IBM DB2 Data Links Manager
for AIX

Quick Beginnings

Version 6

GC09-2837-00

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Before using this information and the product it supports, be sure to read the general information under “Appendix D. Notices” on page 85.

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Contents

Welcome to DB2 Data Links Manager for AIX!

This Quick Beginnings book will guide you through the planning, installation, and set up of a DB2 Data Links server. 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 and link a file to data in this column. Finally, to complete the test scenario, you will retrieve and view your linked data file.

For a complete description of the DB2 library, see "Appendix C. How the DB2 Library Is Structured" on page 69.

The instructions in this book assume that you are using the DB2 Installer program to perform the installation. Furthermore, the instructions also assume that during the installation you use the DB2 Installer program to create the DB2 Data Links Manager Administrator's user ID and instance.

If you do not follow the documented installation method with the recommended defaults, it may be necessary to refer to the *Administration Guide* and the *Command Reference* to complete the installation and configuration of DB2 Data Links Manager.

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* indicates variables that you should replace with your own value. It is also used to indicate book titles and to emphasize words.

- `Monospace` indicates file names, directory paths, and examples of text you enter exactly as shown.

This icon marks a fast path. A fast path guides you to information specific to your configuration where multiple options are available.

This icon marks a tip. It provides additional information that can help you complete a task.

The term *Data Links* is commonly used to refer to DB2 Data Links Manager.

Part 1. Introduction to DB2 Data Links Manager

Chapter 1. Overview to DB2 Data Links Manager

The amount of data stored digitally is growing rapidly because computer systems and storage systems have become very affordable. The file paradigm is very common for such datatypes as video, image, text, graphics, engineering drawings (and so on) because capture, edit, and delivery tools use the file paradigm for these datatypes.

A large number of applications store, retrieve, and manipulate data in files. These applications may use files to store their data for one or more of the following reasons:

- The expense required to rewrite applications that use standard file I/O semantics to instead use a database as a repository where the data in the files is stored and accessed as large objects.
- 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.
- You want to access data directly from a file server that is 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.
- The application uses a stream server because it has real time requirements for delivery and capture (for example, video data). The data is expected to be large, and you may require isochronous delivery. In these kinds of applications, it is likely that such data will not be moved into the database as a BLOB, but rather stay on the file server.

Isochronous delivery can best be explained as a requirement for a video server to deliver video to a client workstation in real time (that is, there is time dependence for the data that is delivered; otherwise, you would see jitters in the picture). Video servers reserve memory, disk, and network bandwidth to deliver a video without a jitter. (Jitter is a term used to describe the *quality of service* that a video server guarantees for simultaneous delivery of video and audio.)

- Data is captured in high volumes, and, for performance reasons, you do not want to store it in the database.
- The application utilizes tools that work with the file paradigm.

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. They keep the parametric data that describes the raw data for objects so that you can search on the important aspects of those objects. The extenders allow you to specify whether the object itself is to be maintained either in or outside the database.

At the time this book was written, the DB2 relational extenders do not provide referential integrity between files on a server and their references in databases. Thus, 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.

Data Links technology includes the DATALINK data type, implemented as an SQL data type in DB2 Universal Database, which references an object stored external to a database. The DATALINK data type is described below. For information about the components of DB2 Data Links Manager environment, see “Components” on page 5.

You use the DATALINK data type, just like any other SQL data type, to define columns in tables. 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 can be robust in terms of integrity, access control, and recovery: DB2 treats a DATALINK value as if the object were stored in the database (even though it is not). You register a set of known Data Links servers, on the DB2 server, using the DB2 Command Line Processor or the Command Center. The only Data Links server names that you can specify in a DATALINK value are those which have been registered to a DB2 database.

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 videos, images, text (and so on), 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 *"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 to 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 and CAM applications, where the engineering drawings are kept as files, and the attributes are stored in the database. Queries are run against the drawing attributes.

Components

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

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

Data Links Server

A Data Links server consists of 3 components:

- Data Links File Manager (DLFM)
- Data Links Filesystem Filter (DLFF)
- DB2 (Logging Manager)

Data Links File Manager (DLFM)

Registers all the files on a particular Data Links server 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)
Filters commands to ensure that linked files are not deleted, renamed, or the file's attributes are not changed. Optionally, it also filters commands to ensure that proper access authority exists.

File systems under the control of a Data Links Filesystem Filter can be NFS exported.

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, and the mount point of the file systems 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. 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 ADSM (ADSTAR Distributed Storage Manager). The files that are linked via a DATALINK column are ensured to be backed up when your database is backed up.

DB2 Universal Database Server

This is the location of the main database where the Data Links server is registered; more than one Data Links server can be registered on a workstation. It contains tables that include columns of the DATALINK data type. No mounts are 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 be participating 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 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.

