYSADM) authority on the `VALIDATE` instance that you created. By default, any user that belongs to the primary group of the instance owner has SYSADM authority on an instance. For more information, refer to your server's *Quick Beginnings* manual.
2. Run the `db2profile` or `db2cshrc` script as follows:  

```
. INSTHOME/sqllib/db2profile    (for bash, Bourne or Korn shell)
source INSTHOME/sqllib/db2cshrc (for C shell)
```

where `INSTHOME` is the home directory of the instance owner.

3. Start the `VALIDATE` instance by entering the `db2start` command.
4. Register a Data Links server that will control the files that are linked by a `DATALINK` data type by entering the following command:

```
db2 "add datalinks manager for database database_alias==>
    using node hostname port port_number" //UFS
```

where:

- `database_alias` is the database alias name of the database.
- `hostname` is the fully qualified hostname of the Data Links server.
- `port_number` is the port number that you have reserved for communications between the Data Links server and the DB2 server. You specified this port number during the installation of DB2 Data Links Manager.

For our UFS example, enter the following command:

```
db2 "add datalinks manager for database staff using==>
    node dlmsvr.services.com port 50100"
```

5. To list the registered Data Links Manager, enter the following command:  

```
db2 list datalinks managers for db staff
```



6. Connect to the STAFF database by entering the following command:
7. Insert an entry into the EMPLOYEE table that you created by entering the following command:

```
db2 connect to staff
db2 "insert into employee values (001,'Paul','Smith',==>
    dlvalue('http://hostname/controlled_file'))"
```

where:

- *hostname* is the fully qualified hostname of the Data Links server.
- *controlled\_file* is the full pathname of the file that you want to control on the Data Links server.

8. Log out.

---

#### 4. Verifying the sample file is controlled by DLFF

To verify that the `psmith.bmp` sample file we created earlier is under the control of the Data Links File Filter:

1. Log on to the system as any user except as a user with root authority, or as the DB2 Data Links Manager Administrator.
2. Verify that the `psmith.bmp` file is now controlled by the Data Links File Manager by entering the following command:

```
cat controlled_file
```

where *controlled\_file* is the full pathname of the file that is controlled by the Data Links server.

For our example, enter the following command:

```
cat /test/pictures/psmith.bmp
```

**Note:** We are using the `cat` command here because `psmith.bmp` is really a text file. Running the `cat` command on a true binary file would return garbage output.

If this file is being controlled by the Data Links File Manager, you will receive the following error:

```
Cannot open /test/pictures/psmith.bmp
```

3. Log out.

---

#### 5. Verifying the sample file is accessible

The next step is to verify that the `psmith.bmp` sample file can be accessed while it is under the control of the Data Links File Manager. To do this, you first need to generate an *access token* on the DB2 Universal Database server.

1. Log on to the system with a valid DB2 user ID that has System Administrative (SYSADM) authority on the VALIDATE instance that you created. By default, any user that belongs to the primary group of the instance owner has SYSADM authority on an instance. For more information, refer to your server's *Quick Beginnings* manual.
2. Run the db2profile or db2cshrc script as follows:
 

```
. INSTHOME/sql1lib/db2profile    (for bash, Bourne or Korn shell)
source INSTHOME/sql1lib/db2cshrc (for C shell)
```

where *INSTHOME* is the home directory of the instance owner.

3. Start the VALIDATE instance by entering the **db2start** command.
4. Connect to the STAFF database by entering the following command:
 

```
db2 connect to staff
```
5. Select the controlled file for update by issuing an SQL SELECT statement. For more information, refer to the *SQL Reference*.

For our example, enter the following command:

```
db2 "select dlurlpath(picture) from employee where lname = 'Smith'"
```

This command returns the full pathname with an access token of the form:

```
controlled_filepath/access_token;controlled_filename
```

where:

- *controlled\_filepath* is the fully qualified path of the controlled file.
- *access\_token* is an encrypted key assigned by the database manager.
- *controlled\_filename* is the name of the file that is under the control of a Data Links Filesystem Filter.

For example, you will receive an access token that is similar to the following:

```
/test/pictures/HVJ5NXGC0WQ.I5KKB6;psmith.bmp
```

This access token will be used to read this file on the Data Links server.

**Note:** This access token is only valid for 60 seconds. This means that once you enter this command, you have only 60 seconds to complete the remaining steps in this section (or edit any Data Links controlled file). You can change the default expiration time by changing the *DL\_EXPINT* database configuration parameter.

To change the default expiration time for an access token to 10 minutes (the value is entered in seconds), enter the following commands:

```
db2 update db cfg for staff using dl_expint 600
db2 terminate
db2 connect to database staff
```

If you change a setting for any database configuration parameter, you must always reconnect to the database for the changes to take effect. For more information on database configuration file parameters, refer to the *Administration Guide*.

## 6. Log out.

If you did not receive an error, you have access to this file and you have installed and configured DB2 Data Links Manager correctly. For information on commands that are used in the day-to-day operations of a DB2 Data Links Manager environment, go to “Chapter 10. Working with the Data Links File Manager” on page 101.

If you received a error, go to “Troubleshooting the configuration on Solaris” on page 98.

For more information on the SQL commands used to verify the installation, refer to the *SQL Reference*.

---

## 6. Viewing the sample file

Finally, you will use this access token to view the `psmith.bmp` file.

1. Log on to the system as any user except as a user with root authority, or as the DB2 Data Links Manager Administrator.
2. Verify that you can access the file that is under the control of the Data Links File Manager.

Enter the following command:

```
cat "/test/pictures/access_token;psmith.bmp"
```

where `access_token` is the encrypted key that you recorded in the previous step.

You should receive the following output from this command:

```
"This is a picture of Paul Smith."
```

If you did not receive an error, you have access to this file and you have installed and configured DB2 Data Links Manager correctly. For information on commands that are used in the day-to-day operations of a DB2 Data Links Manager environment, go to “Chapter 10. Working with the Data Links File Manager” on page 101.

If you received a error, go to “Troubleshooting the configuration on Solaris”.

For more information on the SQL commands used to verify the installation, refer to the *SQL Reference*.

---

## Troubleshooting the configuration on Solaris

If you received an error when you attempted to access the `psmith.bmp` test file, use the following checklist and go through the configuration instructions again, verifying each item as you go:

### At the Data Links server:

- Ensure that you correctly registered the file system that is being used to store any linked files.
- Ensure that the file system that is being used to store linked files is mounted as `d1fs`.
- Ensure that the DB2 database was registered correctly.
- Ensure that the directory where the linked file is stored was *not* created by the DB2 Data Links Manager Administrator username or a username with root authority.
- Ensure that the Data Links File Manager was started by entering the **`d1fm see`** command.

### At the DB2 server:

- The *DATALINKS* database manager configuration parameter is set to *YES*.
- The Data Links Manager was registered correctly using the **`db2 add datalinks manager`** command.

For information on error messages on the DB2 Data Links Manager, see “Appendix A. DB2 Data Links Manager Errors and User Responses” on page 127. For information on error messages on the DB2 server, refer to the *Message Reference*.

---

## Part 5. Working with DB2 Data Links



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## Chapter 10. Working with the Data Links File Manager

This chapter describes the basic commands that a DB2 Data Links Manager Administrator may have to perform on a Data Links server during day-to-day operations.

Unless otherwise noted, the commands in this chapter are common to Data Links servers running on AIX, Solaris, or Windows NT operating systems. For a complete list of all Data Links File Manager commands, enter the **dlfm** command.

---

### Starting and Stopping the Data Links File Manager

You must start the Data Links File Manager before you can link files, access, or create data stored on a Data Links server.

To start the Data Links File Manager:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Enter the **dlfm start** command.

When you enter the **dlfm start** command to start the Data Links File Manager, it will also attempt to start the DB2 database manager on the Data Links server. If it is unsuccessful, you must enter the **dlfm startdbm** command to start the DB2 database manager. For more information, see “Starting and Stopping the DB2 Database Manager on the Data Links Server” on page 111.

To stop the Data Links File Manager:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Enter the **dlfm stop** command.

When you enter the **dlfm stop** command to stop the Data Links File Manager, it will also attempt to stop the DB2 database manager on the Data Links server. If it is unsuccessful, you must enter the **dlfm stopdbm** command to stop the DB2 database manager. For more information, see “Starting and Stopping the DB2 Database Manager on the Data Links Server” on page 111.

To stop and restart the Data Links File Manager by entering only *one* command:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Enter the **dlfm restart** command.

---

## Monitoring the Data Links File Manager Back-End Processes on AIX or Solaris

For every connection that DB2 makes to a Data Links server on AIX or Solaris, a `d1fm_child` back-end process is started. To monitor the Data Links File Manager back-end processes, enter the `d1fm see` command.

If the Data Links File Manager back-end processes started successfully and are running, you receive output similar to the following:

| PID   | PPID  | PGID  | RUNAME | UNAME | ETIME | DAEMON NAME           |
|-------|-------|-------|--------|-------|-------|-----------------------|
| 17500 | 60182 | 40838 | d1fm   | root  | 12:18 | d1fm_copyd_(d1fm)     |
| 41228 | 60182 | 40838 | d1fm   | root  | 12:18 | d1fm_chownd_(d1fm)    |
| 49006 | 60182 | 40838 | d1fm   | root  | 12:18 | d1fm_upcall_(d1fm)    |
| 51972 | 60182 | 40838 | d1fm   | root  | 12:18 | d1fm_gcd_(d1fm)       |
| 66850 | 60182 | 40838 | d1fm   | root  | 12:18 | d1fm_retrieved_(d1fm) |
| 67216 | 60182 | 40838 | d1fm   | d1fm  | 12:18 | d1fm_de1grp_(d1fm)    |
| 60182 | 1     | 40838 | d1fm   | d1fm  | 12:18 | d1fmd_(d1fm)          |

DLFM SEE request was successful.

The name that is enclosed within the parentheses is the name of the DLFM instance, in this case "d1fm".

If the Data Links File Manager back-end processes did not start successfully, this command does not return any output.

---

## Restarting the Data Links Manager after an Abnormal Termination

If the Data Links File Manager terminates abnormally, or you cannot stop the Data Links File Manager using the `d1fm stop` command, perform the following steps:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Enter the `d1fm shutdown` command to bring down the active Data Links File Manager. On AIX or Solaris, *never* use the `kill -9` signal to stop Data Links File Manager processes.
3. Start the Data Links File Manager by entering the `d1fm start` command.

---

## Listing or Adding Registered File Systems Under the Control of a Data Links Filesystem Filter on AIX or Solaris

This section describes how to list any file systems that are under the control of a Data Links Filesystem Filter (DLFF) on AIX or Solaris, and how to register other file systems to be controlled by a DLFF.

To list any file systems that are currently under the control of a DLFF:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Enter the `d1fm list registered prefixes` command on the Data Links server.



To list any file systems where a DLFF is loaded on an AIX system, enter the `lsfs -v dlfs` command.

To list any file systems where a DLFF is loaded on a Solaris system, enter the `/sbin/mount -v | awk '$5 == "dlfs"'` command.

To list file systems where a DLFF is loaded in a DCE-DFS environment, enter the `dfsexport | grep dmlfs` command.

## Adding a DLFF in JFS or UFS environments

To add a DLFF:

1. Prepare a file system to use a DLFF as follows:

- **On AIX:**

- a. Create a JFS using the `smit manfs` command and set the *Mount AUTOMATICALLY at system restart?* option to *no*. You can also use an existing JFS file system. For more information, refer to your AIX product documentation or man pages.
- b. Open the `/etc/filesystems` file, record the current setting for the *vfs* entry, and edit its stanza as follows:

```
mount = false
vfs = dlfs
```

- c. Add the following attribute to the *nodename* stanza:

```
nodename = -
```

**Note:** Ensure that there are no blank spaces after the null ( - ) character.

- d. Set the *Basefs* parameter in the *options* attribute to the value that you recorded for the *vfs* entry above. For example, the entry would be similar to the following:

```
options = rw,Basefs=jfs
```

- **On Solaris:**

- a. Create a UFS using the `newfs` command. You can also use an existing UFS file system. For more information, refer to your Solaris product documentation or man pages.
- b. Open the `/etc/vfstab` file and record the entries as follows:

```
/dev/dsk/c0t0d0s6 /dev/rdisk/c0t0d0s6 /dlfs dlfs - yes Basefs=ufs
```

where `c0t0d0s6` is a sample value for this example.

2. Mount the filesystem you created by entering one of the following commands:

```
/usr/lpp/db2_07_01/instance/dlffmsmd dlfm_mountpoint //AIX
/opt/IBMdb2/V7.1/instance/dlffmsmd dlfm_mountpoint //Solaris
```

where *dlfm\_mountpoint* is the mount point of the file system that you created for the DLFF in the previous step.

3. Log out.
4. Log on to the system as the DB2 Data Links Manager Administrator.
5. Start the Data Links File Manager by entering the **dlfm start** command.
6. Register a file system that is under the control of a Data Links Filesystem Filter by entering the following command:

```
dlfm add_prefix prefix_path
```

where *prefix\_path* is the location of the file system that is under the control of a DLFF.

For example, register the Data Links server to use the Data Links Filesystem Filter on the test file system by entering the following command:

```
dlfm add_prefix /test
```

To update an existing prefix, enter one of the following commands:

```
dlfm update_prefix prefix_path //JFS
```

```
dlfm update_prefix prefix_path for dfs localpath local_mount_point //DFS
```

## Adding a DLFF in a DCE-DFS environment

To add a Data Links Filesystem Filter in a DCE-DFS environment on AIX:

1. Log in as root and dce\_login as a DFS administrator.
2. Create a logical volume by entering the following command:

```
mklv -y aggregate_name -t aggregate_type lfs rootvg 1
```

where *aggregate\_name* represents the name of the logical volume, *aggregate\_type* represents the aggregate type, *rootvg* represents the logical volume type, and 1 represents the number of logical partitions.

3. Create an aggregate in the logical volume by entering the following command:

```
newaggr -aggregate /dev/dmtest -block 8192 -frag 1024 -overwrite
```

where */dev/dmtest* represents the aggregate name, given as a device file. Note that if this aggregate name already exists, the *-overwrite* option will delete all data in the aggregate.

4. Initialize and export the aggregate by entering the following command:

```
mkdfs1fs -d /dev/dmtest -n dmtest
```

where */dev/dmtest* is the device name for the aggregate.

5. Create the filesets in the aggregate by entering the following command:

```
mkdfs1fs -f dmtest1.ft -m /:/dmtest/dmtest1 -n dmtest
```

where `:/dmtest/dmtest1` represents the mountpoint in the DFS namespace and `dmtest` represents the name of the aggregate.

**Note:** You must have a valid `dce_login` and the authority to create directories in the DFS namespace.

6. Edit the `/opt/dcelocal/var/dfs/dfstab` file and change the entry for the aggregate you just created from `lfs` to `dmlfs`. For example, this file will have entries for each aggregate similar to the following:

```
# blkdev aggname aggtype aggid [UFS fsid]
/dev/aggrdev1 aggrname1 lfs 1
/dev/aggrdev2 aggrname2 lfs 2
```

Change `aggtype` to `dmlfs` for all aggregates that are to be brought under Data Links control. Save and close the file.

**Notes:**

- a. When you create an aggregate using SMIT, you can also specify an aggregate id. However, the default id is the next available higher integer value.
  - b. If the aggregate has already been exported, you must unexport it before performing this and the following step.
7. Enable DFS SMT on the aggregate by running the following command:  
`dmaggr -aggregate name [{-on | -off}] [{-needapp | -noneedapp}] [-help]`

We recommend you always use the `-needapp` option when running this command.

8. Export the aggregate so that it can be controlled by the Data Links Filesystem Filter.
9. Register a file system that is under the control of a Data Links Filesystem Filter by entering the following command:

```
dlfm add_prefix prefix_path
```

where `prefix_path` is the location of the file system that is under the control of a DLFF.

10. To register a DCE-DFS fileset, you can either use the `dlfm add_prefix /test` command or you can use one of the following variations:

```
dlfm add_prefix for dfs rwpath prefix_path
```

This command specifies a read-only path for DCE-DFS.

```
dlfm add_prefix for dfs rwpath prefix_path localpath local_mount_point
```

where `local_mount_point` represents the native file system mount point of the prefix. The native file system mount point can be used to improve the

performance of the archival and retrieval of files. For more information, see “Performance Enhancements for Disk Backup in the DFS Environment”.

**Note:** You must issue all **dlfm add\_prefix** commands from the node on which the DFS fileset resides. After issuing this command, you must issue a **dlfm start** command on the same node.

## Performance Enhancements for Disk Backup in the DFS Environment

Consider the following scenario:

- The cell is `d1n1.almaden.ibm.com`, referred to as **cellname**.
- There are 2 nodes in the cell: `node1.almaden.ibm.com`, referred to as **node1**, and `node2.almaden.ibm.com`, referred to as **node2**.

There are two prefixes registered with the File Manager. The two prefixes are:

- `../cellname/fs/prfx1`

This prefix is native to **node1**. This prefix is referred to as **prfx1**. The fileset name is **fileset1**.

- `../cellname/fs/prfx2`

This prefix is native to **node2**. This prefix is referred to as **prfx2**. The fileset name is **fileset2**.

The archive directory has to be a DFS fileset, for example `../cellname/fs/d1fm_backup/`.

The DB2 registry variables on both nodes of the DFS cell need to be set as follows:

```
db2set DLFM_BACKUP_TARGET=LOCAL db2set DLFM_BACKUP_DIR_NAME=../cellname/fs/d1fm_backup/
```

The archives of the files is taken as follows:

1. For files that reside in **prfx1**, the archive is made by the copy daemon running on **node1** to the following directory:

```
../cellname/fs/d1fm_backup/node1/_prfx1/
```

2. For files that reside in **prfx2**, the archive is made by the copy daemon running on **node2** to the following directory:

```
../cellname/fs/d1fm_backup/node2/_prfx2/
```

The directories `../cellname/fs/d1fm_backup/node[1-2]` and `../cellname/fs/d1fm_backup/node[1-2]/_prfx[1-2]` are created on startup.

### Disk Backup Optimization Tip 1

By creating multiple backup DFS filesets instead on one backup fileset, one can take advantage of the localization of the fileset archives. In the above scenario, the administrator can create two backup filesets as follows:

```
../../cellname/fs/dl_fm_backup/node1/
```

which is native to **node1**, and

```
../../cellname/fs/dl_fm_backup/node2/
```

which is native to **node2**.

This way, archives for files that belong to filesets on **node1** (that is, **fileset1**) are done to an archive fileset which is native to **node1**. This reduces network traffic.

**Note:** The `DLFM_BACKUP_TARGET` and `DLFM_BACKUP_DIR_NAME` registry variable still have to be set to `LOCAL` and `../../cellname/fs/dl_fm_backup/` respectively, on both **node1** and **node2**.

### Disk Backup Optimization Tip 2

The administrator can use the `DLFM_BACKUP_DIR_LOCAL_MP` registry variable to bypass the DFS client cache. This can be done only if “Disk Backup Optimization Tip 1” on page 106 is being used. Also, the DFS fileset should be mounted as a native Journaled File System (JFS) by performing the following steps:

1. The fileset **fileset1** (prefix: `../../cellname/fs/dl_fm_backup/node1`) can be mounted at `/local_backup/node1` as a JFS by issuing the following command:

```
mount -v lfs -o aggregate=lfstest1 -n node1 fileset1 /local_backup/node1
```

where `lfstest1` is the aggregate in which the **fileset1** resides.

2. In addition to setting the `DLFM_BACKUP_TARGET` and `DLFM_BACKUP_DIR_NAME` registry variables, set the `DB2` registry variable as follows:

```
db2set DLFM_BACKUP_DIR_LOCAL_MP=/local_backup/
```

**Note:** Although the native JFS mount point contains the node name, the `DLFM_BACKUP_DIR_LOCAL_MP` does not.

---

## Listing or Adding Registered Drives Under the Control of a Data Links Filesystem Filter on Windows NT

This section describes how to list any shared drives that are under the control of a Data Links Filesystem Filter on Windows NT, and how to register another drive to be controlled by a Data Links Filesystem Filter (DLFF).

To list any shared drives that are currently under the control of a Data Links Filesystem Filter, perform the following steps:

1. Log on to the system as the DB2 Data Links Manager Administrator.

2. Enter the **dlfm list registered prefixes** command on the Data Links server. To list any drives where a DLFF is loaded, enter the **dlff list** command.

To add a Data Links Filesystem Filter:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Start the Data Links File Manager by entering the **dlfm start** command.
3. Register the share name of a drive that is under the control of a Data Links Filesystem Filter by entering the following command:

```
dlff add c:  
dlfm add_prefix \sharename
```

where *sharename* is the shared name of the drive that is under the control of a DLFF, and *c:* is the drive that is under the control of the DLFF.

For example, register the Data Links server to use the Data Links Filesystem Filter on the cdrive (which is the share name of the c:\ drive) by entering the following command:

```
dlfm add_prefix \cdrive
```

---

## Loading, Querying, and Unloading a Data Links Filesystem Filter on AIX or Solaris

This section describes how to load, query, or unload a Data Links Filesystem Filter on AIX or Solaris. You may want to use the following commands to disable a Data Links server in order to install a fix pack, debug problems, or clean up an existing machine, and then enable it for use.

### On AIX

To load a Data Links Filesystem Filter:

1. Log in as a user with root authority.
2. Enter the **strload -f /usr/lpp/db2\_07\_01/cfg/dlfs\_cfg** command.

To query a Data Links Filesystem Filter:

1. Log in as a user with root authority.
2. Enter the **strload -q -f /usr/lpp/db2\_07\_01/cfg/dlfs\_cfg** command.

To unload a Data Links Filesystem Filter:

1. Log in as a user with root authority.
2. Enter the **strload -u -f /usr/lpp/db2\_07\_01/cfg/dlfs\_cfg** command

### On Solaris

To load a Data Links Filesystem Filter:

1. Log in as a user with root authority.

2. Enter the **add\_drv -m '\* 0777 dlfm staff' dlfsdrv** command. This command is based on the assumption that the dlfm id is created on the machine in the group staff.

To query a Data Links Filesystem Filter:

1. Log in as a user with root authority.
2. Enter the **usr/sbin/modinfo | grep dlfs** command.

To unload a Data Links Filesystem Filter:

1. Log in as a user with root authority.
2. Enter the **rem\_drv dlfsdrv** command.

### On the DFS Client Enabler

To load a Data Links Filesystem Filter for the DFS Client Enabler:

1. Log in as a user with root authority.
2. Enter the **strload -f /usr/lpp/db2\_07\_01/cfg/dlfsdm\_cfg** command.

To query a Data Links Filesystem Filter for the DFS Client Enabler:

1. Log in as a user with root authority.
2. Enter the **strload -q -f /usr/lpp/db2\_07\_01/cfg/dlfsdm\_cfg** command.

To unload a Data Links Filesystem Filter for the DFS Client Enabler:

1. Log in as a user with root authority.
2. Enter the **strload -u -f /usr/lpp/db2\_07\_01/cfg/dlfsdm\_cfg** command

---

## Mounting and Unmounting a Data Links Filesystem Filter on Windows NT

This section describes how to mount or unmount a Data Links Filesystem Filter on Windows NT. You may want to use the following commands to disable a Data Links server in order to install a fix pack, debug problems, or clean up an existing machine, and then enable it for use.

To mount a Data Links Filesystem Filter:

1. Log in as a user with root authority.
2. Enter the **dlff add drive** command (where *drive* is the drive that you want to mount a Data Links Filesystem Filter).

To unmount a Data Links Filesystem Filter:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Enter the **dlff remove drive** command, where *drive* is the drive that you want to unmount a Data Links Filesystem Filter.
3. Click **Start** and select **Settings** —> **Control Panel** —> **Services**.

4. Select the **DLFS** service, click **Startup** and set the **Startup Type** to **Manual**. Do the same for the **DLFM** service.
5. Reboot the machine.

The Data Links Filesystem Filter is unmounted after the next reboot of the workstation.

---

## Increasing the Size of a File System that is under the Control of a DLFF on AIX or Solaris

This section describes how to increase the size of a filesystem using a Data Links Filesystem Filter on AIX or Solaris. This section does not apply to DCE-DFS environments. For

To allocate more space to an existing filesystem that is using a Data Links Filesystem Filter on AIX or Solaris:

1. Log in as a user with root authority.
2. Modify the properties of the filesystem so that it is no longer under the control of the Data Links Filesystem Filter, and unmount it, by entering the following command:

```
/usr/lpp/db2_07_01/instance/dlffmsmd -j filesystem_name //AIX  
/opt/IBMDB2/V7.1/instance/dlffmsmd -j filesystem_name //Solaris
```

where *filesystem\_name* specifies the name of the mounted file system that is using the Data Links Filesystem Filter.

3. On AIX enter the **smit jfs** command to increase the size of this filesystem. On Solaris, consider running the **fsck** command to defragment a full filesystem. You might then back up the filesystem using **ufsdump**, create a new filesystem using **newfs**, and then restore your data using **ufsrestore**. For more information on these commands, and on other ways to make more space available on your filesystem, refer to your Solaris product documentation or man pages.
4. Modify the properties of a filesystem so that it comes under the control of the Data Links Filesystem Filter, and mount it, by entering the following command:

```
/usr/lpp/db2_07_01/instance/dlffmsmd dlfm_mountpoint //AIX  
/opt/IBMDB2/V7.1/instance/dlffmsmd dlfm_mountpoint //Solaris
```

where *dlfm\_mountpoint* is the mount point of the file system that you created for the Data Links Filesystem Filter in the previous step.

5. Log out.



---

## Listing and Registering Databases with the Data Links Manager

This section describes how to list any DB2 databases that this Data Links server is maintaining linked files for and how to add another database for control by the Data Links File Manager.

To list the databases that have been registered with the Data Links server:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Enter the **dlfm list registered databases** command on the Data Links server.

To register a new database with the Data Links File Manager:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Register the remote DB2 UDB database where the DATALINK data type was defined by entering the following command:

```
dlfm add_db database instance hostname
```

where:

- *database* is the database alias name of the remote database.
- *instance* is the instance where *database* resides. If you are registering a Windows NT instance on an AIX or Solaris Data Links Manager, *instance* must be in uppercase.
- *hostname* is the fully qualified hostname of the DB2 UDB server where *database* resides.

The following command will register a database called STAFF, which resides in the VALIDATE instance on a DB2 UDB server with a fully qualified hostname of db2server.services.com:

```
dlfm add_db staff validate db2server.services.com
```

To list the registered database, enter the following command:

```
dlfm list registered databases
```

Do not specify the DLFM\_DB when you run this command. The DLFM\_DB is a local database that is used to keep track of files that are under the control of the Data Links File Manager.

3. Log out.

Each time you register a database with a Data Links File Manager, the DLFM\_DB database is automatically backed up.

---

## Starting and Stopping the DB2 Database Manager on the Data Links Server

This section describes how to start and stop the database manager instance on the Data Links server.

You must start the DB2 database manager before you can access or create data stored on a Data Links server. Under normal circumstances, the **dlfm start** and **dlfm stop** commands will start and stop the DB2 database manager on the Data Links server automatically. Follow the instructions in this section if the **dlfm start** and **dlfm stop** commands fail to start or stop the DB2 database manager.

To start the DB2 database manager on the Data Links server:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Enter the **dlfm startdbm** command.

To stop the DB2 database manager on the Data Links server:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Stop the Data Links File Manager by entering the **dlfm stop** command.
3. Enter the **dlfm stopdbm** command.

---

## Changing the Diagnostic Level for the Error Message Log File

Error message log files are maintained for DB2 Data Links Manager, DB2 on the Data Links server, and for the DB2 system that contains the database with the DATALINK data type.

**On AIX or Solaris**, error message log files are located in the `/INSTHOME/sql1lib/db2dump/db2diag.log` directory where `INSTHOME` is the home directory of the instance owner.

**On Windows NT**, error message log files are located in the `x:\sql1lib\instance\db2diag.log` directory, where:

- `x`: is the drive where DB2 Data Links Manager is installed.
- `instance` is the name of the instance for which you want to change the diagnostic setting.

You can control the level of the detailed information that is written to the `db2diag.log` file using a combination of the `DIAGLEVEL` database manager configuration parameter and `DLFM_LOG_LEVEL` registry value. For more information on error messages and error message log files, refer to the *Administration Guide*.

---

## Creating and Dropping the DB2 Database on the Data Links Server

This section describes how to create the DLFM\_DB on the Data Links server. You only need to create the DLFM\_DB database if for some reason the installation program could not create it. You should *not* be interacting with this database. The DLFM\_DB database is used to keep track of those files that are stored on a Data Links server and linked to a remote DB2 server.

**Note:** If the DLFM\_DB database is not empty (it has information about files which are being managed by the Data Links server) you should only drop this database after consulting IBM service.

To create the DB2 database on the Data Links server:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Enter the **dlfm setup** command to start the DB2 database manager, create the DLFM\_DB database and tables, and then stop the DB2 database manager.

To drop the DB2 database on the Data Links server:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Enter the **dlfm drop\_db** command to drop the DLFM\_DB database.

---

## Retrieving Archive Server Information

To retrieve a list of files that have been backed up to the archive server:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Enter the **retrieve\_query** command as follows:

```
retrieve_query -h hostname -d database_name -i instance_name -p registered_prefix
```

where:

- *hostname* is the hostname of the archive server.
- *database\_name* is the name of the database that contains the files that were backed up to the archive server.
- *instance\_name* is the name of the instance where the database that contains that files that were backed up to the archive server resides. *instance\_name* is case sensitive.
- *registered\_prefix* is the name of the file system that was registered using the **dlfm add\_prefix** command.

If you enter the **retrieve\_query** command without any parameters, you are asked to provide them interactively, using a generated list of options for the *database\_name* and *instance\_name* parameters. This command, entered without parameters, retrieves output similar to the following on AIX, Solaris, and Windows NT:

No database specified. Going for default database : dl\_fm\_db

Please make your choice of hosts registered with DLFM.

0 ARROW.TOROLAB.IBM.COM

Enter the number

Please make your choice of the database/instance.

0 TSTDB001 regress ARROW.TOROLAB.IBM.COM

1 TSTDB002 regress ARROW.TOROLAB.IBM.COM

2 TSTDB003 regress ARROW.TOROLAB.IBM.COM

3 TSTDB004 regress ARROW.TOROLAB.IBM.COM

4 TSTDB005 regress ARROW.TOROLAB.IBM.COM

Enter the number

Please make your choice of the prefix Name.

0 \dlfstest\

Enter the number

RETRIEVE QUERY OUTPUT

The following files were backed up from database TSTDB001, on host  
ARROW.TOROLAB.IBM.COM from the instance regress

| Copy Status | Link Status | Operation time             | File Name         |
|-------------|-------------|----------------------------|-------------------|
| E1          | L           | 2000-06-03-13.26.49.586476 | \dlfstest\fileA1  |
| E1          | L           | 2000-06-03-13.26.50.243762 | \dlfstest\fileA2  |
| E1          | L           | 2000-06-03-13.25.55.345240 | \dlfstest\fileA3  |
| E1          | L           | 2000-06-03-13.27.03.034247 | \dlfstest\fileA31 |
| E1          | L           | 2000-06-03-13.27.03.937676 | \dlfstest\fileA32 |
| E1          | L           | 2000-06-03-13.25.56.176132 | \dlfstest\fileA4  |
| E1          | L           | 2000-06-03-13.25.56.961493 | \dlfstest\fileA5  |
| E1          | L           | 2000-06-03-13.25.58.424379 | \dlfstest\fileB1  |
| E1          | L           | 2000-06-03-13.25.59.126102 | \dlfstest\fileB2  |
| E1          | L           | 2000-06-03-13.26.51.973211 | \dlfstest\fileB3  |
| E1          | L           | 2000-06-03-13.26.52.623260 | \dlfstest\fileB4  |
| E1          | L           | 2000-06-03-13.26.53.278827 | \dlfstest\fileB5  |

Legend:

L - Linked

U - Unlinked

G - File to be garbage collected

E1 - Marked Copied and in backup

E2 - Marked Copied and not in backup

E3 - Marked To be Copied and not in backup

E4 - Marked To be copied but in backup

\*\*\*\*\*

---

## Chapter 11. Recovering from a Crash on the Data Links Server

This chapter describes how to perform recovery after a disk crash on the Data Links server and the backup strategies that the administrator must undertake to support such disaster recovery scenarios.

Unless otherwise noted, the information in this chapter is common to Data Links servers running on AIX, Solaris, and Windows NT operating systems.

In the case of a machine crash on a Data Links server, DB2 applications interacting with the Data Links File Manager can hang. Use the **force application** command to force DB2 applications off the system. In the case of a machine crash on a DB2 server, the affected Data Links File Managers should also be shut down, using the **dlfm stop** command and then restarted.

---

### Crash and recovery overview

If a disk that contains files referred to in a DATALINK column crashes, all the user files, along with the directory hierarchy of the file system, are destroyed. To recover from such a scenario, the administrator should make periodic backups of the file system containing the user data and directory hierarchy, so that it can be restored. The restored file system must preserve directory and file ownerships, and time stamps.

After restoring the file system, the directory structure must be brought up to the point-in-time of the crash by applying the directory changes that occurred after the file system backup was taken. After this step, the **RECONCILE** command must be run on all tables containing files on the damaged disk. The *db2\_recon\_aid* utility is provided to simplify this task.

Following a crash, there are three possible file states:

1. Files that are in linked state, and have the RECOVERY NO option set, are treated as follows:
  - If the file is not found on the file system, the DATALINK value will be set to NULL.
  - If the file is found, and it has READ and WRITE PERMISSION FS, no additional checks will be made to validate the correctness of the file.
  - If the file is found, and it has WRITE PERMISSION BLOCKED, its modification time and file size will be checked. If there is a mismatch in the values, the DATALINK value will be set to NULL.

2. Files that are in a linked state, and have the RECOVERY YES option set, will be restored from the archive server if the file modification time is less than the file modification time at link time, or if the file is not found.

If the modification time of the version on the file system is greater, it is renamed with extension .MOD so that the more recent changes are not lost. The archived version is still retrieved, and the renamed version is reported in the exception report.

If a renamed version of the file with .MOD extension already exists, the file will not be retrieved, the DATALINK value will be changed to a NULL value, and it will be reported in the exception report and table.

3. Files that are in the unlinked state on the file server are not restored or checked for correctness.

---

## DB2 Data Links Manager System Setup and Backup Recommendations

The following system setup and backup procedures are recommended for easier recovery:

1. Place the DLFM database (DLFM\_DB), any file systems under control of the DB2 Data Links Filesystem Filter (DLFF), the DLFM backup directory, and the DLFM home directory on different file systems. Ensure they do not share disks.
2. Back up any file systems under the control of the DLFF and the DLFM on a storage manager, such as IBM's Tivoli Storage Manager. In the event of disk failure, this will provide added protection.
3. Have one database associated with one or more DB2 Data Links Managers. Avoid having two databases associated with one DB2 Data Links Manager; otherwise, certain recovery scenarios will become more complex than is necessary. Perform full database backups of the DB2 databases (as well as the DLFM\_DB database on the DB2 Data Links Manager) at regular intervals.

---

## Backing up a file system on Windows NT

To create a tape backup, use the Windows NT backup and restore utility.

To create a backup of all the files on a disk:

1. Select **Programs** —> **Administrative Tools** —> **Backup**.
2. In the **Drives** window, select the **drive** that you want to back up.
3. On the **Select** menu, click **Check**.
4. On the **Operations** menu, click **Backup**.

For more information refer to the Windows NT online help.

To reduce recovery time after a crash, use an incremental backup strategy where level 0 refers to a full backup, and levels 1 through 9 refer to incremental backups. A level  $n$  backup backs up only those files that have changed since a level  $(n-1)$  backup. After a level  $n$  backup, the next backup to be taken will be a level  $(n+1)$  backup.

---

## Restoring a file system on Windows NT

This section describes how to restore a backup from tape on Windows NT. This is performed by using the Windows NT backup and restore utility. To access the restore utility perform the following steps:

1. Click **Start** and select **Programs** —> **Administrative Tools** —> **Backup**
2. On the **Operations** menu, click **Catalog** to load the tape catalog of backup sets.
3. In the **Tapes** window, select the files, sets, or tape you want to restore using the appropriate method:
  - To select contiguous sets, click the first set, hold down SHIFT, and click the last contiguous set.
  - To select non-contiguous files, click a set, hold down CTRL, and click each set.
4. On the **Select** menu, click **Check**.
5. **Select** the backup sets you want in the right panel of the **Tapes** window.
6. On the **Select** menu, click **Check** to select the check boxes for the selected backup sets.
7. On the **Operations** menu, click **Restore**.

For more information refer to the Windows NT online help.

---

## Backing up a File System on AIX or Solaris

This section describes how to back up a JFS on AIX or UFS on Solaris. For information on backing up a DCE-DFS file server, see your Transarc product documentation.

**Note:** This approach requires you to stop the Data Links Manager. An alternate approach for AIX users who require high availability can be found in “Appendix D. An Alternative Approach to Backing up a JFS on AIX” on page 149.

To create a backup using Version 3 inode format on AIX:

1. Log in as a user with root authority.
2. Enter the **smit** command.

3. Select **System Storage Management** → **File Systems** → **Unmount a File System**.
4. Select **System Storage Management** → **File Systems** → **Backup a File System**.
5. Select **System Storage Management** → **File Systems** → **Mount a File System**.

To reduce recovery time after a crash, use an incremental backup strategy where level 0 refers to a full backup, and levels 1 through 9 refer to incremental backups. A level *n* backup backs up only those files that have changed since a level (*n*-1) backup. After a level *n* backup, the next backup to be taken will be a level (*n*+1) backup.

To back up a UFS on Solaris:

1. Log in as a user with root authority.
2. To back up complete or individual file systems to a local or remote device, enter the **ufsdump** command. See your Solaris product documentation or man pages for more information on this command.