Figure 1 on page 8 shows an overview of the interaction between a DB2 server, the DB2 Data Links Manager components, the backup media, and a remote client application.

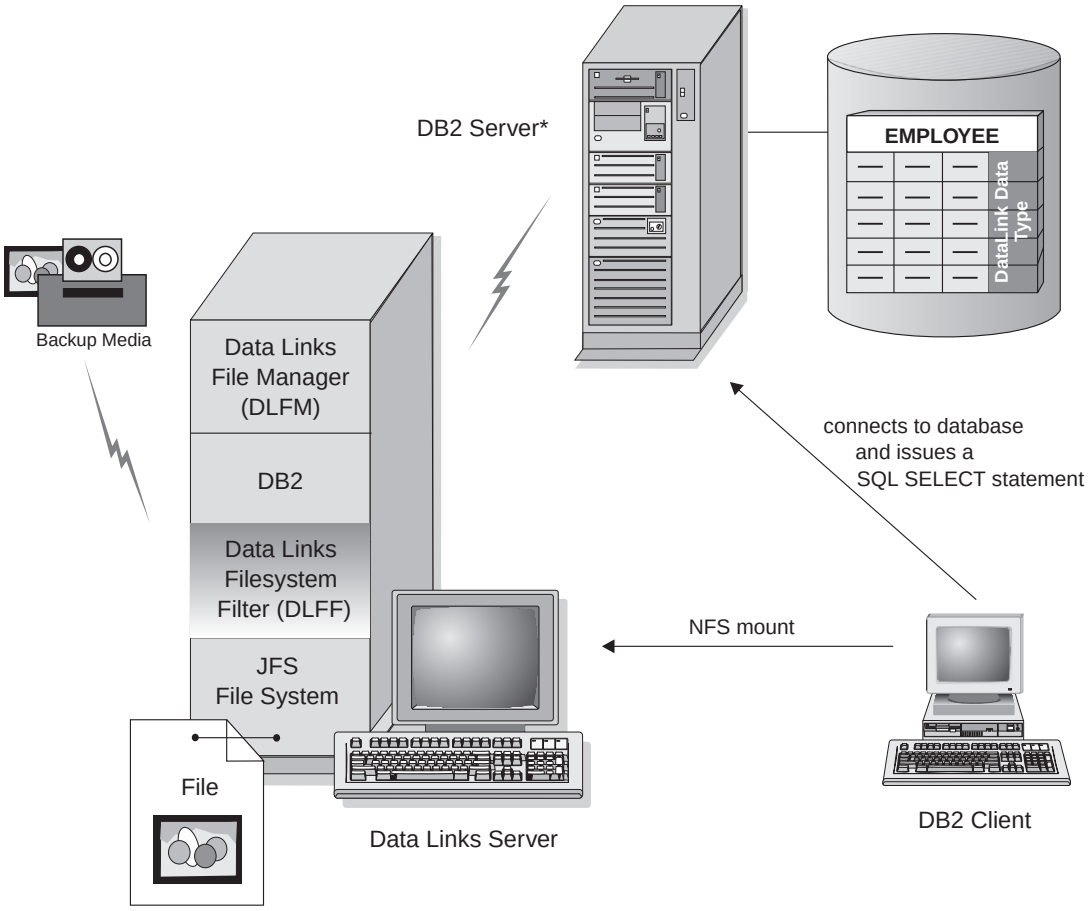


Figure 1. Overview of Data Links Manager Processing

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(dl1) into :var_dl1 from EMPLOYEE
   ```

3. The application would then copy the `:var_dl1` file to the `new_version` file over an NFS mount.

4. Then the application would edit the `new_version` file and issue an SQL statement similar to the following:

```
update set dl1=dlvalue(:new_version)
```

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 63.

Part 2. Installing and Configuring DB2 Data Links Manager

Chapter 2. Installing and Configuring DB2 Data Links Manager

This section describes how to install DB2 Data Links Manager for AIX 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

Read and perform the steps in this section to be sure that you have the required items and information to install DB2 Data Links Manager.

__ 1. 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 following command:

```
df -k /usr/lpp
```

__ 2. Ensure that there is at least 256 MB of memory available to your system. To check for available memory, enter the following command:

```
lsattr -l sys0 -E -a realmem
```

__ 3. Ensure that you are running AIX Version 4.2 or later. To check the level of the operating system, enter the following command:

```
oslevel
```

__ 4. If DB2 is already installed on any machine that will participate in your Data Links environment, ensure that the version of DB2 is DB2 Universal Database Version 6.1 or later. The version of DB2 on the DB2 server, and the DB2 Data Links Manager server, *must* be at the same level. To check the version of DB2 that resides on a workstation, enter the following command:

```
db2level
```

Different levels of DB2 Data Links Manager instances cannot exist on the same machine. If you have a pre-Version 6.1 Data Links instance on your system, you must migrate the instance to the Version 6.1 format using the **db2imigr** command. For more information, refer to the *DB2 for UNIX Quick Beginnings*.

__ 5. During installation, you will be given the option to create the DB2 Data Links Manager Administrator (DLADMIN) user. These installation instructions assume that you select this option.

When you select to create the DLADMIN username, the DB2 Installer program 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.

If you use the DB2 Installer program to create the *dlfm* username, ensure that you change the **Password** and **Verify Password** fields. The *dlfm* username's password is *ibmdb2* for any DB2 Data Links Manager installation and therefore is well known. This could pose a security risk to your network.

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

__ a. Must *not* have its home directory reside on a file system that is using a Data Links Filesystem Filter.

__ b. Must have a username that is eight characters or less.

__ c. Must *not* be a user with `root` authority.

To create a username for use as the DB2 Data Links Manager Administrator (DLADMIN), perform the following steps:

Step a. Log on to the system as a user with `root` authority.

Step b. Create the a group for the DB2 Data Links Administrator (for example, `dlfmgrp`) and username (for example, `dlfm`), using the `/home/dlfm` directory as the home directory of the DLADMIN, by entering the following commands:

```
mkgroup dlfmgrp
mkuser pgrp='dlfmgrp' groups='dlfmgrp' home='/home/dlfm' dlfm
```

Step c. Assign a password to this username by entering the following command:

```
passwd username
```

where *username* is the username that you created for the DLADMIN.

The DB2 Data Links Manager Administrator (DLADMIN) should never own files or directories on a file system that is under the control of a Data Links Filesystem Filter. The DLADMIN 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.

__ 6. Ensure that there is at least 70 MB of free disk space in the home directory where the DB2 Data Links Administrator's home directory will reside. To check available free disk space, enter the following command:

```
df -k INSTHOME
```

where *INSTHOME* is the home directory of the DLADMIN user.

__ 7. Have a TCP/IP port free for use by the Data Links File Manager. By default, the DB2 Installer 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.

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 `services` file located in the `/etc` directory. You will need to specify this port during the installation.

Make note of the port number for use by the Data Links server here: _____.

__ 8. Resolve the fully qualified hostname of your Data Links server. You will need to know this hostname to verify the installation. To resolve this hostname, enter the following commands:

```
hostname
```

This command will return output similar to the following:

```
jgartner
```

This is your *hostname*.

Now enter the **host** *hostname* command. This command should return output similar to the following:

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

This is your fully qualified hostname name.

The fully qualified hostname has been **bolded** in this example to clarify the entry that you should record. The output of this command does not return the fully qualified hostname in bold.

Make note of the Data Links server's fully qualified hostname name here: _____.

__ 9. Resolve the fully qualified hostname of the DB2 server where the DATALINK data type is defined. You will need to know this hostname to verify the installation.

On the DB2 server, follow the instructions in the previous step to resolve this hostname or contact your database administrator.

Make note of the DB2 server's fully qualified hostname here:_____.

__ 10. Ensure that the system clocks on the Data Links server and the remote DB2 server are synchronized (and remain synchronized). To check the system time and date, enter the following command:

```
date
```

For more information on synchronizing system clocks, refer to your *AIX Administration Guide*.

Performing the Installation

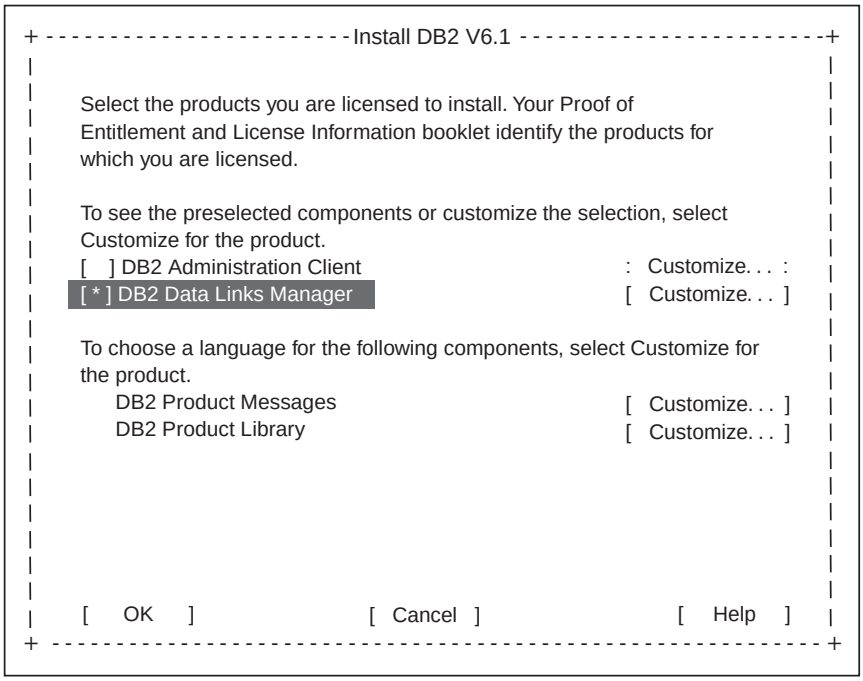
To install and configure DB2 Data Links Manager, perform the following steps:

Step 1. Log on to the system as a user with `root` authority.

Step 2. Mount the CD-ROM drive.

Step 3. Enter the **./db2setup** command, from the mounted CD-ROM, to start the DB2 Installer.

The Install DB2 V6.1 window opens.



From the product list on the Install DB2 V6.1 window, select **DB2 Data Links Manager** and then select **OK**.

Press the **Tab** key to change a highlighted option and the **Enter** key to select or deselect the option you want.

To display the required and optional components for a product that you want to install, select **Customize**. To go back to a previous window at any time, select **Cancel**.

Complete the windows in the DB2 Installer program as they open. For more information about any window, select **Help**.

For a complete description of the actions performed by the DB2 Installer, select **View Log** once the installation completes. You can also check the `/tmp/db2setup.log` file for even more detailed information.

The DB2 Installer program has now:

1. Installed DB2 Data Links Manager in the `/usr/lpp/db2_06_01` directory.
2. Installed DB2 Universal Database in the `/usr/lpp/db2_06_01` directory. DB2 Data Links Manager uses DB2 to maintain logged information for the linked files.
3. If selected, created a group and user ID for the DB2 Data Links Manager Administrator (DLADMIN).
4. Set up the required links for the Data Links Filesystem Filter.
5. Created an instance for the Data Link File Manager. The default instance, associated with the default group and user ID, is called `DLFM`.

If you did not use the DB2 Installer to create the DB2 Data Links Manager Administrator (DLADMIN) username, you must create an instance for this user by entering the following command:

```
/usr/lpp/db2_06_01/instance/dlfmcrt
    -p port_number dladmin_usename
```

where:

- *port_number* is the port number you reserved for communications with the Data Links server.
- *dladmin_username* is the username of the DB2 Data Links Manager Administrator.

For example, if you reserved the TCP/IP port *50100* and the username you created for the DLADMIN was `dlfm`, enter the following command:

```
/usr/lpp/db2_06_01/instance/dlfmcrt -p 50100 dlfm
```

6. Set the following registry variables:

```
DLFM_PORT=port_number
DLFM_LOG_LEVEL=LOG_ERR
DB2_RR_TO_RS=ON
DB2_HASH_JOIN=ON
```

```
DLFM_INSTALL_PATH=$HOME/sqllib/bin
DB2INSTANCE=dladmin_username
DLFM_BACKUP_DIR_NAME=$HOME/dlfmbackup
```

where:

- *port_number* is the port number reserved for the Data Links File Manager.
- *dladmin_username* is the username the DB2 Data Links Manager Administrator.

7. Set the following variables in the DB2 Data Links Manager Administrator's db2profile or db2cshrc script file:

```
(for Bash, Bourne, or Korn shell)
export PATH=$PATH:$HOME/sqllib/bin:$HOME/sqllib/adm:$HOME/sqllib/misc
(for C shell)
setenv PATH=${PATH}:${HOME}/sqllib/bin:${HOME}/sqllib/adm:${HOME}/sqllib/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/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.

8. Added the following entry to the /etc/vfs file:

```
dlfs 12  /usr/lpp/db2_06_01/bin/dlfs_mnthlp /usr/lpp/db2_06_01/bin/dlfs_fshelper
```

If the vfs number *12* is already in use, the DB2 Installer will specify a different number between *8-15* for use by the Virtual File System (VFS).

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 Steps

Once the DB2 Installer program 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 disaster recovery and protect the integrity of your data.

To verify that the DLFM_DB database was successfully created and catalogued, perform the following steps:

Step 1. Log on to the system as the DB2 Data Links Manager Administrator.

Step 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.

Step 3. 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
 Catalog node number            = 0
```

If this database does not exist, see "Creating and Dropping the DB2 Database on the Data Links Server" on page 41.

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 (default method) and ADSTAR Distributed Storage Manager (ADSM) are the two options that are supported for file backup to an archive server. Future releases of DB2 Data Links Manager will support other vendor's backup media and software.

(1) Disk Copy (default method)

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 any directories 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 (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_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.

(2) ADSM Archive Server

To use ADSM as an archive server, perform the following the steps:

Step 1. Install ADSM on the Data Links server. For more information, refer to your ADSM product documentation.

Step 2. Register the Data Links server client application with the ADSM server. For more information, refer to your ADSM product documentation.

Step 3. Add the following environment variables to the DB2 Data Links Manager Administrator's db2profile or db2cshrc script files:

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

(for C shell)
setenv DSMI_DIR /usr/lpp/adsm/bin
```

```
setenv DSMI_CONFIG ${HOME}/adsm/dsm.opt
setenv DSMI_LOG ${HOME}/dldump
setenv PATH=${PATH}:/usr/lpp/adsm/bin
```

Step 4. Ensure that the `dsm.sys` ADSM system options file is located in the `/usr/lpp/adsm/bin` directory.