---

## Restoring a File System on AIX or Solaris

This section describes how to restore a JFS on AIX or a UFS on Solaris. For information on backing up a DCE-DFS file server, see your Transarc product documentation.

To restore a JFS file system on AIX perform the following steps:

1. Log in as a user with root authority.
2. Start the System Management Interface Tool (SMIT) by entering the **smit** command.
3. Using your backup media, mount the device where the file system is to be restored. Select **System Storage Management** → **File Systems** → **Mount a File System**.
4. To restore the file system, select **System Storage Management** → **File Systems** → **Restore a File System**.

To restore a UFS file system on Solaris perform the following steps:

- Log in as a user with root authority.
- To restore complete filesystems or individual files from removable media to a working directory, enter the **ufsrestore** command. See your Solaris product documentation or man pages for more information on this command.



---

## Bringing the File System Directory Hierarchy to the Current Point in Time

**On AIX or Solaris**, the directory changes are logged in the *INSTHOME*/sql11ib/fsysadm.log file, where *INSTHOME* is the home directory of the Data Links Administrator.

**On Windows NT**, the directory changes are logged in the *x:\sql11ib\d1fm\fsysadm.log* file, where *x*: represents the drive where you installed DB2 Data Links Manager.

On all platforms this file is appended to and will not be truncated. There is one entry for each event. Setting the attributes of a file is also logged. The format of the entry is:

```
Time = <timestamp> EUID = <integer> UID = <integer> GID = <integer> Mode = <octal>  
Action = <CREATE/REMOVE/SETATTR> Object type = <DIR/FILE> Path = <fully qualified name>
```

where:

- *Time* is the time of the activity in local time
- *EUID* is the effective user ID of the user performing the action
- *UID* is the user ID attribute of the file or directory that was created, or whose attributes were modified
- *GID* is the group ID attribute of the file or directory that was created, or whose attributes were modified
- *Mode* is the octal representation of the mode of the file or directory

where Action can be:

- *CREATE* indicates the file or directory was created
- *REMOVE* indicates the file or directory was removed
- *SETATTR* indicates the mode of the file or directory was modified by the user

where Object type can be:

- *DIR* the directory
- *FILE* the file

and where Path is the fully qualified path of the file or directory.

---

## Running RECONCILE after restoring a file system

The *db2\_recon\_aid* utility provides a mechanism for checking and running RECONCILE on tables that are potentially inconsistent with the DATALINK file data on the file server, after a disk failure on the file server.

**On AIX or Solaris**, the `db2_recon_aid` utility is located in the `INSTHOME/sqllib/adm` directory, where `INSTHOME` is the home directory of the instance owner.

**On Windows NT**, the `db2_recon_aid` utility is located in `x:\sqllib\bin` directory, where `x`: is the drive where you installed DB2 Data Links Manager.

To run RECONCILE, use the following syntax:

```
db2_recon_aid -check -db database_name==>
               [-server_name fileserver_name] [-reportdir report_directory]
```

where:

- `check` lists the tables that may need reconciliation. No reconcile operation will be performed.
- `database_name` is the name of the database for which the reconcile operation needs to be performed.
- `fileserver_name` is the name of the DLFM server for which the reconcile operation is to be performed. If no name is provided, all the file servers will be reconciled.
- `report_directory` is the directory containing a report for each of the reconcile operations. For each table on which reconcile was performed, files of the following format will be created where:
  - `<tbschema>` is the schema of the table.
  - `<tbname>` is the table name.
  - `<ext>` is `.ulk` or `.exp`. The `.ulk` file contains a list of files that were unlinked on the file server, and the `.exp` file contains a list of files that were in exception on the file server.

For more information, see refer to the RECONCILE command in the Command Reference.

---

## DB2 Data Links Manager Recovery Scenarios

This section lists some of the possible DB2 Data Links Manager failure scenarios and the steps required to recover from them. For a description of recommended procedures for easier recovery, see “DB2 Data Links Manager System Setup and Backup Recommendations” on page 116.

In the following scenarios, we will use the following terms and examples:

### **DLFS file system**

Registered prefix (example: `/dlink`)

### **DLFM backup directory**

Directory where files are backed up (example:  
/home/dlfm/dlfm\_backup)

### **DLFM home directory**

Home directory of DLFM user ID (example: /home/dlfm)

### **DLFM DB2 database**

DB2 database that contains all meta-data (DLFM\_DB)

### **DB2 database**

Registered database that contains DATALINK data type (example:  
CROWN)

## **Components that may require recovery**

The following components may require recovery after a crash of the DB2 Data Links server:

1. The DB2 database containing a table which has a DATALINK column.
2. The DB2 Data Links Manager database (DLFM\_DB).
3. Data Links Filesystem Filter (DLFF).
4. File systems under the control of the DB2 DLFF which are registered to the Data Links Manager.
5. The DB2 Data Links Manager backup directory

## **Recovery scenarios**

The following recovery scenarios may require operations to be performed on both the DB2 node and the DB2 File Manager node.

The DB2 database is referred to as "CROWN" throughout all examples, and the DB2 table containing the DATALINK column is referred to as "DATALINKTABLE".

| <b>Scenario</b>                                                                               | <b>Recovery Steps</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DB2 database is lost or was accidentally dropped, but DB2 backup and log files are available. | <p>In this scenario, the DB2 database has not been dropped from the DLFM server.</p> <ol style="list-style-type: none"><li>1. On the DB2 server, enter the following commands to place all tables in Datalink_Reconcile_Not_Possible (DRNP) state:<br/><pre>db2 "restore database CROWN"<br/>db2 "rollforward database CROWN to end of logs and stop"</pre></li><li>2. Place all tables with datalinks into Datalink_Reconcile_Pending (DRP) state with the following commands:<br/><pre>db2 set integrity for &lt;table&gt; datalink reconcile pending<br/>db2 set integrity for &lt;table&gt; datalink reconcile pending immediate unchecked<br/>db2 reconcile &lt;table&gt;</pre></li></ol> |

| Scenario                                                                                                                            | Recovery Steps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>DB2 database was explicitly dropped, but DB2 backup and log files are available.</p>                                             | <ol style="list-style-type: none"> <li>1. Ensure that the drop database operation is complete, and that all files associated with that database have been unlinked.</li> <li>2. On the Data Links server enter the following commands: <pre>db2 "connect to dl_fm_db" db2 "select dbid, dbname, dbinst, hostname from dfm dbid" db2 "update dfm_dbid set action=5 where dbid=x'35B3D7BE00068F7B'"</pre> <p>Set dbid equal to value found in previous step.</p> </li> <li>3. On the DB2 server enter the following commands to place all tables in Datalink_Reconcile_Not_Possible (DRNP) state: <pre>db2 "restore database CROWN" db2 "rollforward database CROWN to end of logs and stop"</pre> </li> <li>4. For each table placed in DRNP state in step 3, enter the following commands: <pre>db2 set integrity for &lt;table&gt; datalink reconcile pending db2 set integrity for &lt;table&gt; datalink reconcile pending immediate unchecked db2 reconcile &lt;table&gt;</pre> </li> </ol> |
| <p>The DLFM_DB database is lost, but the backup and all log files for the DLFM_DB database are available.</p>                       | <ol style="list-style-type: none"> <li>1. On the Data Links server enter the following commands: <pre>db2 "restore database dl_fm_db" db2 "rollforward database dl_fm_db to end of logs and stop"</pre> </li> <li>2. On the DB2 server enter the following command: <pre>db2 "connect to CROWN" db2 "reconcile table DATALINKTABLE"</pre> </li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <p>The DLFM_DB database is lost, a backup of the DFLM_DB database is available, but the not all of the log files are available.</p> | <ol style="list-style-type: none"> <li>1. On the Data Links server enter the following commands: <pre>db2 "restore database dl_fm_db" db2 "rollforward database dl_fm_db to end of logs and stop"</pre> </li> <li>2. On the DB2 server enter the following commands to place all tables in Datalink_Reconcile_Pending (DRP) state: <pre>db2 "connect to CROWN" db2 "restore database dl_fm_db" db2 "rollforward database dl_fm_db to end of logs and stop"</pre> </li> <li>3. Place all tables with datalinks into DRP state by entering the following commands: <pre>db2 set integrity for &lt;table&gt; datalink reconcile pending db2 set integrity for &lt;table&gt; datalink reconcile pending immediate unchecked db2 reconcile &lt;table&gt;</pre> </li> </ol>                                                                                                                                                                                                                           |

| Scenario                                                                                                                                                         | Recovery Steps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The DLFS file system is lost.                                                                                                                                    | <ol style="list-style-type: none"> <li>1. Restore the DLFS file system from your storage manager.</li> <li>2. On the DB2 Server enter the following command:<br/> <code>db2_recon_aid CROWN</code></li> </ol>                                                                                                                                                                                                                                                                                                                                         |
| The DLFM backup directory is lost.                                                                                                                               | Restore the DLFM backup directory from your storage manager.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| The DLFS file system and the DLFM backup directory are lost.                                                                                                     | <ol style="list-style-type: none"> <li>1. Restore the DLFM backup directory from your storage manager.</li> <li>2. Restore the DLFS file system from your storage manager.</li> <li>3. On the DB2 Server enter the following command:<br/> <code>db2_recon_aid CROWN</code></li> </ol>                                                                                                                                                                                                                                                                |
| The DLFM_DB database, the DLFM backup directory, and the DLFS file system are lost, but the backup and all log files for the DLFM_DB database are available.     | <ol style="list-style-type: none"> <li>1. On the Data Links server enter the following commands to place all tables in Datalink_Reconcile_Pending (DRP) state:<br/> <code>db2 "restore database dlfm_db"</code><br/> <code>db2 "rollforward database dlfm_db to end of logs and stop"</code></li> <li>2. Restore the DLFM backup directory from your storage manager.</li> <li>3. Restore the DLFS file system from your storage manager.</li> <li>4. On the DB2 Server enter the following command:<br/> <code>db2_recon_aid CROWN</code></li> </ol> |
| The DLFM_DB, the DLFS file system, and the DLFM backup directory are lost. The backup of the DLFM_DB database is available, but not all log files are available. | <ol style="list-style-type: none"> <li>1. On the Data Links server enter the following commands:<br/> <code>db2 "restore database dlfm_db"</code><br/> <code>db2 "rollforward database dlfm_db to end of logs and stop"</code></li> <li>2. Restore the DLFM backup directory from your storage manager.</li> <li>3. Restore the DLFS file system from your storage manager.</li> <li>4. On the DB2 Server enter the following command:<br/> <code>db2_recon_aid CROWN</code></li> </ol>                                                               |

| Scenario                                                                                                                                                                      | Recovery Steps                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>The DB2 database, the DLFM_DB database, the DLFS file system and DLFM backup directory are lost, but backup, and all log files for the DLFM_DB database are available.</p> | <ol style="list-style-type: none"> <li>1. On the Data Links server enter the following commands: <pre>db2 "restore database dlfm_db" db2 "rollforward database dlfm_db to end of logs and stop"</pre> </li> <li>2. Restore the DLFM backup directory from your storage manager.</li> <li>3. Restore the DLFS file system from your storage manager.</li> <li>4. On the DB2 server enter the following commands to place all tables in Datalink_Reconcile_Not_Possible (DRNP) state: <pre>db2 "restore database CROWN" db2 "rollforward database CROWN to end of logs and stop" db2 "connect to CROWN"</pre> </li> <li>5. For each table placed in DRNP state in step 4, enter the following commands to place them in DNP state: <pre>db2 set integrity for &lt;table&gt; datalink reconcile pending db2 set integrity for &lt;table&gt; datalink reconcile pending immediate unchecked db2 reconcile &lt;table&gt;</pre> </li> </ol> <p><b>Note:</b> Rollforward to a point-in-time may not put tables that have all DATALINK columns defined as recovery = no into Datalink_Reconcile_Pending (DRP) state. For all such tables, run the reconcile utility.</p> |

---

## Part 6. Appendixes





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## Appendix A. DB2 Data Links Manager Errors and User Responses

This section describes the errors, messages, causes, and required actions to errors that you may encounter when using the Data Links File Manager on AIX or Windows NT.

On AIX, error messages are directed to the *INSTHOME*/sql11ib/db2dump/db2diag.log file, where *INSTHOME* is the home directory of the instance owner. Error messages are also returned to the user who executed the **dlfm** command.

On Windows NT, error messages are directed to the *x:\sql11ib\instance\db2diag.log* file, where *x*: is the directory where you installed DB2 Data Links Manager and *instance* is the name of the instance for which you want to change the diagnostic setting. Error messages are also returned to the user who executed the **dlfm** command.

---

### DLFM001I

Data Links File Manager started.

**Cause:** The Data Links File Manager has started successfully.

**Action:**  
None.

---

### DLFM101E

Error in the Data Links File Manager start-up. See the appropriate reason code.

**Reason Code -1:**

The Data Links File Manager is already running.

**Cause:** Possible causes are:

1. The Data Links File Manager is already running.
2. The Data Links File Manager (or one of its agents) is still active, even after stopping the Data Links File Manager.

**Action:**

Perform the following steps:

1. Log on to the system as the DB2 Data Links Manager Administrator.

2. Enter the **dlfm stop** command to stop the Data Links File Manager.
3. Enter the **dlfm shutdown** command to shutdown the Data Links server.
4. Start the Data Links File Manager by entering the **dlfm start** command.

**Reason Code -2:**

Initialization of the Data Links File Manager log manager failed.

**Cause:** There is a problem in initializing the Data Links File Manager log manager.

**Action:**

Perform the following steps:

1. See the error trace information in the `db2diag.log`.
2. Report the problem to an IBM technical service representative.

**Reason Code -3:**

Data Links File Manager initialization failed.

**Cause:** Possible causes are:

1. An operating system call failed.
2. There was an error in initializing global shared resources for the Data Links File Manager.
3. There was an error in initializing a critical Data Links File Manager service.
4. There was an error in initializing a communication service.

**Action:**

Perform the following steps:

1. See the error trace information in the `db2diag.log`.
2. Contact the system administrator for further help.

---

## DLFM201E

Error in the Data Links File Manager registration service. See the appropriate reason code.

**Reason Code -1:**

There is an invalid database server registration entry.

**Cause:** The *database\_name*, *instance\_name*, or *node\_name* parameters in the registration entry are not valid.

**Action:**

The DB2 Data Links Manager Administrator should register the correct values for the *database\_name*, *instance\_name*, or *node\_name* parameters.

For more information, see “Listing or Adding Registered File Systems Under the Control of a Data Links Filesystem Filter on AIX or Solaris” on page 102.

**Reason Code -2:**

Error in database registration.

**Cause:** There is an error with the Data Links File Manager log manager.

**Action:**

Perform the following steps:

1. See the error trace information in the *db2diag.log*.
2. Report the problem to an IBM technical service representative.

**Reason Code -3:**

Invalid prefix entry.

**Cause:** Possible causes are:

1. A file system does not exist on the local system.
2. On AIX, the file system is not mounted using the specified Data Links Filesystem Filter.
3. On Windows NT, the share drive is not loaded using the specified Data Links Filesystem Filter.

**Action:**

The DB2 Data Links Manager Administrator should mount or load the file system using the Data Links Filesystem Filter as the specified file prefix.

**Reason Code -4:**

Error in prefix registration.

**Cause:** There is an error with the Data Links File Manager log manager.

**Action:**

Perform the following steps:

1. See the error trace information in the *db2diag.log*.
2. Report the problem to an IBM technical service representative.

For more information, see “Listing or Adding Registered File Systems Under the Control of a Data Links Filesystem Filter on AIX or Solaris” on page 102.

---

## DLFM301E

Data Links File Manager agent closing connection with remote database.

**Cause:** The Data Links File Manager log manager was interrupted while the Data Links File Manager was running.

**Action:**

Perform the following steps:

1. Log on to the system as the DB2 Data Links Manager Administrator.
2. Enter the **dlfm shutdown** command to shutdown the Data Links server.
3. Start the Data Links File Manager by entering the **dlfm start** command.

---

## DLFM401E

Connection management service failed and therefore the database could not connect to the Data Links File Manager. See the appropriate action (Connect or Disconnect).

Connect

**Cause:** The database failed to connect to the Data Links File Manager. The database is not registered with the Data Links File Manager, or there was an error accessing system shared resources, or an operating system error occurred.

**Action:**

Perform the following steps:

1. See the error trace information in the `db2diag.log`.
2. The DB2 Data Links Manager Administrator should register the database with the Data Links File Manager or report the problem to an IBM technical service representative.

Disconnect

**Cause:** Possible causes are:

1. There is an error with the Data Links File Manager log manager.
2. There was an error encountered when accessing system shared resources or an operating system error occurred.

3. The Data Links File Manager log file is corrupt.

**Action:**

Perform the following steps:

1. See the error trace information in the db2diag.log.
2. Restart the Data Links File Manager (if needed).
3. Report the problem to an IBM technical service representative.

---

## **DLFM501E**

Transaction management service failed. See the appropriate action (AbortTxn, BeginTxn, CommitTxn, PrepareTxn, QueryARTxn, or QueryPreparedTxn).

### **AbortTxn**

**Cause:** Possible causes are:

1. There is an error with the Data Links File Manager log manager.
2. There was an error encountered when accessing system shared resources or an operating system error occurred.
3. The Data Links File Manager log file is corrupt.

**Action:**

Perform the following steps:

1. See the error trace information in the db2diag.log.
2. Restart the Data Links File Manager (if needed).
3. Report the problem to an IBM technical service representative.

### **BeginTxn**

**Cause:** Possible causes are:

1. There is an error with the Data Links File Manager log manager.
2. There was an error encountered when accessing system shared resources or an operating system error occurred.
3. The Data Links File Manager log file is corrupt.

**Action:**

Perform the following steps:

1. See the error trace information in the db2diag.log.
2. Restart the Data Links File Manager (if needed).
3. Report the problem to an IBM technical service representative.

### **CommitTxn**

**Cause:** Possible causes are:

1. There is an error with the Data Links File Manager log manager.

2. There was an error encountered when accessing system shared resources or an operating system error occurred.
3. The Data Links File Manager log file is corrupt.

**Action:**

Perform the following steps:

1. See the error trace information in the db2diag.log.
2. Restart the Data Links File Manager (if needed).
3. Report the problem to an IBM technical service representative.

PrepareTxn

**Cause:**

1. There is an error with the Data Links File Manager log manager.
2. There was an error encountered when accessing system shared resources or an operating system error occurred.
3. The Data Links File Manager log file is corrupt.

**Action:**

Perform the following steps:

1. See the error trace information in the db2diag.log.
2. Restart the Data Links File Manager (if needed).
3. Report the problem to an IBM technical service representative.

QueryARTxn

**Cause:** Possible causes are:

1. There is an error with the Data Links File Manager log manager.
2. There was an error encountered when accessing system shared resources or an operating system error occurred.
3. The Data Links File Manager log file is corrupt.

**Action:**

Perform the following steps:

1. See the error trace information in the db2diag.log.
2. Restart the Data Links File Manager (if needed).
3. Report the problem to an IBM technical service representative.