Step 5. Ensure that the `dsm.opt` ADSM user options file is located in the *INSTHOME*`/adsm` directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 6. Set the *PASSWORDACCESS* option to `generate` in the `/usr/lpp/adsm/bin/dsm.sys` ADSM system options file.

Step 7. Register an ADSM 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 ADSM server. For more information, refer to your ADSM product documentation.

Step 8. Set the *DLFM_BACKUP_DIR_NAME* registry variable to *ADSM* by entering the following command:

```
db2set DLFM_BACKUP_DIR_NAME=adsm
```

This will activate the ADSM backup option.

Step 9. Stop the Data Links File Manager by entering the **dlfm stop** command.

Step 10. 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 3. Verifying the Installation” on page 23 for more information.

Chapter 3. Verifying the Installation

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

For the purposes of this scenario, we will assume the following:

- The hostname of the Data Links Server is: `jgartner.services.com`.
- The hostname of the DB2 Server is: `dmcinnis.services.com`.
- The port number reserved for communications is: `50100`.
- The name of the file system that is under the control of a Data Links Filesystem Filter is: `/test`.

To verify the installation and configuration of DB2 Data Links Manager, perform the following steps:

A. On the DB2 Server

Step 1. Log on to the system as a user with `root` authority.

Step 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*.

For our example, create an instance called `VALIDATE` by entering the following commands:

```
mkgroup testers
mkuser pgrp='testers' groups='testers' home='/home/validate' validate
/usr/lpp/db2_06_01/instance/db2icrt -u validate validate
```

Step 3. Log out.

Step 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. For more information, refer to your server's *Quick Beginnings* manual.

By default, any user that belongs to the primary group of the instance owner has SYSADM authority on an instance.

Step 5. 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*.

Step 6. Start the VALIDATE instance by entering the **db2start** command.

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 had not started the VALIDATE instance and that is why we only issued the **db2start** command. For more information, refer to the *Administration Guide*.

Step 7. Create a database using the **db2 create database** command. This database will contain a table, that you will create, using the DATALINK data type. For more information, refer to the *Command Reference*.

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

```
db2 create database staff
```

Step 8. Connect to the STAFF database by entering the following command:

```
db2 connect to staff
```

Step 9. 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)"
```

Step 10. Terminate all connections to this database by entering the following command:

```
db2 connect reset
```

Step 11. Log out.

B. On the DB2 Data Links Server

Step 1. Log on to the system as a user with root authority.

Step 2. Create a Journaled File System (JFS) file system using the **smit jfs** utility, or use an existing JFS file system. For more information, refer to your *AIX Administration Guide*.

For the purposes of this example, we will assume that the name of the file system that you are using for the Data Links Filesystem Filter is called /test.

Step 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_06_01/instance/dlfmfsmd dlfm_mountpoint
```

where *dlfm_mountpoint* is the mount point of the JFS file system that you created for the Data Links Filesystem Filter in the previous step.

For our example, enter the following command:

```
/usr/lpp/db2_06_01/instance/dlfmfsmd /test
```

Step 4. Log out.

Step 5. Log on to the system as the DB2 Data Links Manager Administrator.

Step 6. 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.

Step 7. Start the Data Links File Manager by entering the **dlfm start** command.

Step 8. 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     dlfm     dlfm    02:44   dlfmd
  49852      1  55994     dlfm     dlfm    02:44   dlfmd
⋮
  56510  49852  55994     dlfm     root    02:44   dlfm_chownd
```

Step 9. Ensure that you successfully mounted the file system that is under the control of a Data Links Filesystem Filter (DLFF) by entering the following command:

```
lsfs -v dlfs
```

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

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

Step 10. Register a file system that is under the control of a Data Links Filesystem Filter (DLFF) by entering the following command:

```
dlfm add_prefix filesystem_name
```

where *filesystem_name* is the name file system that is under the control of a DLFF.

For our 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
```

Step 11. Register the remote DB2 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 where the DATALINK data type is defined.
- *instance* is the instance where the *database* resides.
- *hostname* is the fully qualified hostname of the DB2 server where the *database* is resides.

For our example, register the database called STAFF, which resides in the VALIDATE instance on a machine called *dmcinnis.services.com*, by entering the following command:

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

You should not run this command specifying the DLFM_DB database. This is a local database that is used to keep track of those files that are under the control of the Data Links File Manager.

Step 12. Log out.

Step 13. Log on to the system as any user that is not a DB2 Data Links Manager Administrator.