QueryPreparedTxn

**Cause:** Possible causes are:

1. There is an error with the Data Links File Manager log manager.
2. There was an error encountered when accessing system shared resources or an operating system error occurred.

3. The Data Links File Manager log file is corrupt.

**Action:**

Perform the following steps:

1. See the error trace information in the db2diag.log.
2. Restart the Data Links File Manager (if needed).
3. Report the problem to an IBM technical service representative.

---

## DLFM601E

Group management service failed. See the appropriate action (DefineGroup, DeleteDatabase, DeleteGroup, and QueryGroups).

### DefineGroup

**Cause:** Possible causes are:

1. There is an error with the Data Links File Manager log manager.
2. There was an error encountered when accessing system shared resources or an operating system error occurred.
3. The Data Links File Manager log file is corrupt.

**Action:**

Perform the following steps:

1. See the error trace information in the db2diag.log.
2. Restart the Data Links File Manager (if needed).
3. Report the problem to an IBM technical service representative.

### DeleteDatabase

**Cause:** Possible causes are:

1. There is an error with the Data Links File Manager log manager.
2. There was an error encountered when accessing system shared resources or an operating system error occurred.
3. The Data Links File Manager log file is corrupt.

**Action:**

Perform the following steps:

1. See the error trace information in the db2diag.log.
2. Restart the Data Links File Manager (if needed).
3. Report the problem to an IBM technical service representative.

### DeleteGroup

**Cause:** Possible causes are:

1. There is an error with the Data Links File Manager log manager.

2. There was an error encountered when accessing system shared resources or an operating system error occurred.
3. The Data Links File Manager log file is corrupt.

**Action:**

Perform the following steps:

1. See the error trace information in the db2diag.log.
2. Restart the Data Links File Manager (if needed).
3. Report the problem to an IBM technical service representative.

QueryGroups

**Cause:** Possible causes are:

1. There is an error with the Data Links File Manager log manager.
2. There was an error encountered when accessing system shared resources or an operating system error occurred.
3. The Data Links File Manager log file is corrupt.

**Action:**

Perform the following steps:

1. See the error trace information in the db2diag.log.
2. Restart the Data Links File Manager (if needed).
3. Report the problem to an IBM technical service representative.

---

## DLFM701E

Prefix management service failed. See the appropriate action (ResolvePrefixId or ResolvePrefixName).

ResolvePrefixId

**Cause:** Possible causes are:

1. There is an error with the Data Links File Manager log manager.
2. There was an error encountered when accessing system shared resources or an operating system error occurred.
3. The Data Links File Manager log file is corrupt.

**Action:**

Perform the following steps:

1. See the error trace information in the db2diag.log.
2. Restart the Data Links File Manager (if needed).
3. Report the problem to an IBM technical service representative.

ResolvePrefixName



**Cause:** The prefix for the given file is not registered with the Data Links File Manager.

**Action:**

The DB2 Data Links Manager Administrator should register this file with the Data Links server.

---

## DLFM801E

File management service failed. See the appropriate action (LinkFiles, ReleaseDelete, ReleaseRestore, Takeover, or UnlinkFile).

### LinkFiles

**Cause:** Possible causes are:

1. There is an error with the Data Links File Manager log manager.
2. There was an error encountered when accessing system shared resources or an operating system error occurred.
3. The Data Links File Manager log file is corrupt.

**Action:**

Perform the following steps:

1. See the error trace information in the db2diag.log.
2. Restart the Data Links File Manager (if needed).
3. Report the problem to an IBM technical service representative.

### ReleaseDelete

**Cause:** The Data Links File Manager is unable to delete the file in its current state. The file was deleted or modified while it was being managed by the Data Links File Manager.

**Action:**

Check the status of this file and delete it if necessary.

### ReleaseRestore

**Cause:** The Data Links File Manager is unable to restore the original owners and the permissions of this file. The file was deleted or modified while it was being managed by the Data Links File Manager.

**Action:**

Check the status of this file and delete it if necessary.

### Takeover

**Cause:** The Data Links File Manager is unable to initiate the management of a file. The file was deleted or modified while it was being managed by the Data Links File Manager.

**Action:**

Check the status of this file and delete it if necessary.

UnlinkFile

**Cause:** Possible causes are:

1. There is an error with the Data Links File Manager log manager.
2. There was an error encountered when accessing system shared resources or an operating system error occurred.
3. The Data Links File Manager log file is corrupt.

**Action:**

Perform the following steps:

1. See the error trace information in the `db2diag.log`.
2. Restart the Data Links File Manager (if needed).
3. Report the problem to an IBM technical service representative.

---

## DLFM9001

The Data Links File Manager server is stopped.

**Cause:** The Data Links File Manager was stopped normally or abnormally.

**Action:**

None required.

---

## DLFM901E

One of the Data Links File Manager agents terminated abnormally.

**Cause:** The Data Links File Manager was stopped normally or abnormally.

**Action:**

Perform the following steps:

1. See the error trace information in the `db2diag.log`.
2. Log on to the system as the DB2 Data Links Manager Administrator.
3. Enter the **dlfm shutdown** command to shutdown the Data Links server.
4. Start the Data Links File Manager by entering the **dlfm start** command.

---

## DLFM905E

There was an abnormal shutdown of the Data Links File Manager.

**Cause:** There was an abnormal shutdown of the Data Links File Manager due to a problem with global shared system resources.

**Action:**

Perform the following steps:

1. See the error trace information in the `db2diag.log`.
2. Log on to the system as the DB2 Data Links Manager Administrator.
3. Enter the **dlfm shutdown** command to shutdown the Data Links server.
4. Start the Data Links File Manager by entering the **dlfm start** command.

---

## DLFM906E

The Transaction Management service was unable to take over the file. The error message states *The Data Links Manager will attempt the operation again*.

**Cause** Data Links Manager failed to takeover the file that was inserted into a DATALINK column. Before commit processing could complete, one of the following may have happened:

- The filesystem containing the file went offline.
- The file was deleted by the user.

---

## DLFM907E

The Transaction Management service was unable to return the file to the filesystem. The error code was . The Data Links Manager will attempt the operation again.

**Cause** Data Links Manager failed to release the file to the filesystem that was deleted from a DATALINK column. Before commit processing could complete, one of the following may have happened:

- The filesystem containing the file went offline.
- The file was deleted by an administrative user.

**Action**

No user action is required. Data Links Manager will try the operation again.

---

**DLFM908E**

The Transaction Management service was unable to take-over file(s) or release file(s) after repeated attempts. The Data Links Manager has been stopped. No further activity will be allowed.

**Cause** Data Links Manager failed to take over or release file(s) to the filesystem that were inserted into, or deleted from, a DATALINK column. Before commit processing could complete, one of the following may have happened:

- The filesystem containing the file went offline.
- The file was deleted by an administrative user.

**Action**

Perform the following steps:

1. Make sure the filesystem is available and check for the existence of the file.
2. If the file was not deleted and is now available, then restart the Data Links Manager. This should release the file and the Data Links Manager should become usable.

If the file was deleted or if the problem persists, please report the problem to an IBM technical service representative.

---

## Appendix B. CLI Example

The following is an example of a DB2 CLI program designed to:

- Connect to a database.
- Create a table with a single DATALINK row.
- Insert a single row into this database.
- Fetch the data parse information.
- Drop the table.
- Disconnect from the database.

This program can be executed on AIX, Solaris, or Windows NT. Windows NT-specific syntax and output is denoted in comments similar to the following:

```
/*
*****
On Windows NT ...

*****
**//*****
**
** Source File Name = datalink.c
**
** Licensed Materials - Property of IBM
**
** (C) COPYRIGHT International Business Machines Corp. 1998
** All Rights Reserved.
**
** US Government Users Restricted Rights - Use, duplication or
** disclosure restricted by GSA ADP Schedule Contract with IBM Corp.
**
** PURPOSE :
** Modified version of the CLI sample clisampl.c to demonstrate creating and
** parsing
**
** The following operations are performed:
** - Connect to a database.
** - Create a table with a single datalink
** - Insert a single row using SQLBuildDataLink() and SQLBindParameter()
** - Fetch the data
** - parse information from the retrieved datalink using SQLGetDataLinkAttr()
** - Drop the table
** - Disconnect from the database.
**
*****/
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <sqlclil.h>
#include "samputil.h"          /* Header file for CLI sample code */
/*
```

```

* Global Variables for user id and password.
* To keep samples simple, not a recommended practice.
*/
extern SQLCHAR server[SQL_MAX_DSN_LENGTH + 1] ;
extern SQLCHAR uid[MAX_UID_LENGTH + 1] ;
extern SQLCHAR pwd[MAX_PWD_LENGTH + 1] ;

void getattr(
    SQLHSTMT hStmt,
    SQLSMALLINT AttrType,
    SQLCHAR* DataLink,
    SQLCHAR* Attribute,
    SQLINTEGER BufferLength )
{
    SQLINTEGER StringLength ;
    SQLRETURN rc ;

rc = SQLGetDataLinkAttr(
    hStmt,
    AttrType,
    DataLink,
    strlen( (char *)DataLink),
    Attribute,
    BufferLength,
    &StringLength
) ;
CHECK_HANDLE( SQL_HANDLE_STMT, hStmt, rc ) ;

printf("Attribute #%d <%=s>\n", AttrType, Attribute) ;
return ;
}

int main(int argc, char * argv[] ) {

    SQLHANDLE henv, hdbc, hstmt ;
    SQLRETURN rc ;

    SQLCHAR szCreate[] = "CREATE TABLE DL_SAMPL "
        "( "
        "DL1 DATALINK "
        "LINKTYPE URL "
        "FILE LINK CONTROL "
        "INTEGRITY ALL "
        "READ PERMISSION DB "
        "WRITE PERMISSION BLOCKED "
        "RECOVERY NO "
        "ON UNLINK RESTORE "
        ")";

    SQLCHAR szInsert[] = "INSERT INTO DL_SAMPL VALUES (?)";

    SQLCHAR szFileLink[] = "http://mycomputer.company.com/nfsdlink/userid/test_1.jpg"
/*
    *****
    On Windows NT, replace "http://...jpg" with:
    "unc:\\mycomputer.company.com\\nfsdlink\\userid\\test_1.jpg" ;
    *****
*/
    SQLCHAR szComment[] = "My First Datalink" ;

    SQLCHAR szSelect[] = "SELECT * FROM DL_SAMPL" ;
    SQLCHAR szDrop[] = "DROP TABLE DL_SAMPL" ;
    SQLCHAR szDLCol[254] ;

```

```

SQLCHAR szBuffer[254] ;
SQLSMALLINT cCol ;
SQLCHAR szColName[33] ;
SQLSMALLINT fSqlType ;
SQLINTEGER cbColDef ;
SQLSMALLINT ibScale ;
SQLSMALLINT fNullable ;
SQLINTEGER siLength= SQL_NTS ;

/* macro to initialize server, uid and pwd */
INIT_UID_PWD ;

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

/* allocate a connect handle, and connect */
rc = DBconnect( henv, &hdbc ) ;
if ( rc != SQL_SUCCESS ) return( terminate( henv, rc ) ) ;

rc = SQLAllocHandle( SQL_HANDLE_STMT, hdbc, &hstmt ) ;
CHECK_HANDLE( SQL_HANDLE_DBC, hdbc, rc ) ;

/*
 * Create the sample table. This code assumes
 * that the table DL_SAMPL does not exist.
 */

printf( "Create table - %s\n", szCreate ) ;
rc = SQLExecDirect( hstmt, szCreate, SQL_NTS ) ;
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

/* Commit the changes. */
rc = SQLEndTran( SQL_HANDLE_DBC, hdbc, SQL_COMMIT ) ;
CHECK_HANDLE( SQL_HANDLE_DBC, hdbc, rc ) ;

/* Prepare an insert statement. */
printf( "Insert - %s\n", szInsert ) ;
rc = SQLPrepare( hstmt, szInsert, SQL_NTS ) ;
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

/* Build Datalink */
rc = SQLBuildDataLink( hstmt,
                      (SQLCHAR *) "URL",
                      strlen("URL"),
                      szFileLink,
                      strlen((char*)szFileLink),
                      szComment,
                      strlen((char *)szComment),
                      szDLCol,
                      sizeof(szDLCol),
                      &siLength
                      );

CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

/* Set input parameter. */
rc = SQLBindParameter(
                      hstmt,
                      1,
                      SQL_PARAM_INPUT,
                      SQL_C_DATALINK,
                      SQL_DATALINK,

```

```

        sizeof(szDLCol),
        0,
        (SQLPOINTER)szDLCol,
        sizeof(szDLCol),
        NULL
    );
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc );

/* Insert row into the database. */
rc = SQLExecute( hstmt );
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc );

/* Commit the changes. */
rc = SQLEndTran( SQL_HANDLE_DBC, hdbc, SQL_COMMIT );
CHECK_HANDLE( SQL_HANDLE_DBC, hdbc, rc );

/* Reset input parameter. */
rc = SQLFreeStmt( hstmt, SQL_RESET_PARAMS );
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc );

/* Execute the select statement. */
printf( "Select - %s\n", szSelect );
rc = SQLExecDirect( hstmt, szSelect, SQL_NTS );
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc );

/* Return number of columns and describe result set. */
rc = SQLNumResultCols( hstmt, &cCol );
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc );
printf( "Number of columns - %d\n", cCol );
rc = SQLDescribeCol( hstmt,
    1,
    szColName,
    sizeof( szColName ),
    NULL,
    &fSqlType,
    &cbColDef,
    &ibScale,
    &fNullable
);
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc );
printf( "Column name - %s\n", szColName );
printf( "Column type - %d\n", fSqlType );
printf( "Column precision - %ld\n", cbColDef );
printf( "Column scale - %d\n", ibScale );
printf( "Column nullable - %s\n", ( fNullable ) ? "TRUE" : "FALSE" );

/* Bind the output parameter. */
rc = SQLBindCol( hstmt, 1, SQL_C_DATALINK, szDLCol, sizeof(szDLCol), NULL );
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc );

/* Fetch data. */
rc = SQLFetch( hstmt );
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc );

printf( "Column value - %s\n", szDLCol );

getattr( hstmt, 1, szDLCol, szBuffer, sizeof( szBuffer ) );
getattr( hstmt, 2, szDLCol, szBuffer, sizeof( szBuffer ) );
getattr( hstmt, 3, szDLCol, szBuffer, sizeof( szBuffer ) );
getattr( hstmt, 4, szDLCol, szBuffer, sizeof( szBuffer ) );
getattr( hstmt, 5, szDLCol, szBuffer, sizeof( szBuffer ) );
getattr( hstmt, 6, szDLCol, szBuffer, sizeof( szBuffer ) );
getattr( hstmt, 7, szDLCol, szBuffer, sizeof( szBuffer ) );

```



```

/* Close cursor and free bound columns. */
/* Free statement resources */
rc = SQLFreeStmt(hstmt, SQL_UNBIND );
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc );

rc = SQLFreeStmt( hstmt, SQL_CLOSE );
CHECK_HANDLE(SQL_HANDLE_STMT, hstmt, rc );

/* Drop table. */
rc = SQLExecDirect(hstmt, szDrop, SQL_NTS );
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc );

/* Commit the changes. */
rc = SQLEndTran( SQL_HANDLE_DBC, hdbc, SQL_COMMIT );
CHECK_HANDLE( SQL_HANDLE_DBC, hdbc, rc );

/* Disconnect and free up CLI resources. */
rc = SQLFreeHandle(SQL_HANDLE_STMT, hstmt );
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc );

printf( "\n>Disconnecting ..... \n" );
rc = SQLDisconnect(hdbc );
CHECK_HANDLE( SQL_HANDLE_DBC, hdbc, rc );

rc= SQLFreeHandle( SQL_HANDLE_DBC, hdbc );
CHECK_HANDLE( SQL_HANDLE_DBC, hdbc, rc );

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

return(SQL_SUCCESS );

} /* end main */

/* =====
** Sample Output:
**
** >Enter Server Name:
** sample
** >Enter User Name:
** userid
** >Enter Password:
** password
** >Connected to sample
** Create table - CREATE TABLE DL_SAMPL
** ( DL1 DATALINK LINKTYPE URL FILE LINK CONTROL INTEGRITY ALL
** READ PERMISSION DB WRITE PERMISSION BLOCKED RECOVERY NO ON UNLINK RESTORE )
** Insert - INSERT INTO DL_SAMPL VALUES (?)
** Select - SELECT * FROM DL_SAMPL
** Number of columns - 1
** Column name - DL1
** Column type - -400
** Column precision - 254
** Column scale - 0
** Column nullable - TRUE
** Column value - 1,URL,79,17,19,HTTP://mycomputer.company.com/nfsdlink/userid/
** HVJ5NXGC0WQ.I5KKB6;test_1.jpgMyFirst Datalink

/*

```

```

*****
On Windows NT, the sample output will be:
** Column value - 1,UNC:\\mycomputer.company.com\nfsdlink\userid\
  HVJ5NXGC0WQ.I5KKB6;test_1.jpgMyFirst Datalink
*****
*/
** Attribute #1) <My First Datalink>
** Attribute #2) <URL>
** Attribute #3) <HTTP://mycomputer.company.com/nfsdlink/userid/
  HVJ5NXGC0WQ.I5KKB6;test_1.jpg>
/*
*****
On Windows NT, the sample output will be:
** Attribute #3) <UNC:\\mycomputer.company.com\nfsdlink\userid\
  HVJ5NXGC0WQ.I5KKB6;test_1.jpg>
*****
*/
** Attribute #4) </nfsdlink/userid/HVJ5NXGC0WQ.I5KKB6;test_1.jpg>
/*
*****
On Windows NT, the sample output will be:
** Attribute #4) <\nfsdlink\userid\HVJ5NXGC0WQ.I5KKB6;test_1.jpg>
*****
*/
** Attribute #5) </nfsdlink/userid/test_1.jpg>
/*
*****
On Windows NT, the sample output will be:
** Attribute #5) <\nfsdlink\userid\test_1.jpg>
*****
*/
** Attribute #6) <HTTP>
/*
*****
On Windows NT, the sample output will be:
** Attribute #6) <UNC>
*****
*/
** Attribute #7) <mycomputer.company.com>
**
** >Disconnecting .....
**
**
===== */

```

---

## Appendix C. DCE-DFS Common Tasks and References

This appendix contains information on tasks which must be performed in your DCE-DFS environment to configure your Data Links solution. It also provides pointers to further information about DCE-DFS.

---

### Creating a New DCE Identity

Before installing DB2 Data Links Manager in a DCE-DFS environment, your DCE cell administrator must create a new DCE identity, consisting of a new user and a new group. This new user and group should not be used for any other purpose.

To create a new DCE identity:

1. Identify the DFS file servers which will store any linked files. Designate one to hold the DLFM\_DB (DB2 server node) and the rest as clients of the DLFM\_DB. Additional DFS servers can be added as Data Links Manager nodes at any time.
2. Identify a uid value and a gid value to be used to administer the Data Links Manager in the cell. Both the uid and gid must not already be in use by any principal in the cell or by any user on the DFS file servers identified above.
3. Identify a corresponding user name and group name. Again, these names cannot already be in use, either in your DCE environment or elsewhere on your AIX system. For example, you might call these names the DLMADMIN user name/uid and DLMADMIN group name/gid.
4. Ask your DCE cell administrator to do the following:
  - a. Create a new DCE group having the gid identified above and the group name identified above.
  - b. Create a new DCE principal with uid as identified above and user name as identified above
  - c. Add this DCE principal to the DCE group.

This DCE principal and DCE group must be used only for administration of Data Links Manager.

5. As root on each DFS file server, create a group with its name and gid as identified above. On each DFS file server, create a user with its name and uid as identified above, and make this user a member of the group you just created.

Next, validate the setup of the new DCE identity. In this scenario, we will assume that the DLMADMIN *name/uid* is *d1madmin/14649* and the DLMADMIN *group/gid* is *d1madmin/14649*.

1. Check the DCE **uid** by entering the following command:

```
dcecp -c principal show d1madmin
```

In our scenario, this command would return the following output:

```
{fullname {Data Links Manager Admin}}
{uid 14649}
{uuid 00003939-38d0-21d3-9700-006094e92924}
{alias no}
{quota unlimited}
{groups d1madmin}
```

2. Check the DCE **gid** by entering the following command:

```
dcecp -c group show d1madmin
```

In our scenario, this command would return the following output:

```
{alias no}
{fullname {Data Links Manager Admin}}
{gid 14649}
{uuid 00003939-38d0-21d3-b500-006094e92924}
{inproplist yes}
```

3. On each Data Links Manager server, verify that the UNIX uid matches the DCE uid by entering the following command:

```
lsuser d1madmin
```

In our scenario, this command would return the following output:

```
d1madmin id=14649 pgrp=d1madmin groups=d1madmin ==>
home=/u/d1madmin shell=/bin/ksh gecos=Data Links Mgr Admin
```

4. On each Data Links Manager server, verify that the UNIX gid matches the DCE gid by entering the following command:

```
lsgroup d1madmin
```

In our scenario, this command would return the following output:

```
d1madmin id=14649 users=d1madmin
```

---

## Creating a DFS Fileset for DataLinks Configuration

Ask your DCE cell administrator to set up a DFS fileset to hold the Data Links Manager configuration files. This must be a LFS (not a DMLFS) fileset and must have mount point `:/DataLinks`. This directory should have the owner and group set to the DLMADMIN user and group. This fileset should not be replicated. Make sure that this fileset is backed up on a regular basis. Your DCE cell administrator should also perform the following tasks.

1. Ensure that the ACLs of `/:` are set so that `any_other` for `/:` is `{any_other r-x---`. To verify this setting, enter the following command:

```
dcecp -c acl show /: | grep any_other
```

2. The DCE Object ACL for `/:/DataLinks` must be set up as follows:

```
{mask_obj r-x---}  
{user_obj rwxcid}  
{group_obj r-x---}  
{other_obj r-x---}  
{any_other r-x---
```

To verify these settings, enter the following command:

```
dcecp -c acl show /:/DataLinks
```

3. The DCE Initial Container Creation ACL for `/:/DataLinks` must be set up as follows:

```
{mask_obj r-x---}  
{user_obj rwxcid}  
{group_obj r-x---}  
{other_obj r-x---}  
{any_other r-x---
```

To verify these settings, enter the following command:

```
dcecp -c acl show /:/DataLinks -ic
```

4. The DCE Initial Object Creation ACL for `/:/DataLinks` must be set up as follows:

```
{mask_obj r-x---}  
{user_obj rwxcid}  
{group_obj r-x---}  
{other_obj r-x---}  
{any_other r-x---
```

To verify these settings, enter the following command:

```
dcecp -c acl show /:/DataLink -io
```

5. The DCE administrator should change the owner/group of `/:/DataLinks` to `DLMADMIN` by entering the following command:

```
chown dlmadmin.dlmadmin /:/DataLinks
```

---

## References to DCE-DFS documentation

For further information on Transarc's DCE-DFS, refer to your product documentation or to the Transarc online library at <http://www.transarc.com/Library/documentation/index.html>.



---

## Appendix D. An Alternative Approach to Backing up a JFS on AIX

The following approach, which removes the requirement of stopping the Data Links Manager, is suggested for users who require higher availability.

1. Extract the following CLI source file `quiesce.c` and the shell script `online.sh`.
2. Compile `quiesce.c`:  

```
x1C -o quiesce -ldb2 -L$HOME/sql1lib/lib -I$HOME/sql1lib/include quiesce.c
```
3. Run the script on the node that has the DLFS file system.

The shell script `online.sh` assumes that you have a catalog entry on the Data Link Manager node for each database that is registered with the Data Link Manager. It also assumes that `/etc/filesystem` has the complete entry for the DLFS file system. The shell script does the following:

- Quiesces all the tables in databases that are registered with the Data Links Manager. This will stop any new activity.
- Unmounts and remounts the file system as a read-only file system.
- Performs a file system backup.
- Unmounts and remounts the file system as a read-write file system.
- Resets the DB2 tables; that is, brings them out of the quiesce state.

The script must be modified to suit your environment as follows:

1. Select the backup command and put in the `do_backup` function of the script.
2. Set the following environment variables within the script:
  - `DLFM_INST`: set this to the DLFM instance name.
  - `PATH_OF_EXEC`: set this to the path where the "quiesce" executable resides.

Invoke the script as follows:

```
online.sh <filesystem_name>
```

---

### online.sh

```
----- start of 'online.sh' script -----  
#!/bin/ksh  
  
# Sample script for performing a filesystem backup without bringing it  
# offline for most of the duration of the backup
```

```

# Some sections of the script need to be modified by the users to suit their
# specific needs including replacing some of the parameters with their own.
# Usage: onlineb <filesystem name>

#The dlfs filesystem being backed up would remain accessible in read-only mode
#for most of the time that the filesystem backup is going on.
#For a short while in between it may be necessary to have all users off the
#filesystem. This would be required at two points; the first, when switching
#the filesystem to read-only (an unmount followed by re-mount as read-only)
#and the second when switching it back to read-write (unmount again followed by
#re-mount as read-write)

# Environment dependent variables ...
# To be changed according to needs ...
DLFM_INST=sharada
PATH_OF_EXEC=/home/sharada/amit

# Local environment variables.
EXEC=quiesce
DLFM_DB_NAME=dlfm_db

# Function to check if root
check_id() {
if [ `id -u` -ne 0 ]
then
echo "You need to be root to run this"
exit 1
fi
}

#
# Function to quiesce the tables with Datalinks value in databases registered
# with DLFM_DB
#
quiesce_tables()
{
echo "Starting DB2 ..."
su - $DLFM_INST "-c db2start | tail -n 1" # Print just the last line
su - $DLFM_INST "-c $PATH_OF_EXEC/$EXEC -q $DLFM_DB_NAME"
}

#
# Function to make the dlfs filesystem read-only
#
# [The filesystem should not be in use during this time; no user should even
# have 'cd'-ied into the filesystem]
# - If the filesystem is NFS exported, unexport it
#
unexport_fs() {
if exportfs | grep -w $filesystem_name
then
echo $filesystem_name " is NFS exported"
nfs_export_existed=1

```



```

        echo "Unexporting " $filesystem_name
        exportfs -u $filesystem_name
        result=$?
        if [ $result -ne 0 ]
        then
            echo "Failed to unexport " $filesystem_name
            reset_tables
            exit 1
        fi
    else
        echo $filesystem_name " is not NFS exported"
    fi
}

#
# Function to Unmount the filesystem
#
umount_fs() {
    echo "Unmounting " $filesystem_name
    umount $filesystem_name
    result=$?
    if [ $result -ne 0 ]
    then
        echo "Unable to unmount " $filesystem_name
        echo "Filesystem " $filesystem_name " may be in use"
        echo "Please make sure that no one is using the filesystem and"
        echo "and then press a key"
        read $ans
        umount $filesystem_name
        result=$?
    fi
    if [ $result -ne 0 ]
    then
        echo "Unable to unmount " $filesystem_name
        echo "Aborting ..."
        echo "Resetting the quiesced tables ..."
        reset_tables
        exit 1
    fi

    echo "Successfully unmounted " $filesystem_name
}

#
# Function to remount the same filesystem back as read-only or
# read-write depending on the value of "RO" variable.
#
remount_fs()
{
    if [ $RO -eq 1 ]
    then
        echo "Now re-mounting " $filesystem_name " as read-only"
        mount -v dlfs -r $filesystem_name
    else
        echo "Now re-mounting " $filesystem_name " as read-write"
    fi
}

```

```

        mount -v dlfs $filesystem_name
    fi
    result=$?
    if [ $result -ne 0 ]
    then
        echo "Failed to remount " $filesystem_name
        echo "Aborting ..."
        reset_tables
        exit 1
    fi
    echo "Successfully re-mounted " $filesystem_name " as read-only"
}

#
# Function: If this was NFS exported, then export it a read-only now
#
make_fs_ro() {
    if [ $nfs_export_existed ]
    then
        echo "Re-exporting for NFS as read-only"
        chnfsexp -d $filesystem_name -N -t ro
        result=$?
        if [ $result -ne 0 ]
        then
            echo "Warning: Unable to NFS export " $filesystem_name
            # Not aborting here - continuing with a warning
            # at least the filesystem is available locally
            ## TBD: Or perhaps it would be better to exit
        else
            echo "Successfully exported " $filesystem_name " as read-only"
        fi
    fi
}

#
# Function to do the backup.
# Update this function with the backup command that you want to use.
#
do_backup() {
    echo "Initiating backup of " $filesystem_name

    # [ Add lines here to issue your favourite backup command with the right
    #   parameters, or uncomment one of the following ]

    # To invoke backup via smit, uncomment the following line
    # smit fs # Select Backup a Filesystem

    # OR
    # To issue the backup command directly, uncomment and modify the following
    # line with your own options (for example full/incremental) and the
    # appropriate parameters (you might want to replace /dev/rmt0 by the name of
    # your backup device)

```

```

# /usr/sbin/backup -f'/dev/rmt0' -'0' $filesystem_name
# result=$?
# if [ $result -ne 0 ]
# then
# echo "Backup failed"
# # Do we exit here ? Or cleanup ?
# else
# echo "Successful backup"
# fi

# OR
# Put in your own backup script here
#
}

#
# Function to remount the filesystem as read-write. And NFS export it, if it
# was NFS exported to start with.
export_fs() {
    if [ $nfs_export_existed ]
    then
        echo "Exporting back for NFS as read-write"
        chnfsexp -d $filesystem_name -N -t rw
        result=$?
        if [ $result -ne 0 ]
        then
            echo "Warning: Unable to NFS export " $filesystem_name
            # Not aborting here - continuing with a warning
            # at least the filesystem is available locally
            # TBD: Or perhaps it would be better to exit
        else
            echo "Successfully exported " $filesystem_name " as read-write"
        fi
    fi
}

# Function to reset Quiesced tables
reset_tables() {
    su - $DLFM_INST "-c $PATH_OF_EXEC/$EXEC -r $DLFM_DB_NAME"
}

#***** MAIN PORTION starts here ...*****

#Check args
#
if [ $# -lt 1 ]
then
    echo "Usage: " $0 " <filesystem_name>"
    exit 1
fi

check_id

```

```

# Quiesce tables ( after waiting for all transactions to get over ...)
quiesce_tables

# (i) umount and remount the filesystem as read-only

filesystem_name=$1
unexport_fs
umount_fs
RO=1
remount_fs # READ_ONLY
make_fs_ro

# (ii) Start BackUp

do_backup

# (iii) unmount and remount the filesystem as read-write

umount_fs
RO=0
remount_fs # READ_WRITE
export_fs

# Reset all Quiesced tables ...

reset_tables
# Now the filesystem is ready for normal operation of Datalinks
echo "Done"
exit 0
----- end of 'online.sh' script -----

```

---

## quiesce.c

```

----- start of 'quiesce.c' script -----
/*****
*
* OCO SOURCE MATERIALS
*
* COPYRIGHT: P#2 P#1
*           (C) COPYRIGHT IBM CORPORATION Y1, Y2
*
* The source code for this program is not published or otherwise divested of
* its trade secrets, irrespective of what has been deposited with the U.S.
* Copyright Office.
*
* Source File Name = quiesce.c           (%W%)
*
* Descriptive Name = Quiesce or Reset tables.
*
* Function: It quiesces ( OR resets ) the tables ( with datalinks column ) of
*           the databases which are registered with DLFM_DB
*
*           This program expects the databases registered with DLFM_DB are
*           catalogued. It also expects that db2 is started.
*
* Dependencies:
*
* Restrictions:
*
*****/

#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <sqlclil.h>
#include <sqlutil.h>
#include <sqlca.h>

#define MAX_UID_LENGTH 20

```

```

#define MAX_PWD_LENGTH 20
#define MAXCOLS 255

struct sqlca sqlca;
struct SQLB_TBSPQRY_DATA *sqlb;
#ifndef max
#define max(a,b) (a > b ? a : b)
#endif

#define CHECK_HANDLE( htype, hndl, RC ) if ( RC != SQL_SUCCESS ) \
    { check_error( htype, hndl, RC, __LINE__, __FILE__ ); }

SQLRETURN check_error( SQLSMALLINT, SQLHANDLE, SQLRETURN, int, char * ) ;
SQLRETURN DBconnect( SQLHANDLE, SQLHANDLE * ) ;
SQLRETURN print_error( SQLSMALLINT, SQLHANDLE, SQLRETURN, int, char * ) ;
SQLRETURN prompted_connect( SQLHANDLE, SQLHANDLE * ) ;
SQLRETURN terminate( SQLHANDLE, SQLRETURN ) ;

SQLCHAR server[SQL_MAX_DSN_LENGTH + 1] ;
SQLCHAR uid[MAX_UID_LENGTH + 1] ;
SQLCHAR pwd[MAX_PWD_LENGTH + 1] ;

/* check_error - calls print_error(), checks severity of return code */
SQLRETURN check_error( SQLSMALLINT htype, /* A handle type identifier */
                      SQLHANDLE hndl, /* A handle */
                      SQLRETURN frc, /* Return code to be included with error msg */
                      int line, /* Used for output message, indicate where */
                      char * file /* the error was reported from */
                      ) {

    print_error( htype, hndl, frc, line, file ) ;

    switch ( frc ) {
        case SQL_SUCCESS:
            break ;
        case SQL_INVALID_HANDLE:
            printf( "\n>----- ERROR Invalid Handle ----- \n" );
        case SQL_ERROR:
            printf( "\n>--- FATAL ERROR, Attempting to rollback transaction -- \n" );
            if ( SQLEndTran( htype, hndl, SQL_ROLLBACK ) != SQL_SUCCESS )
                printf( "\n>Rollback Failed, Exiting application\n" );
            else
                printf( "\n>Rollback Successful, Exiting application\n" );
            return( terminate( hndl, frc ) );
        case SQL_SUCCESS_WITH_INFO:
            printf( "\n> ---- Warning Message,
application continuing ----- \n" );
            break ;
        case SQL_NO_DATA_FOUND:
            printf( "\n> ---- No Data Found, application continuing ----- \n" );
            break ;
        default:
            printf( "\n> ----- Invalid Return Code ----- \n" );
            printf( "\n> ----- Attempting to rollback transaction ----- \n" );
            if ( SQLEndTran( htype, hndl, SQL_ROLLBACK ) != SQL_SUCCESS )
                printf( "\n>Rollback Failed, Exiting application\n" );
            else
                printf( "\n>Rollback Successful, Exiting application\n" );
            return( terminate( hndl, frc ) );
    }

    return ( frc ) ;
}

/* connect without prompt */
SQLRETURN DBconnect( SQLHANDLE henv,
                    SQLHANDLE * hdbc
                    ) {

    /* allocate a connection handle */
    if ( SQLAllocHandle( SQL_HANDLE_DBC,
                       henv,
                       hdbc
                       ) != SQL_SUCCESS ) {
        printf( "\n>---ERROR while allocating a connection handle---- \n" );
        return( SQL_ERROR ) ;
    }

    /* Set AUTOCOMMIT OFF */
    if ( SQLSetConnectAttr( * hdbc,
                           SQL_ATTR_AUTOCOMMIT,
                           ( void * ) SQL_AUTOCOMMIT_OFF, SQL_NTS
                           ) != SQL_SUCCESS ) {
        printf( "\n>---ERROR while setting AUTOCOMMIT OFF ----- \n" );
        return( SQL_ERROR ) ;
    }
}

```

```

}

if ( SQLConnect( * hdbc,
                server, SQL_NTS,
                uid,   SQL_NTS,
                pwd,   SQL_NTS
                ) != SQL_SUCCESS ) {
    printf( ">--- Error while connecting to database: %s -----\n",
           server
           );
    SQLDisconnect( * hdbc );
    SQLFreeHandle( SQL_HANDLE_DBC, * hdbc );
    return( SQL_ERROR );
}
else /* Print Connection Information */
    printf( "\nConnected to %s\n", server );

return( SQL_SUCCESS );
}

/*--> SQLL1X32.SCRIPT */
/* print_error - calls SQLGetDiagRec(), displays SQLSTATE and message **
** - called by check_error */

SQLRETURN print_error( SQLSMALLINT htype, /* A handle type identifier */
                      SQLHANDLE hnd1, /* A handle */
                      SQLRETURN frc, /* Return code to be included with error msg */
                      int line, /* Used for output message, indicate where */
                      char * file /* the error was reported from */
                      ) {

    SQLCHAR buffer[SQL_MAX_MESSAGE_LENGTH + 1];
    SQLCHAR sqlstate[SQL_SQLSTATE_SIZE + 1];
    SQLINTEGER sqlcode;
    SQLSMALLINT length, i;

    printf( ">--- ERROR -- RC = %d Reported from %s, line %d -----\n",
           frc,
           file,
           line
           );

    i = 1;
    while ( SQLGetDiagRec( htype,
                          hnd1,
                          i,
                          sqlstate,
                          &sqlcode,
                          buffer,
                          SQL_MAX_MESSAGE_LENGTH + 1,
                          &length
                          ) == SQL_SUCCESS ) {
        printf( " SQLSTATE: %s\n", sqlstate );
        printf( "Native Error Code: %ld\n", sqlcode );
        printf( "%s\n", buffer );
        i++;
    }

    printf( ">-----\n" );

    return( SQL_ERROR );
}
/*<-- */

/* prompted_connect - prompt for connect options and connect */

SQLRETURN prompted_connect( SQLHANDLE henv,
                           SQLHANDLE * hdbc
                           ) {

    /* allocate a connection handle */
    if ( SQLAllocHandle( SQL_HANDLE_DBC,
                       henv,
                       hdbc
                       ) != SQL_SUCCESS ) {
        printf( ">---ERROR while allocating a connection handle-----\n" );
        return( SQL_ERROR );
    }

    /* Set AUTOCOMMIT OFF */
    if ( SQLSetConnectAttr( * hdbc,
                           SQL_ATTR_AUTOCOMMIT,
                           ( void *) SQL_AUTOCOMMIT_OFF, SQL_NTS
                           ) != SQL_SUCCESS ) {
        printf( ">---ERROR while setting AUTOCOMMIT OFF -----\n" );
        return( SQL_ERROR );
    }

    if ( SQLConnect( * hdbc,