Step 14. 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 our example, create the directory called pictures, on the file system /test, by entering the following command:

```
mkdir /test/pictures
```

Step 15. 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 /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.

For our example, enter the following command:

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

Step 16. Create a file called paulz.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 Zikopoulos" > /test/pictures/paulz.bmp
```

Step 17. Log out.

C. On the DB2 Server

Step 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. For more information, refer to your server's *Quick Beginnings* manual.

By default, any user that belongs to the primary group of the instance owner has SYSADM authority on an instance.

Step 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.

Step 3. Start the VALIDATE instance by entering the **db2start** command.

Step 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 jgartner.services.com port 50100"
```

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

```
db2 connect to staff
```

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

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

where:

- *hostname* is the fully qualified hostname of the Data Links server. You recorded this hostname in "Before You Begin" on page 13.
- *controlled_file* is the full pathname of the file that you want to control on the Data Links server.

In our example, enter the following command

```
db2 "insert into employee values (001,'Paul','Zikopoulos',
     dlvalue('http://jgartner.services.com/test/pictures/paulz.bmp'))"
```

Step 7. Log out.

D. On the DB2 Data Links Server

Step 1. Log on to the system as any user (except as a user with root authority, or as the DB2 Data Links Manager Administrator).

Step 2. Verify that the paulz.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/paulz.bmp
```

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

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

Step 3. Log out.

E. On the DB2 Server

Step 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. For more information, refer to your server's *Quick Beginnings* manual.

By default, any user that belongs to the primary group of the instance owner has SYSADM authority on an instance.

Step 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.

Step 3. Start the VALIDATE instance by entering the **db2start** command.

Step 4. Connect to the STAFF database by entering the following command:

```
db2 connect to staff
```

Step 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 = 'Zikopoulos'"
```

This command will return 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 our example, the access token that you receive will be similar to the following:

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

This key will be used to read this file on the Data Links server. Make note of the *access_token* here: _____.

The access token that is returned is only valid for 60 seconds. This means that once you enter this command, you will only have 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*.

Step 6. Log out.

F. On the DB2 Data Links Server

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.

   For our example, enter the following command:

   ```
   cat "/test/pictures/token_key;paulz.bmp"
   ```

   where *token_key* 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 Zikopoulos"
   ```

For the purposes of testing the installation, you created a file called `paulz.bmp`. This file was created to represent an employee's picture that was inserted into a table that was defined with the DATALINKS data type.

We created the `paulz.bmp` file by piping text into this file using the **echo** command. The extension of this file (`.bmp`) implies that this is a binary file, however, it is really a text file. Most files that are controlled by a Data Links server are binary files.

Running the **cat** command on a true binary file would return garbage output. The example is merely illustrating the fact that a Data Links server controlled and then released control of a linked file. *Do not* run the **cat** command on binary files.

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 4. Using the Data Links File Manager" on page 35.

If you received a error, go to "Troubleshooting the Configuration"

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

Troubleshooting the Configuration

If you received an error, use the following checklist and go through the configuration instructions again, verifying each item as you complete the task.

At the Data Links server:

__ 1. Ensure that you correctly registered the file system that is being used to store any linked files.

__ 2. Ensure that the DB2 database was registered correctly.

__ 3. 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.

__ 4. Ensure that the Data Links File Manager was started.

At the DB2 server:

__ 1. The *DATALINKS* database manager configuration parameter is set to *YES*.

__ 2. The Data Links server was registered correctly using the **db2 add datalinks manager** command.

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 Messages" on page 51. For information on any error messages that you may encounter on the DB2 server, refer to the *Message Reference*.

Part 3. Using DB2 Data Links Manager

Chapter 4. Using the Data Links File Manager

This section describes the basic commands that the DB2 Data Links Manager Administrator may have to perform on a Data Links server during day-to-day operations.

For a complete list of all the Data Links File Manager commands, enter the **dlfm** command.

Starting and Stopping the Data Links File Manager

This section describes how to start and stop a 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, perform the following steps:

Step 1. Log on to the system as the DB2 Data Links Manager Administrator.

Step 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 40.

To stop the Data Links File Manager, perform the following steps:

Step 1. Log on to the system as the DB2 Data Links Manager Administrator.

Step 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 40.

To stop and restart the Data Links File Manager by entering only one command, perform the following steps:

Step 1. Log on to the system as the DB2 Data Links Manager Administrator.

Step 2. Enter the **dlfm restart** command.

Monitoring the Data Links File Manager Back-End Processes

This section describes how to monitor the Data Links File Manager back-end process.

For every connection that DB2 makes to the Data Links server, a `dlfm_child` back-end process will be started.

To monitor the Data Links File Manager back-end processes, enter the following command:

```
dlfm see
```

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     dlfm     dlfm    02:44   dlfmd_upcalld
49852     1 55994     dlfm     dlfm    02:44   dlfmd
52674 49852 55994     dlfm     root    02:44   dlfm_gcd
54214 49852 55994     dlfm     dlfm    02:44   dlfmd_delgrpd
54720 49852 55994     dlfm     root    02:44   dlfm_retrieved
56260 49852 55994     dlfm     root    02:44   dlfm_copyd
56510 49852 55994     dlfm     root    02:44   dlfm_chownd
```

If the Data Links File Manager back-end processes did not start successfully, this command will not return any output.

Restarting the Data Links Server after an Abnormal Termination

This section describes how to restart a Data Links server after an abnormal termination.

If the Data Links File Manager terminates abnormally, or you simply cannot stop the Data Links File Manager using the **dlfm stop** command, perform the following steps:

Step 1. Log on to the system as the DB2 Data Links Manager Administrator.

Step 2. Enter the **dlfm shutdown** command to bring down the active Data Links File Manager.

Step 3. Start the Data Links File Manager by entering the **dlfm start** command.

You should *never* stop any Data Links File Manager processes using the `kill -9` signal.

Listing or Adding Registered File Systems Under the Control of a Data Links Filesystem Filter

This section describes how to list any file systems that are under the control of a Data Links Filesystem Filter, and how to register other file systems to be controlled by a Data Links Filesystem Filter (DLFF).

To list any file systems that are currently under the control of a Data Links Filesystem Filter, perform the following steps:

Step 1. Log on to the system as the DB2 Data Links Manager Administrator.

Step 2. Enter the **dlfm list registered prefixes** command on the Data Links server.

To add a Data Links Filesystem Filter, perform the following steps:

Step 1. Create a Journaled File System (JFS) file system using the **smit jfs** utility, or use an existing JFS file system. For more information, refer to your *AIX Administration Guide*.

For the purposes of this example, we will assume that the name of the file system that you are using for the Data Links Filesystem Filter is called `/test`.

Step 2. 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_06_01/instance/dlfmfsmd dlfm_mountpoint
```

where *dlfm_mountpoint* is the mount point of the JFS file system that you created for the Data Links Filesystem Filter in the previous step.

Step 3. Log out.

Step 4. Log on to the system as the DB2 Data Links Manager Administrator.

Step 5. Start the Data Links File Manager by entering the **dlfm start** command.

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

```
dlfm add_prefix filesystem_name
```

where *filesystem_name* is the name file system that is under the control of a DLFF.

For our 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
```

Loading, Querying, and Unloading a Data Links Filesystem Filter

This section describes how to load, query, or unload a Data Links Filesystem Filter. You may want to use any of the following commands to disable a Data Links server (in order to install a fix pack, debug problems, or cleanup an existing machine), and then enable it for use.

To load a Data Links Filesystem Filter, perform the following steps:

Step 1. Log on to the system as a user with `root` authority.

Step 2. Enter the **strload -f /usr/lpp/db2_06_01/cfg/dlfs_cfg** command.

To query a Data Links Filesystem Filter, perform the following steps:

Step 1. Log on to the system as a user with `root` authority.

Step 2. Enter the **strload -q -f /usr/lpp/db2_06_01/cfg/dlfs_cfg** command.

To unload a Data Links Filesystem Filter, perform the following steps:

Step 1. Log on to the system as the DB2 Data Links Manager Administrator.

Step 2. Enter the **strload -u -f /usr/lpp/db2_06_01/cfg/dlfs_cfg** command

Increasing the Size of a File System that is under the Control of a Data Links Filesystem Filter

This section describes how to increase the size of a file system using a Data Links Filesystem Filter.

To allocate more space to an existing file system that is using a Data Links Filesystem Filter, perform the following steps:

Step 1. Log on to the system as a user with `root` authority.

Step 2. Modify the properties of the file system 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_06_01/instance/dlfmfsmd -j filesystem_name
```

where *filesystem_name* specifies the name of the mounted file system that is using the Data Links Filesystem Filter.

Step 3. Enter the **smit jfs** command and increase the size of this file system.

Step 4. 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_06_01/instance/dlfmfsmd dlfm_mountpoint
```

where *dlfm_mountpoint* is the mount point of the JFS file system that you created for the Data Links Filesystem Filter in the previous step.

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, perform the following steps:

Step 1. Log on to the system as the DB2 Data Links Manager Administrator.

Step 2. Enter the **dlfm list registered databases** command on the Data Links server.

To register a new database with the Data Links File Manager, perform the following steps:

Step 1. Log on to the system as the DB2 Data Links Manager Administrator.

Step 2. Register the remote DB2 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 where the DATALINK data type is defined.
- *instance* is the instance where the *database* resides.
- *hostname* is the fully qualified hostname of the DB2 server where the *database* is resides.