```

```

        server, SQL_NTS,
        uid, SQL_NTS,
        pwd, SQL_NTS
    ) != SQL_SUCCESS ) {
printf( ">--- ERROR while connecting to %s -----\n",
server
) ;

SQLDisconnect( * hdbc ) ;
SQLFreeHandle( SQL_HANDLE_DBC, * hdbc ) ;
return( SQL_ERROR ) ;
}
else /* Print Connection Information */
printf( "\nConnected to %s\n", server ) ;

return( SQL_SUCCESS ) ;
}

/* terminate and free environment handle */
SQLRETURN terminate( SQLHANDLE henv,
SQLRETURN rc
) {

SQLRETURN lrc ;

printf( ">Terminating ... \n" ) ;
print_error( SQL_HANDLE_ENV,
henv,
rc,
LINE,
FILE
) ;

/* Free environment handle */
if ( ( lrc = SQLFreeHandle( SQL_HANDLE_ENV, henv ) ) != SQL_SUCCESS )
print_error( SQL_HANDLE_ENV,
henv,
lrc,
LINE,
FILE
) ;

return( rc ) ;
}

void show_progress()
{
int i ;
for(i=0;i<3;i++)
{
printf("...");
sleep(1);*/
}
printf("... DONE.\n");
}

void wrong_input(char *str)
{
printf("\n\n\t*****\n\n");
printf("\t* usage: %s -q <DB-NAME> ( to Quiesce tables .. ) * \n",str);
printf("\t* OR * \n");
printf("\t* usage: %s -r <DB-NAME> ( to reset Quiesced tables ..)* \n",str);
printf("\t*****\n\n");

exit(0);
}

extern SQLCHAR server[SQL_MAX_DSN_LENGTH + 1] ;
extern SQLCHAR uid[MAX_UID_LENGTH + 1] ;
extern SQLCHAR pwd[MAX_PWD_LENGTH + 1] ;

#define MAX_STMT_LEN 500

int reset=-1;

/*****
** main
*****/

int main( int argc, char * argv[] ) {

SQLHANDLE henv,hdbc[3], hstmt,hstmt1,hstmt2 ;
SQLRETURN rc ;

SQLCHAR * sqlstmt = ( SQLCHAR * ) "SELECT dbname,dbinst,password from dfm_dbid" ;/* for the primary db */
SQLCHAR * stmt = ( SQLCHAR * ) "SELECT COLS.TBCREATOR, COLS.TBNAME FROM SYSIBM.SYSCOLUMNS COLS, "
" SYSIBM.SYSCOLPROPERTIES PROPS WHERE COLS.TBCREATOR = PROPS.TABSHEMA AND "
" COLS.TBNAME = PROPS.TABNAME AND COLS.TYPENAME='DATALINK' AND SUBSTR(PROPS.DL_FEATURES, 2, 1) "
" = 'F' GROUP BY COLS.TBCREATOR, COLS.TBNAME";/*test for the secondary db's*/
SQLCHAR * stmt2 = ( SQLCHAR * ) "SELECT count(*) from dfm_xnstate where xn_state=3" ;/* for the primary db */

SQLCHAR v_dbname[20] ;

```

```

SQLINTEGER v_xnstate ;
SQLCHAR v_usernm[20] ;
SQLCHAR v_passwd[20] ;
SQLINTEGER nullind;
SQLVARCHAR v_tbname[128];
SQLCHAR v_tbcreator[20];
SQLINTEGER rowcount;
int i,count;
char state[6],v_tb[100];
int flag=0;
int xxx,tong=0;

if ( argc != 2 && argc!=3) || argv[1][0]!='-' || strlen(argv[1]) !=2) wrong_input(argv[0]);

/** NOTE : If argc==2 then DB-NAME the program would ask user to enter
DB-Name else it would take the second argument to this program ( argv[2] )
as DB-NAME ***/

if(argv[1][1]=='q' || argv[1][1]=='Q')
{
reset=0;
}
else
{
if(argv[1][1]!='r' || argv[1][1]!='R')
{
reset=1;
}
else
{
wrong_input(argv[0]);
}
if(reset==-1) wrong_input(argv[0]);
}

SQLAllocHandle( SQL_HANDLE_ENV, SQL_NULL_HANDLE, &henv ) ;

/*
Before allocating any connection handles, set Environment wide
Connect Options
Set to Connect Type 2, Syncpoint 1
*/
if ( SQLSetEnvAttr( henv,
SQL_CONNECTTYPE,
( SQLPOINTER ) SQL_COORDINATED_TRANS,
0
) != SQL_SUCCESS ) {
printf( ">---ERROR while setting Connect Type 2 ----->\n" ) ;
return( SQL_ERROR ) ;
}
/*<-- */
/*--> */
if ( SQLSetEnvAttr( henv,
SQL_SYNC_POINT,
( SQLPOINTER ) SQL_ONEPHASE,
0
) != SQL_SUCCESS ) {
printf( ">---ERROR while setting Syncpoint One Phase ----->\n" ) ;
return( SQL_ERROR ) ;
}

if(argc==3)
{
strcpy(server,argv[2]);
}
else
{
printf( ">Enter database Name:\n" ) ;
gets( ( char * ) server ) ;
}

/*prompted_connect(henv,&hdbc[0]);*/

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

/* allocate a connect handle, and connect to the primary database*/
rc = DBconnect( henv, &hdbc[0] ) ;
if ( rc != SQL_SUCCESS ) return( terminate( henv, rc ) ) ;

flag=1;
if(reset!=1)
{
printf("\nWaiting for XNs to get over ...");
while(flag) /* Outer While */
{

```



```

rc = SQLAllocHandle( SQL_HANDLE_STMT, hdbc[0], &hstmt2 );
CHECK_HANDLE( SQL_HANDLE_DBC, hdbc[0], rc );

rc = SQLExecDirect( hstmt2, stmt2, SQL_NTS );
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc );

rc = SQLBindCol( hstmt2, 1, SQL_C_LONG, &v_xnstate, 0, &nullid );
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt2, rc );

while ( ( rc = SQLFetch( hstmt2 ) ) == SQL_SUCCESS )
{
    /*printf( "\nCount of XNs Pending : %d \n",v_xnstate) ;*/
    if (v_xnstate > 0)
    {
        fflush(stdout);
        printf("\n");
        sleep(1);
        break;
    }
    else flag=0;
} /* Inner While */

/* Deallocation */
rc = SQLFreeHandle( SQL_HANDLE_STMT, hstmt2 );
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt2, rc );

} /* Outer While */
/* IF */

if(!reset) printf("XNs OVER !!\n");

rc = SQLAllocHandle( SQL_HANDLE_STMT, hdbc[0], &hstmt );
CHECK_HANDLE( SQL_HANDLE_DBC, hdbc[0], rc );

rc = SQLExecDirect( hstmt, sqlstmt, SQL_NTS );
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc );

rc = SQLBindCol( hstmt, 1, SQL_C_CHAR, v_dbname, sizeof(v_dbname), NULL );
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc );

rc = SQLBindCol( hstmt, 2, SQL_C_CHAR, v_usernm, sizeof(v_usernm), NULL );
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc );
v_passwd[0]='\0';

rc = SQLBindCol( hstmt, 3, SQL_C_CHAR, v_passwd, sizeof(v_passwd), NULL );
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc );

/* Counter for number of rows fetched from the primary db*/
count=1;

for (i=1;i<=count;i++) /* For the FOR LOOP */
{
    while ( ( rc = SQLFetch( hstmt ) ) == SQL_SUCCESS )
    {
        printf( "\nDatabase Name : %s \n",v_dbname) ;

        count=count+1;
        /* Depending on the no. of rows fetched from the primary db connect to the sec db's */

        if ( SQLAllocHandle( SQL_HANDLE_DBC,henv,&hdbc[i]) != SQL_SUCCESS )
        {
            printf(">---ERROR while allocating a connection handle----\n");
            return( SQL_ERROR );
        }
    }

/* Set AUTOCOMMIT ON */
    if ( SQLSetConnectAttr( * hdbc,SQL_ATTR_AUTOCOMMIT,( void * ) SQL_AUTOCOMMIT_ON, SQL_NTS) != SQL_SUCCESS )
    {
        printf(">---ERROR while setting AUTOCOMMIT OFF -----\n");
        return( SQL_ERROR );
    }

rc = SQLConnect(hdbc[i],v_dbname,SQL_NTS,((v_passwd[0]!='\0') ? NULL : v_usernm),SQL_NTS,v_passwd,SQL_NTS);
if ( rc != SQL_SUCCESS ) return( terminate( henv, rc ) );

/* TRYING OUT FOR SELECTION FROM THESE DB'S*/

rc = SQLAllocHandle( SQL_HANDLE_STMT, hdbc[i], &hstmt1 );
CHECK_HANDLE( SQL_HANDLE_DBC, hdbc[i], rc );

```

```

rc = SQLExecDirect( hstmt1, stmt, 276 ) ;
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt1, rc ) ;

rc = SQLBindCol( hstmt1, 1, SQL_C_CHAR, v_tcreator, sizeof(v_tcreator), NULL ) ;
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt1, rc ) ;

rc = SQLBindCol( hstmt1, 2, SQL_C_CHAR, v_tname, sizeof(v_tname), NULL ) ;
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt1, rc ) ;

while ( ( rc = SQLFetch( hstmt1 ) ) == SQL_SUCCESS )
{
    v_tb[0]= '\0';
    strcat( v_tb, v_tcreator );
    strcat( v_tb, "-" );
    strcat( v_tb, v_tname );
    printf( "\tTABLE : %s\n", v_tb );
    sqluvdp( v_tb, (reset==1) ? 9 : 2, NULL, &sqlca );

    /** 9 -> to RESET      2 -> to Quiesce ( exclusive) */

    if ( sqlca.sqlcode==0 )
    {
        if ( reset==1 )
        {
            /* printf("The quiesced tablespace successfully reset.\n");      */
            show_progress();
        }
        else
        {
            /* printf("The tablespace successfully quiesced\n");*/
            show_progress();
        }
    }
    else if ( sqlca.sqlcode== -3805 || sqlca.sqlcode==01004 )
    {
        if( reset==1 )
        {
            /* printf("The quiesced tablespace could not be reset.\n");*/
            show_progress();
        }
        else
        {
            /* printf("The tablespace has already been quiesced\n");*/
            show_progress();
        }
    }
    else
    {
        if( reset==1 )
        {
            printf("The quiesced tablespace could not be reset.\n");
        }
        else
        {
            printf("The tablespace could not be quiesced. \n");
        }
    }

    printf( "\t\tSQLCODE = %ld\n", sqlca.sqlcode );
    strncpy( state, sqlca.sqlstate, 5 );
    state[5] = '\0';
    printf( "\t\tSQLSTATE = %s\n", state );
}

rc = SQLFreeHandle( SQL_HANDLE_STMT, hstmt1 ) ;
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt1, rc ) ;

rc = SQLDisconnect( hdbc[i] );
CHECK_HANDLE( SQL_HANDLE_DBC, hdbc[i], rc ) ;

rc = SQLFreeHandle( SQL_HANDLE_DBC, hdbc[i] ) ;
CHECK_HANDLE( SQL_HANDLE_DBC, hdbc[i], rc ) ;

}

}

printf("The NO. of DATABASES is %d \n", count-1);

if ( rc != SQL_NO_DATA_FOUND )
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc ) ;

/* Commit the changes. */
rc = SQLEndTran( SQL_HANDLE_DBC, hdbc[0], SQL_COMMIT ) ;
CHECK_HANDLE( SQL_HANDLE_DBC, hdbc[0], rc ) ;

```

```

/* Disconnect and free up CLI resources. */
rc = SQLFreeHandle( SQL_HANDLE_STMT, hstmt );
CHECK_HANDLE( SQL_HANDLE_STMT, hstmt, rc );

/* *****/

printf( "\n>Disconnecting ....\n" );
rc = SQLDisconnect( hdbc[0] );
CHECK_HANDLE( SQL_HANDLE_DBC, hdbc[0], rc );

rc = SQLFreeHandle( SQL_HANDLE_DBC, hdbc[0] );
CHECK_HANDLE( SQL_HANDLE_DBC, hdbc[0], rc );

/* *****/

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

return( SQL_SUCCESS );

}
----- end of 'quiesce.c' script -----

```



---

## Appendix E. Using the DB2 Library

The DB2 Universal Database library consists of online help, books (PDF and HTML), and sample programs in HTML format. This section describes the information that is provided, and how you can access it.

To access product information online, you can use the Information Center. For more information, see “Accessing Information with the Information Center” on page 177. You can view task information, DB2 books, troubleshooting information, sample programs, and DB2 information on the Web.

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### DB2 PDF Files and Printed Books

#### DB2 Information

The following table divides the DB2 books into four categories:

##### **DB2 Guide and Reference Information**

These books contain the common DB2 information for all platforms.

##### **DB2 Installation and Configuration Information**

These books are for DB2 on a specific platform. For example, there are separate *Quick Beginnings* books for DB2 on OS/2, Windows, and UNIX-based platforms.

##### **Cross-platform sample programs in HTML**

These samples are the HTML version of the sample programs that are installed with the Application Development Client. The samples are for informational purposes and do not replace the actual programs.

##### **Release notes**

These files contain late-breaking information that could not be included in the DB2 books.

The installation manuals, release notes, and tutorials are viewable in HTML directly from the product CD-ROM. Most books are available in HTML on the product CD-ROM for viewing and in Adobe Acrobat (PDF) format on the DB2 publications CD-ROM for viewing and printing. You can also order a printed copy from IBM; see “Ordering the Printed Books” on page 173. The following table lists books that can be ordered.

On OS/2 and Windows platforms, you can install the HTML files under the `sql1lib\doc\html` directory. DB2 information is translated into different

languages; however, all the information is not translated into every language. Whenever information is not available in a specific language, the English information is provided

On UNIX platforms, you can install multiple language versions of the HTML files under the `doc/%L/html` directories, where `%L` represents the locale. For more information, refer to the appropriate *Quick Beginnings* book.

You can obtain DB2 books and access information in a variety of ways:

- “Viewing Information Online” on page 176
- “Searching Information Online” on page 180
- “Ordering the Printed Books” on page 173
- “Printing the PDF Books” on page 172

Table 2. DB2 Information

| Name                                       | Description                                                                                                                                                                                             | Form Number<br>PDF File Name | HTML<br>Directory |
|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------|
| <b>DB2 Guide and Reference Information</b> |                                                                                                                                                                                                         |                              |                   |
| <i>Administration Guide</i>                | <i>Administration Guide: Planning</i> provides an overview of database concepts, information about design issues (such as logical and physical database design), and a discussion of high availability. | SC09-2946<br>db2d1x70        | db2d0             |
|                                            | <i>Administration Guide: Implementation</i> provides information on implementation issues such as implementing your design, accessing databases, auditing, backup and recovery.                         | SC09-2944<br>db2d2x70        |                   |
|                                            | <i>Administration Guide: Performance</i> provides information on database environment and application performance evaluation and tuning.                                                                | SC09-2945<br>db2d3x70        |                   |
|                                            | You can order the three volumes of the <i>Administration Guide</i> in the English language in North America using the form number SBOF-8934.                                                            |                              |                   |
| <i>Administrative API Reference</i>        | Describes the DB2 application programming interfaces (APIs) and data structures that you can use to manage your databases. This book also explains how to call APIs from your applications.             | SC09-2947<br>db2b0x70        | db2b0             |

Table 2. DB2 Information (continued)

| Name                                    | Description                                                                                                                                                                                                                                                                                                                     | Form Number<br>PDF File Name | HTML<br>Directory |
|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------|
| <i>Application Building Guide</i>       | Provides environment setup information and step-by-step instructions about how to compile, link, and run DB2 applications on Windows, OS/2, and UNIX-based platforms.                                                                                                                                                           | SC09-2948<br>db2axx70        | db2ax             |
| <i>APPC, CPI-C, and SNA Sense Codes</i> | Provides general information about APPC, CPI-C, and SNA sense codes that you may encounter when using DB2 Universal Database products.                                                                                                                                                                                          | No form number<br>db2apx70   | db2ap             |
|                                         | Available in HTML format only.                                                                                                                                                                                                                                                                                                  |                              |                   |
| <i>Application Development Guide</i>    | Explains how to develop applications that access DB2 databases using embedded SQL or Java (JDBC and SQLJ). Discussion topics include writing stored procedures, writing user-defined functions, creating user-defined types, using triggers, and developing applications in partitioned environments or with federated systems. | SC09-2949<br>db2a0x70        | db2a0             |
| <i>CLI Guide and Reference</i>          | Explains how to develop applications that access DB2 databases using the DB2 Call Level Interface, a callable SQL interface that is compatible with the Microsoft ODBC specification.                                                                                                                                           | SC09-2950<br>db2l0x70        | db2l0             |
| <i>Command Reference</i>                | Explains how to use the Command Line Processor and describes the DB2 commands that you can use to manage your database.                                                                                                                                                                                                         | SC09-2951<br>db2n0x70        | db2n0             |
| <i>Connectivity Supplement</i>          | Provides setup and reference information on how to use DB2 for AS/400, DB2 for OS/390, DB2 for MVS, or DB2 for VM as DRDA application requesters with DB2 Universal Database servers. This book also details how to use DRDA application servers with DB2 Connect application requesters.                                       | No form number<br>db2h1x70   | db2h1             |
|                                         | Available in HTML and PDF only.                                                                                                                                                                                                                                                                                                 |                              |                   |

Table 2. DB2 Information (continued)

| Name                                                                    | Description                                                                                                                                                                                                                                                                                  | Form Number<br>PDF File Name | HTML<br>Directory |
|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------|
| <i>Data Movement Utilities Guide and Reference</i>                      | Explains how to use DB2 utilities, such as import, export, load, AutoLoader, and DPROP, that facilitate the movement of data.                                                                                                                                                                | SC09-2955<br>db2dmx70        | db2dm             |
| <i>Data Warehouse Center Administration Guide</i>                       | Provides information on how to build and maintain a data warehouse using the Data Warehouse Center.                                                                                                                                                                                          | SC26-9993<br>db2ddx70        | db2dd             |
| <i>Data Warehouse Center Application Integration Guide</i>              | Provides information to help programmers integrate applications with the Data Warehouse Center and with the Information Catalog Manager.                                                                                                                                                     | SC26-9994<br>db2adx70        | db2ad             |
| <i>DB2 Connect User's Guide</i>                                         | Provides concepts, programming, and general usage information for the DB2 Connect products.                                                                                                                                                                                                  | SC09-2954<br>db2c0x70        | db2c0             |
| <i>DB2 Query Patroller Administration Guide</i>                         | Provides an operational overview of the DB2 Query Patroller system, specific operational and administrative information, and task information for the administrative graphical user interface utilities.                                                                                     | SC09-2958<br>db2dwx70        | db2dw             |
| <i>DB2 Query Patroller User's Guide</i>                                 | Describes how to use the tools and functions of the DB2 Query Patroller.                                                                                                                                                                                                                     | SC09-2960<br>db2wwx70        | db2ww             |
| <i>Glossary</i>                                                         | Provides definitions for terms used in DB2 and its components.<br><br>Available in HTML format and in the <i>SQL Reference</i> .                                                                                                                                                             | No form number<br>db2t0x70   | db2t0             |
| <i>Image, Audio, and Video Extenders Administration and Programming</i> | Provides general information about DB2 extenders, and information on the administration and configuration of the image, audio, and video (IAV) extenders and on programming using the IAV extenders. It includes reference information, diagnostic information (with messages), and samples. | SC26-9929<br>dmbu7x70        | dmbu7             |
| <i>Information Catalog Manager Administration Guide</i>                 | Provides guidance on managing information catalogs.                                                                                                                                                                                                                                          | SC26-9995<br>db2dix70        | db2di             |



Table 2. DB2 Information (continued)

| Name                                                               | Description                                                                                                                                                                                                                                                                                                                          | Form Number<br>PDF File Name                                           | HTML<br>Directory |
|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|-------------------|
| <i>Information Catalog Manager Programming Guide and Reference</i> | Provides definitions for the architected interfaces for the Information Catalog Manager.                                                                                                                                                                                                                                             | SC26-9997<br>db2bix70                                                  | db2bi             |
| <i>Information Catalog Manager User's Guide</i>                    | Provides information on using the Information Catalog Manager user interface.                                                                                                                                                                                                                                                        | SC26-9996<br>db2aix70                                                  | db2ai             |
| <i>Installation and Configuration Supplement</i>                   | Guides you through the planning, installation, and setup of platform-specific DB2 clients. This supplement also contains information on binding, setting up client and server communications, DB2 GUI tools, DRDA AS, distributed installation, the configuration of distributed requests, and accessing heterogeneous data sources. | GC09-2957<br>db2iyx70                                                  | db2iy             |
| <i>Message Reference</i>                                           | Lists messages and codes issued by DB2, the Information Catalog Manager, and the Data Warehouse Center, and describes the actions you should take.<br><br>You can order both volumes of the Message Reference in the English language in North America with the form number SBOF-8932.                                               | Volume 1<br>GC09-2978<br>db2m1x70<br>Volume 2<br>GC09-2979<br>db2m2x70 | db2m0             |
| <i>OLAP Integration Server Administration Guide</i>                | Explains how to use the Administration Manager component of the OLAP Integration Server.                                                                                                                                                                                                                                             | SC27-0787<br>db2dpx70                                                  | n/a               |
| <i>OLAP Integration Server Metaoutline User's Guide</i>            | Explains how to create and populate OLAP metaoutlines using the standard OLAP Metaoutline interface (not by using the Metaoutline Assistant).                                                                                                                                                                                        | SC27-0784<br>db2upx70                                                  | n/a               |
| <i>OLAP Integration Server Model User's Guide</i>                  | Explains how to create OLAP models using the standard OLAP Model Interface (not by using the Model Assistant).                                                                                                                                                                                                                       | SC27-0783<br>db2lpx70                                                  | n/a               |
| <i>OLAP Setup and User's Guide</i>                                 | Provides configuration and setup information for the OLAP Starter Kit.                                                                                                                                                                                                                                                               | SC27-0702<br>db2ipx70                                                  | db2ip             |
| <i>OLAP Spreadsheet Add-in User's Guide for Excel</i>              | Describes how to use the Excel spreadsheet program to analyze OLAP data.                                                                                                                                                                                                                                                             | SC27-0786<br>db2epx70                                                  | db2ep             |

Table 2. DB2 Information (continued)

| Name                                                        | Description                                                                                                                                                                                                                                                                                                               | Form Number<br>PDF File Name                                               | HTML<br>Directory |
|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|-------------------|
| <i>OLAP Spreadsheet Add-in User's Guide for Lotus 1-2-3</i> | Describes how to use the Lotus 1-2-3 spreadsheet program to analyze OLAP data.                                                                                                                                                                                                                                            | SC27-0785<br>db2tpx70                                                      | db2tp             |
| <i>Replication Guide and Reference</i>                      | Provides planning, configuration, administration, and usage information for the IBM Replication tools supplied with DB2.                                                                                                                                                                                                  | SC26-9920<br>db2e0x70                                                      | db2e0             |
| <i>Spatial Extender User's Guide and Reference</i>          | Provides information about installing, configuring, administering, programming, and troubleshooting the Spatial Extender. Also provides significant descriptions of spatial data concepts and provides reference information (messages and SQL) specific to the Spatial Extender.                                         | SC27-0701<br>db2sbx70                                                      | db2sb             |
| <i>SQL Getting Started</i>                                  | Introduces SQL concepts and provides examples for many constructs and tasks.                                                                                                                                                                                                                                              | SC09-2973<br>db2y0x70                                                      | db2y0             |
| <i>SQL Reference, Volume 1 and Volume 2</i>                 | Describes SQL syntax, semantics, and the rules of the language. This book also includes information about release-to-release incompatibilities, product limits, and catalog views.<br><br>You can order both volumes of the <i>SQL Reference</i> in the English language in North America with the form number SBOF-8933. | Volume 1<br>SC09-2974<br>db2s1x70<br><br>Volume 2<br>SC09-2975<br>db2s2x70 | db2s0             |
| <i>System Monitor Guide and Reference</i>                   | Describes how to collect different kinds of information about databases and the database manager. This book explains how to use the information to understand database activity, improve performance, and determine the cause of problems.                                                                                | SC09-2956<br>db2f0x70                                                      | db2f0             |
| <i>Text Extender Administration and Programming</i>         | Provides general information about DB2 extenders and information on the administration and configuring of the text extender and on programming using the text extenders. It includes reference information, diagnostic information (with messages) and samples.                                                           | SC26-9930<br>desu9x70                                                      | desu9             |

Table 2. DB2 Information (continued)

| Name                                                                        | Description                                                                                                                                                                                                                                              | Form Number<br>PDF File Name | HTML<br>Directory |
|-----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------|
| <i>Troubleshooting Guide</i>                                                | Helps you determine the source of errors, recover from problems, and use diagnostic tools in consultation with DB2 Customer Service.                                                                                                                     | GC09-2850<br>db2p0x70        | db2p0             |
| <i>What's New</i>                                                           | Describes the new features, functions, and enhancements in DB2 Universal Database, Version 7.                                                                                                                                                            | SC09-2976<br>db2q0x70        | db2q0             |
| <b>DB2 Installation and Configuration Information</b>                       |                                                                                                                                                                                                                                                          |                              |                   |
| <i>DB2 Connect Enterprise Edition for OS/2 and Windows Quick Beginnings</i> | Provides planning, migration, installation, and configuration information for DB2 Connect Enterprise Edition on the OS/2 and Windows 32-bit operating systems. This book also contains installation and setup information for many supported clients.    | GC09-2953<br>db2c6x70        | db2c6             |
| <i>DB2 Connect Enterprise Edition for UNIX Quick Beginnings</i>             | Provides planning, migration, installation, configuration, and task information for DB2 Connect Enterprise Edition on UNIX-based platforms. This book also contains installation and setup information for many supported clients.                       | GC09-2952<br>db2cyx70        | db2cy             |
| <i>DB2 Connect Personal Edition Quick Beginnings</i>                        | Provides planning, migration, installation, configuration, and task information for DB2 Connect Personal Edition on the OS/2 and Windows 32-bit operating systems. This book also contains installation and setup information for all supported clients. | GC09-2967<br>db2c1x70        | db2c1             |
| <i>DB2 Connect Personal Edition Quick Beginnings for Linux</i>              | Provides planning, installation, migration, and configuration information for DB2 Connect Personal Edition on all supported Linux distributions.                                                                                                         | GC09-2962<br>db2c4x70        | db2c4             |
| <i>DB2 Data Links Manager Quick Beginnings</i>                              | Provides planning, installation, configuration, and task information for DB2 Data Links Manager for AIX and Windows 32-bit operating systems.                                                                                                            | GC09-2966<br>db2z6x70        | db2z6             |

Table 2. DB2 Information (continued)

| Name                                                                  | Description                                                                                                                                                                                                                       | Form Number<br>PDF File Name | HTML<br>Directory |
|-----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------|
| <i>DB2 Enterprise - Extended Edition for UNIX Quick Beginnings</i>    | Provides planning, installation, and configuration information for DB2 Enterprise - Extended Edition on UNIX-based platforms. This book also contains installation and setup information for many supported clients.              | GC09-2964<br>db2v3x70        | db2v3             |
| <i>DB2 Enterprise - Extended Edition for Windows Quick Beginnings</i> | Provides planning, installation, and configuration information for DB2 Enterprise - Extended Edition for Windows 32-bit operating systems. This book also contains installation and setup information for many supported clients. | GC09-2963<br>db2v6x70        | db2v6             |
| <i>DB2 for OS/2 Quick Beginnings</i>                                  | Provides planning, installation, migration, and configuration information for DB2 Universal Database on the OS/2 operating system. This book also contains installation and setup information for many supported clients.         | GC09-2968<br>db2i2x70        | db2i2             |
| <i>DB2 for UNIX Quick Beginnings</i>                                  | Provides planning, installation, migration, and configuration information for DB2 Universal Database on UNIX-based platforms. This book also contains installation and setup information for many supported clients.              | GC09-2970<br>db2ixx70        | db2ix             |
| <i>DB2 for Windows Quick Beginnings</i>                               | Provides planning, installation, migration, and configuration information for DB2 Universal Database on Windows 32-bit operating systems. This book also contains installation and setup information for many supported clients.  | GC09-2971<br>db2i6x70        | db2i6             |
| <i>DB2 Personal Edition Quick Beginnings</i>                          | Provides planning, installation, migration, and configuration information for DB2 Universal Database Personal Edition on the OS/2 and Windows 32-bit operating systems.                                                           | GC09-2969<br>db2i1x70        | db2i1             |
| <i>DB2 Personal Edition Quick Beginnings for Linux</i>                | Provides planning, installation, migration, and configuration information for DB2 Universal Database Personal Edition on all supported Linux distributions.                                                                       | GC09-2972<br>db2i4x70        | db2i4             |

Table 2. DB2 Information (continued)

| Name                                                | Description                                                                                                                                                                                                                                                                                                                                                                                                                            | Form Number<br>PDF File Name      | HTML<br>Directory |
|-----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------------------|
| <i>DB2 Query Patroller<br/>Installation Guide</i>   | Provides installation information about DB2 Query Patroller.                                                                                                                                                                                                                                                                                                                                                                           | GC09-2959<br>db2iwx70             | db2iw             |
| <i>DB2 Warehouse Manager<br/>Installation Guide</i> | Provides installation information for warehouse agents, warehouse transformers, and the Information Catalog Manager.                                                                                                                                                                                                                                                                                                                   | GC26-9998<br>db2idx70             | db2id             |
| <b>Cross-Platform Sample Programs in HTML</b>       |                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                   |                   |
| Sample programs in HTML                             | Provides the sample programs in HTML format for the programming languages on all platforms supported by DB2. The sample programs are provided for informational purposes only. Not all samples are available in all programming languages. The HTML samples are only available when the DB2 Application Development Client is installed.<br><br>For more information on the programs, refer to the <i>Application Building Guide</i> . | No form number                    | db2hs             |
| <b>Release Notes</b>                                |                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                   |                   |
| <i>DB2 Connect Release Notes</i>                    | Provides late-breaking information that could not be included in the DB2 Connect books.                                                                                                                                                                                                                                                                                                                                                | See note #2.                      | db2cr             |
| <i>DB2 Installation Notes</i>                       | Provides late-breaking installation-specific information that could not be included in the DB2 books.                                                                                                                                                                                                                                                                                                                                  | Available on product CD-ROM only. |                   |
| <i>DB2 Release Notes</i>                            | Provides late-breaking information about all DB2 products and features that could not be included in the DB2 books.                                                                                                                                                                                                                                                                                                                    | See note #2.                      | db2ir             |

**Notes:**

1. The character *x* in the sixth position of the file name indicates the language version of a book. For example, the file name db2d0e70 identifies the English version of the *Administration Guide* and the file name db2d0f70 identifies the French version of the same book. The following letters are used in the sixth position of the file name to indicate the language version:

| Language             | Identifier |
|----------------------|------------|
| Brazilian Portuguese | b          |

|               |   |
|---------------|---|
| Bulgarian     | u |
| Czech         | x |
| Danish        | d |
| Dutch         | q |
| English       | e |
| Finnish       | y |
| French        | f |
| German        | g |
| Greek         | a |
| Hungarian     | h |
| Italian       | i |
| Japanese      | j |
| Korean        | k |
| Norwegian     | n |
| Polish        | p |
| Portuguese    | v |
| Russian       | r |
| Simp. Chinese | c |
| Slovenian     | l |
| Spanish       | z |
| Swedish       | s |
| Trad. Chinese | t |
| Turkish       | m |

2. Late breaking information that could not be included in the DB2 books is available in the Release Notes in HTML format and as an ASCII file. The HTML version is available from the Information Center and on the product CD-ROMs. To view the ASCII file:
  - On UNIX-based platforms, see the `Release.Notes` file. This file is located in the `DB2DIR/Readme/%L` directory, where `%L` represents the locale name and `DB2DIR` represents:
    - `/usr/lpp/db2_07_01` on AIX
    - `/opt/IBMDB2/V7.1` on HP-UX, PTX, Solaris, and Silicon Graphics IRIX
    - `/usr/IBMDB2/V7.1` on Linux.
  - On other platforms, see the `RELEASE.TXT` file. This file is located in the directory where the product is installed. On OS/2 platforms, you can also double-click the **IBM DB2** folder and then double-click the **Release Notes** icon.

## Printing the PDF Books

If you prefer to have printed copies of the books, you can print the PDF files found on the DB2 publications CD-ROM. Using the Adobe Acrobat Reader, you can print either the entire book or a specific range of pages. For the file name of each book in the library, see Table 2 on page 164.

You can obtain the latest version of the Adobe Acrobat Reader from the Adobe Web site at <http://www.adobe.com>.

The PDF files are included on the DB2 publications CD-ROM with a file extension of PDF. To access the PDF files:

1. Insert the DB2 publications CD-ROM. On UNIX-based platforms, mount the DB2 publications CD-ROM. Refer to your *Quick Beginnings* book for the mounting procedures.
2. Start the Acrobat Reader.
3. Open the desired PDF file from one of the following locations:
  - On OS/2 and Windows platforms:  
*x:\doc\language* directory, where *x* represents the CD-ROM drive and *language* represent the two-character country code that represents your language (for example, EN for English).
  - On UNIX-based platforms:  
*/cdrom/doc/%L* directory on the CD-ROM, where */cdrom* represents the mount point of the CD-ROM and *%L* represents the name of the desired locale.

You can also copy the PDF files from the CD-ROM to a local or network drive and read them from there.

## Ordering the Printed Books

You can order the printed DB2 books either individually or as a set (in North America only) by using a sold bill of forms (SBOF) number. To order books, contact your IBM authorized dealer or marketing representative, or phone 1-800-879-2755 in the United States or 1-800-IBM-4Y0U in Canada. You can also order the books from the Publications Web page at <http://www.elink.ibm.com/pbl/pbl>.

Two sets of books are available. SBOF-8935 provides reference and usage information for the DB2 Warehouse Manager. SBOF-8931 provides reference and usage information for all other DB2 Universal Database products and features. The contents of each SBOF are listed in the following table:

Table 3. Ordering the printed books

| SBOF Number | Books Included                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SBOF-8931   | <ul style="list-style-type: none"> <li>• Administration Guide: Planning</li> <li>• Administration Guide: Implementation</li> <li>• Administration Guide: Performance</li> <li>• Administrative API Reference</li> <li>• Application Building Guide</li> <li>• Application Development Guide</li> <li>• CLI Guide and Reference</li> <li>• Command Reference</li> <li>• Data Movement Utilities Guide and Reference</li> <li>• Data Warehouse Center Administration Guide</li> <li>• Data Warehouse Center Application Integration Guide</li> <li>• DB2 Connect User's Guide</li> <li>• Installation and Configuration Supplement</li> <li>• Image, Audio, and Video Extenders Administration and Programming</li> <li>• Message Reference, Volumes 1 and 2</li> </ul> | <ul style="list-style-type: none"> <li>• OLAP Integration Server Administration Guide</li> <li>• OLAP Integration Server Metaoutline User's Guide</li> <li>• OLAP Integration Server Model User's Guide</li> <li>• OLAP Integration Server User's Guide</li> <li>• OLAP Setup and User's Guide</li> <li>• OLAP Spreadsheet Add-in User's Guide for Excel</li> <li>• OLAP Spreadsheet Add-in User's Guide for Lotus 1-2-3</li> <li>• Replication Guide and Reference</li> <li>• Spatial Extender Administration and Programming Guide</li> <li>• SQL Getting Started</li> <li>• SQL Reference, Volumes 1 and 2</li> <li>• System Monitor Guide and Reference</li> <li>• Text Extender Administration and Programming</li> <li>• Troubleshooting Guide</li> <li>• What's New</li> </ul> |
| SBOF-8935   | <ul style="list-style-type: none"> <li>• Information Catalog Manager Administration Guide</li> <li>• Information Catalog Manager User's Guide</li> <li>• Information Catalog Manager Programming Guide and Reference</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>• Query Patroller Administration Guide</li> <li>• Query Patroller User's Guide</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

## DB2 Online Documentation

### Accessing Online Help

Online help is available with all DB2 components. The following table describes the various types of help.



| Type of Help                                | Contents                                                                                                                                                                                           | How to Access...                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Command Help</i>                         | Explains the syntax of commands in the command line processor.                                                                                                                                     | <p>From the command line processor in interactive mode, enter:</p> <p style="padding-left: 40px;"><i>? command</i></p> <p>where <i>command</i> represents a keyword or the entire command.</p> <p>For example, <i>? catalog</i> displays help for all the CATALOG commands, while <i>? catalog database</i> displays help for the CATALOG DATABASE command.</p>                                                                                                                                                                                                                                                     |
| <i>Client Configuration Assistant Help</i>  | Explains the tasks you can perform in a window or notebook. The help includes overview and prerequisite information you need to know, and it describes how to use the window or notebook controls. | From a window or notebook, click the <b>Help</b> push button or press the <b>F1</b> key.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <i>Command Center Help</i>                  |                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>Control Center Help</i>                  |                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>Data Warehouse Center Help</i>           |                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>Event Analyzer Help</i>                  |                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>Information Catalog Manager Help</i>     |                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>Satellite Administration Center Help</i> |                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>Script Center Help</i>                   |                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>Message Help</i>                         | Describes the cause of a message and any action you should take.                                                                                                                                   | <p>From the command line processor in interactive mode, enter:</p> <p style="padding-left: 40px;"><i>? XXXnnnnn</i></p> <p>where <i>XXXnnnnn</i> represents a valid message identifier.</p> <p>For example, <i>? SQL30081</i> displays help about the SQL30081 message.</p> <p>To view message help one screen at a time, enter:</p> <p style="padding-left: 40px;"><i>? XXXnnnnn   more</i></p> <p>To save message help in a file, enter:</p> <p style="padding-left: 40px;"><i>? XXXnnnnn &gt; filename.ext</i></p> <p>where <i>filename.ext</i> represents the file where you want to save the message help.</p> |

| Type of Help  | Contents                               | How to Access...                                                                                                                                                                                                                                                                                                                                                                       |
|---------------|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SQL Help      | Explains the syntax of SQL statements. | <p>From the command line processor in interactive mode, enter:</p> <pre>help <i>statement</i></pre> <p>where <i>statement</i> represents an SQL statement.</p> <p>For example, help SELECT displays help about the SELECT statement.</p> <p><b>Note:</b> SQL help is not available on UNIX-based platforms.</p>                                                                        |
| SQLSTATE Help | Explains SQL states and class codes.   | <p>From the command line processor in interactive mode, enter:</p> <pre>? <i>sqlstate</i> or ? <i>class code</i></pre> <p>where <i>sqlstate</i> represents a valid five-digit SQL state and <i>class code</i> represents the first two digits of the SQL state.</p> <p>For example, ? 08003 displays help for the 08003 SQL state, while ? 08 displays help for the 08 class code.</p> |

## Viewing Information Online

The books included with this product are in Hypertext Markup Language (HTML) softcopy format. Softcopy format enables you to search or browse the information and provides hypertext links to related information. It also makes it easier to share the library across your site.

You can view the online books or sample programs with any browser that conforms to HTML Version 3.2 specifications.

To view online books or sample programs:

- If you are running DB2 administration tools, use the Information Center.
- From a browser, click **File** —> **Open Page**. The page you open contains descriptions of and links to DB2 information:
  - On UNIX-based platforms, open the following page:

```
INSTHOME/sql11ib/doc/%L/html/index.htm
```

where %L represents the locale name.

- On other platforms, open the following page:

```
sql11ib\doc\html\index.htm
```

The path is located on the drive where DB2 is installed.

If you have not installed the Information Center, you can open the page by double-clicking the **DB2 Information** icon. Depending on the system you are using, the icon is in the main product folder or the Windows Start menu.

### **Installing the Netscape Browser**

If you do not already have a Web browser installed, you can install Netscape from the Netscape CD-ROM found in the product boxes. For detailed instructions on how to install it, perform the following:

1. Insert the Netscape CD-ROM.
2. On UNIX-based platforms only, mount the CD-ROM. Refer to your *Quick Beginnings* book for the mounting procedures.
3. For installation instructions, refer to the `CDNAVnn.txt` file, where *nn* represents your two character language identifier. The file is located at the root directory of the CD-ROM.

### **Accessing Information with the Information Center**

The Information Center provides quick access to DB2 product information. The Information Center is available on all platforms on which the DB2 administration tools are available.

You can open the Information Center by double-clicking the Information Center icon. Depending on the system you are using, the icon is in the Information folder in the main product folder or the Windows **Start** menu.

You can also access the Information Center by using the toolbar and the **Help** menu on the DB2 Windows platform.

The Information Center provides six types of information. Click the appropriate tab to look at the topics provided for that type.

|                        |                                                                                                                                                                  |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Tasks</b>           | Key tasks you can perform using DB2.                                                                                                                             |
| <b>Reference</b>       | DB2 reference information, such as keywords, commands, and APIs.                                                                                                 |
| <b>Books</b>           | DB2 books.                                                                                                                                                       |
| <b>Troubleshooting</b> | Categories of error messages and their recovery actions.                                                                                                         |
| <b>Sample Programs</b> | Sample programs that come with the DB2 Application Development Client. If you did not install the DB2 Application Development Client, this tab is not displayed. |
| <b>Web</b>             | DB2 information on the World Wide Web. To access this information, you must have a connection to the Web from your system.                                       |

When you select an item in one of the lists, the Information Center launches a viewer to display the information. The viewer might be the system help viewer, an editor, or a Web browser, depending on the kind of information you select.

The Information Center provides a find feature, so you can look for a specific topic without browsing the lists.

For a full text search, follow the hypertext link in the Information Center to the **Search DB2 Online Information** search form.

The HTML search server is usually started automatically. If a search in the HTML information does not work, you may have to start the search server using one of the following methods:

#### **On Windows**

Click **Start** and select **Programs** → **IBM DB2** → **Information** → **Start HTML Search Server**.

#### **On OS/2**

Double-click the **DB2 for OS/2** folder, and then double-click the **Start HTML Search Server** icon.

Refer to the release notes if you experience any other problems when searching the HTML information.

**Note:** The Search function is not available in the Linux, PTX, and Silicon Graphics IRIX environments.

## **Using DB2 Wizards**

Wizards help you complete specific administration tasks by taking you through each task one step at a time. Wizards are available through the Control Center and the Client Configuration Assistant. The following table lists the wizards and describes their purpose.

**Note:** The Create Database, Create Index, Configure Multisite Update, and Performance Configuration wizards are available for the partitioned database environment.

| <b>Wizard</b>          | <b>Helps You to...</b>                         | <b>How to Access...</b>                                                                                                         |
|------------------------|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <i>Add Database</i>    | Catalog a database on a client workstation.    | From the Client Configuration Assistant, click <b>Add</b> .                                                                     |
| <i>Backup Database</i> | Determine, create, and schedule a backup plan. | From the Control Center, right-click the database you want to back up and select <b>Backup</b> → <b>Database Using Wizard</b> . |

| <b>Wizard</b>                     | <b>Helps You to...</b>                                                                                       | <b>How to Access...</b>                                                                                                                                                                                                                                                                                                        |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Configure Multisite Update</i> | Configure a multisite update, a distributed transaction, or a two-phase commit.                              | From the Control Center, right-click the <b>Databases</b> folder and select <b>Multisite Update</b> .                                                                                                                                                                                                                          |
| <i>Create Database</i>            | Create a database, and perform some basic configuration tasks.                                               | From the Control Center, right-click the <b>Databases</b> folder and select <b>Create</b> → <b>Database Using Wizard</b> .                                                                                                                                                                                                     |
| <i>Create Table</i>               | Select basic data types, and create a primary key for the table.                                             | From the Control Center, right-click the <b>Tables</b> icon and select <b>Create</b> → <b>Table Using Wizard</b> .                                                                                                                                                                                                             |
| <i>Create Table Space</i>         | Create a new table space.                                                                                    | From the Control Center, right-click the <b>Table Spaces</b> icon and select <b>Create</b> → <b>Table Space Using Wizard</b> .                                                                                                                                                                                                 |
| <i>Create Index</i>               | Advise which indexes to create and drop for all your queries.                                                | From the Control Center, right-click the <b>Index</b> icon and select <b>Create</b> → <b>Index Using Wizard</b> .                                                                                                                                                                                                              |
| <i>Performance Configuration</i>  | Tune the performance of a database by updating configuration parameters to match your business requirements. | From the Control Center, right-click the database you want to tune and select <b>Configure Performance Using Wizard</b> .<br><br>For the partitioned database environment, from the Database Partitions view, right-click the first database partition you want to tune and select <b>Configure Performance Using Wizard</b> . |
| <i>Restore Database</i>           | Recover a database after a failure. It helps you understand which backup to use, and which logs to replay.   | From the Control Center, right-click the database you want to restore and select <b>Restore</b> → <b>Database Using Wizard</b> .                                                                                                                                                                                               |

## Setting Up a Document Server

By default, the DB2 information is installed on your local system. This means that each person who needs access to the DB2 information must install the same files. To have the DB2 information stored in a single location, perform the following steps:

1. Copy all files and subdirectories from `\sql11ib\doc\html` on your local system to a Web server. Each book has its own subdirectory that contains all the necessary HTML and GIF files that make up the book. Ensure that the directory structure remains the same.

2. Configure the Web server to look for the files in the new location. For information, refer to the NetQuestion Appendix in the *Installation and Configuration Supplement*.
3. If you are using the Java version of the Information Center, you can specify a base URL for all HTML files. You should use the URL for the list of books.
4. When you are able to view the book files, you can bookmark commonly viewed topics. You will probably want to bookmark the following pages:
  - List of books
  - Tables of contents of frequently used books
  - Frequently referenced articles, such as the ALTER TABLE topic
  - The Search form

For information about how you can serve the DB2 Universal Database online documentation files from a central machine, refer to the NetQuestion Appendix in the *Installation and Configuration Supplement*.

### **Searching Information Online**

To find information in the HTML files, use one of the following methods:

- Click **Search** in the top frame. Use the search form to find a specific topic. This function is not available in the Linux, PTX, or Silicon Graphics IRIX environments.
- Click **Index** in the top frame. Use the index to find a specific topic in the book.
- Display the table of contents or index of the help or the HTML book, and then use the find function of the Web browser to find a specific topic in the book.
- Use the bookmark function of the Web browser to quickly return to a specific topic.
- Use the search function of the Information Center to find specific topics. See “Accessing Information with the Information Center” on page 177 for details.

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## Appendix F. Notices

IBM may not offer the products, services, or features discussed in this document in all countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

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# Index

## A

- access tokens
  - on Windows NT 31
- add database wizard 178, 179
- AIX
  - common installation considerations 37
  - db2setup versus SMIT 37
  - disk space requirements 37
  - installing Data Links Manager 37
  - JFS installation considerations 39
  - memory requirements 37
  - product version levels for JFS 39
  - system clocks 39
  - TCP/IP port number 38
- archive server
  - retrieving information 113

## B

- backing up a file system
  - on Windows NT 116
- backing up a JFS file system
  - on AIX 117
- backing up a UFS file system
  - on Solaris 117
- backup database wizard 178
- Before You Begin
  - on AIX 37
  - on Solaris 77
- books 163, 173

## C

- choosing a backup method
  - on AIX 51
    - Disk Copy 51
    - XBSA Archive Server 54, 86
  - on Solaris 84
    - Disk Copy 84
- commands
  - cacls 29
  - db2 add datalinks manager 34
  - db2\_install 81
  - db2 list database directory 20, 51, 83
  - db2 list datalinks manager 34
  - db2\_recon\_aid 120
  - db2dlmmg 38

- commands (*continued*)
  - db2icrt 25
  - db2imigr 37
  - db2set 37
  - db2setup 43, 80
    - actions performed by 44
  - dlff add 109
  - dlff list 27, 108
  - dlff remove 109
  - dlff set dlfmaccount 20
  - dlfm client\_conf 49
  - dlfm drop\_db 113
  - dlfm list registered prefixes 108
  - dlfm server\_conf 49
  - dlfm setup 49, 82, 113
  - dlfm shutdown 102
  - dlfm startdbm 112
  - dlfm stopdbm 112
  - dlfmcr 48, 82
  - dmaggr 42
  - host [dlmserver] 41, 80
  - hostname 18, 41, 80
  - kta 46
  - mount -o noac 74
  - nslookup 18
  - pkgadd 81
  - retrieve\_query 113
  - rgy\_edit 46
  - smit 47
- configure multisite update wizard 178
- crash recovery 115
  - overview 115
- crash recovery scenarios 120
- create database wizard 179
- create table space wizard 179
- create table wizard 179
- creating a sample file
  - on AIX 67
  - on Solaris 93
  - on Windows NT 28
- creating a test environment
  - on AIX DB2 Data Links server 63
  - on AIX DB2 server 61
  - on Solaris DB2 Data Links server 91
  - on Solaris DB2 server 89

- creating a test environment on the Data Links server
  - on Windows NT 27
- creating a test environment on the DB2 server
  - on Windows NT 25

## D

- Data Links File Manager (DLFM)
  - overview 7
- Data Links Filesystem Filter (DLFF)
  - overview 8
- Data Links Manager component descriptions 7
- data manager application (DMAPP) 46
- database registration of Data Links Manager servers
  - on AIX 42
- DATALINK data type
  - overview 3
- DB2 (Logging Manager)
  - overview 8
- DB2 client
  - overview 9
- DB2 library
  - books 163
  - Information Center 177
  - language identifier for books 171
  - late-breaking information 172
  - online help 174
  - ordering printed books 173
  - printing PDF books 172
  - searching online information 180
  - setting up document server 179
  - structure of 163
  - viewing online information 176
  - wizards 178
- DB2 Product Library and Messages
  - installing manually on AIX 50
  - installing manually on Solaris 83
- DB2 UDB Server
  - overview 8
- db2cshrc script 50, 82
- db2profile script 50, 82

- db2setup
  - installing additional products and components on Solaris
    - using 81
  - installing Data Links for Solaris
    - using 81
  - installing DB2 for Solaris
    - using 80
- db2setup utility 43
- DCE-DFS
  - common administration tasks 145
  - creating filesets 146
  - Data Links DFS Client Enabler 43
  - Data Links Manager 43
  - disk backup optimization
    - tip 106, 107
  - disk backup performance
    - enhancements 106
  - installation considerations 41
  - installation prerequisites 41
  - keytab file 46
  - operating system levels 42
  - other sources of information 147
  - post-installation task 46
  - reference material 145
  - restrictions 42
  - setting the disk archive
    - directory 48
  - supported version levels 42
- DCE identity 42
  - creating 145
- determining hostname
  - on Windows NT 18
- DFS Client
  - overview 9
- DFS Client Enabler
  - configuring 59
  - db2setup versus SMIT 57
  - disk space requirements 57
  - installing using db2setup
    - utility 58
  - installing using SMIT 58
  - operating system levels 57
  - overview 9
  - system clocks 58
- DLFF
  - adding in DCE-DFS
    - environment 104
  - adding in JFS environment 103
  - adding in UFS environment 103
  - listing or adding registered file systems on AIX 102
- DLFF (*continued*)
  - listing or adding registered file systems on Solaris 102
  - listing or adding registered file systems on Windows NT 107
  - loading in DFS
    - environments 109
  - loading in JFS environments 108
  - loading in UFS
    - environments 108
  - mounting on Windows NT 109
  - querying in DFS
    - environments 109
  - querying in JFS
    - environments 108
  - querying in UFS
    - environments 109
  - unloading in DFS
    - environments 109
  - unloading in JFS
    - environments 108
  - unloading in UFS
    - environments 109
  - unmounting on Windows NT 109
- DLFM
  - backup procedures 116
  - crash recovery scenarios 120
  - error messages 127
  - listing registered databases 111
  - processes on AIX 102
  - processes on Solaris 102
  - registering databases 111
  - restarting after abnormal
    - termination 102
  - setup procedures 116
  - starting 101
  - starting on the Data Links
    - Server 111
  - stopping 101
  - stopping on the Data Links
    - Server 111
- DLFM\_DB
  - creating 113
  - dropping 113
- DLFM1 user account 18
- DLFS-DMAPP
  - overview 8
- dlnadmin username
  - on Windows NT 17
- DMAPP 46
- E**
  - error messages 127
    - changing diagnostic level 112
- F**
  - file system directory hierarchy 119
- H**
  - hostnames
    - on JFS 40
    - on UFS 79
  - HTML
    - sample programs 171
- I**
  - index wizard 179
  - Information Center 177
  - installation
    - verifying on AIX 61
    - verifying on Solaris 89
  - installation directory
    - on AIX 44
  - installation procedures
    - on Windows NT 19
  - installing
    - additional products and components on Solaris 81
    - Data Links Manager on AIX
      - using db2setup 43
    - Data Links Manager on AIX
      - using SMIT 47
    - Data Links Manager on Windows NT 15
    - Netscape browser 177
    - on Solaris using db2setup 80
- J**
  - JFS
    - hostnames 40
    - increasing size 110
    - installation considerations 39
- Journaled File System (JFS) 39
- L**
  - language identifier
    - books 171
  - late-breaking information 172
- M**
  - memory requirements
    - on Windows NT 16
  - migration
    - from DB2 File Manager for AIX
      - Version 5.2 38
    - on AIX 37
  - mounting CD-ROM
    - using NFS 81
- N**
  - Netscape browser
    - installing 177

NFS workarounds 73  
NTFS drive sharing 16  
NTFS formatted drive 15

## O

online help 174  
online information  
  searching 180  
  viewing 176

## P

PDF 172  
performance configuration  
  wizard 179  
post-installation tasks  
  on AIX 50  
  on AIX using SMIT 48  
  on Solaris 82, 83  
  on Windows NT 20  
pre-start registration for DMAPP 46  
preparing a file system  
  DCE-DFS 64  
  JFS 63  
  on AIX 63  
  on Solaris 91  
  UFS 91  
printing PDF books 172

## R

RECONCILE 119  
registering  
  Data Links server with DB2  
    on AIX 68  
    on Solaris 94  
    on Windows NT 29  
  DB2 database  
    on AIX 67  
    on Solaris 92  
    on Windows NT 28  
  file system with DLFF on  
    AIX 65  
  file system with DLFF on  
    Solaris 91  
  NTFS drive with DLFF 27  
registry entries  
  on Windows NT 19  
registry variables  
  on AIX 37, 45  
release notes 172  
restore wizard 179  
restoring a file system  
  on Windows NT 117  
restoring a JFS file system  
  on AIX 118  
restoring a UFS file system  
  on Solaris 118

## S

sample programs  
  cross-platform 171  
  HTML 171  
searching  
  online information 178, 180  
setting up document server 179  
setup program  
  actions performed by on  
    Windows NT 19  
SmartGuides  
  wizards 178  
Solaris 82  
  common installation  
    considerations 77  
  disk space requirements 77  
  installing additional products and  
    components using  
      db2setup 81  
  installing Data Links  
    Manager 77  
  installing using db2setup 80  
  kernel configuration  
    parameters 77  
  manually installing Data  
    Links 81  
  memory requirements 77  
  product version levels for  
    UFS 78  
  system clocks 80  
  TCP/IP port number 79  
  Volume Manager 81  
synchronize system clocks  
  on Windows NT 16  
system clocks  
  synchronizing on AIX 39  
  synchronizing on Solaris 80  
system requirements  
  on Windows NT 15

## T

TCP/IP  
  on Windows NT 18  
Transarc Distributed Computing  
  Environment (DCE) 41  
troubleshooting Data Links  
  configuration  
    on AIX 72  
    on Solaris 98  
troubleshooting the configuration on  
  Windows NT 33

## U

UFS  
  hostnames 79

UFS (*continued*)  
  increasing size 110  
  user account rights  
    on Windows NT 17

## V

verifying sample file  
  on AIX 69, 70, 95  
  on Solaris 95  
verifying the installation  
  on Windows NT 25  
verifying the sample file is accessible  
  on Windows NT 31  
verifying the sample file is  
  controlled by DLFF  
  on Windows NT 30  
version levels of DB2 Data Links and  
  DB2 UDB  
  on Windows NT 17  
viewing  
  online information 176  
viewing sample file  
  on AIX 72  
  on Solaris 97  
  on Windows NT 32  
Virtual File System (VFS) 45

## W

wizards  
  add database 178, 179  
  backup database 178  
  completing tasks 178  
  configure multisite update 178  
  create database 179  
  create table 179  
  create table space 179  
  index 179  
  performance configuration 179  
  restore database 179

## X

XBSA 54, 86





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