For our example, register the database called STAFF, which resides in the VALIDATE instance on a machine called *dmcinnis.services.com*, by entering the following command:

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

You should not run this command specifying the DLFM_DB database. This is a local database that is used to keep track of those files that are under the control of the Data Links File Manager.

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, perform the following steps:

Step 1. Log on to the system as the DB2 Data Links Manager Administrator.

Step 2. Enter the **dlfm startdbm** command.

To stop the DB2 database manager on the Data Links server, perform the following steps:

Step 1. Log on to the system as the DB2 Data Links Manager Administrator.

Step 2. Stop the Data Links File Manager by entering the **dlfm stop** command.

Step 3. Enter the **dlfm stopdbm** command.

Changing the Diagnostic Level for the Error Messages Log File

Error messages 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. Error messages log files are located in the */INSTHOME*/sqllib/db2dump/db2diag.log directory where *INSTHOME* is the home directory of the instance owner.

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

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, perform the following steps:

Step 1. Log on to the system as the DB2 Data Links Manager Administrator.

Step 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, perform the following steps:

Step 1. Log on to the system as the DB2 Data Links Manager Administrator.

Step 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, perform the following steps:

Step 1. Log on to the system as the DB2 Data Links Manager Administrator.

Step 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.

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 will be asked to provide them interactively, using a generated list of options for the *database_name* and *instance_name* parameters.

This command, entered without parameters, will retrieve output similar to the following:

```
   No database specified. Going for default database : dlfm_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       1998-06-03-13.26.49.586476    /dlfstest/fileA1
E1            L       1998-06-03-13.26.50.243762    /dlfstest/fileA2
E1            L       1998-06-03-13.25.55.345240    /dlfstest/fileA3
E1            L       1998-06-03-13.27.03.034247    /dlfstest/fileA31
E1            L       1998-06-03-13.27.03.937676    /dlfstest/fileA32
E1            L       1998-06-03-13.25.56.176132    /dlfstest/fileA4
E1            L       1998-06-03-13.25.56.961493    /dlfstest/fileA5
E1            L       1998-06-03-13.25.58.424379    /dlfstest/fileB1
E1            L       1998-06-03-13.25.59.126102    /dlfstest/fileB2
E1            L       1998-06-03-13.26.51.973211    /dlfstest/fileB3
E1            L       1998-06-03-13.26.52.623260    /dlfstest/fileB4
E1            L       1998-06-03-13.26.53.278827    /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 5. Recovering from a Crash on the Data Links Server

This section 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.

In the case of a machine crash on a Data Links server, DB2 applications interacting with the DB2 File Manager can hang. Use the **force application** command to force such applications off the system.

In the case of a machine crash on a DB2 server, the affected Data Links File Managers (DLFMs) should also be shut down, using the **dlfm stop** command and then restarted.

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 must 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 utility, *db2_recon_aid*, 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.

Backing up a file system

This section describes how to backup a file system on AIX.

To create a backup using Version 3 inode format, perform the following steps:

Step 1. Log on to the system as a user with root authority.

Step 2. Start the System Management Interface Tool (SMIT) by entering the **smit** command.

Step 3. Unmount the file system to be backed up. Select **System Storage Management-> File Systems->Unmount a File System.**

Step 4. Backup the file system. Select **System Storage Management->File Systems-> Backup a File System.**

Step 5. Mount the file system that was just backed up. 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.

Restoring a file system

This section describes how to restore a file system on AIX.

To restore a file system perform the following steps:

Step 1. Log on to the system as a user with root authority.

Step 2. Start the System Management Interface Tool (SMIT) by entering the **smit** command.

Step 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.**

Step 4. To restore the file system, select **System Storage Management->File Systems->Restore a File System.**

Bringing the File System Directory Hierarchy to the Current Point in Time

The directory changes are logged in the *INSTHOME*/sqllib/db2dump/fsysadm.log file, where *INSTHOME* is the home directory of the Data Links Administrator. 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

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. The db2_recon_aid utility is located in the *INSTHOME*/sqllib/adm directory, where *INSTHOME* is the home directory of the instance owner. 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.

Part 4. Appendixes

Appendix A. DB2 Data Links Manager Errors and Messages

This section describes the errors, messages, causes, and required actions to errors that you may encounter when using the Data Links File Manager.

Error messages are directed to the *INSTHOME*/sqllib/db2dump/db2diag.log file (where *INSTHOME* is the home directory of the instance owner), or are 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:

Step 1. Log on to the system as the DB2 Data Links Manager Administrator.

Step 2. Enter the **dlfm stop** command to stop the Data Links File Manager.

Step 3. Enter the **dlfm shutdown** command to shutdown the Data Links server.

Step 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:

Step 1. See the error trace information in the `db2diag.log` file, located in the *INSTHOME*`/sqllib/db2dump` directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 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:

Step 1. See the error trace information in the `db2diag.log` file, located in the *INSTHOME*`/sqllib/db2dump` directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 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 page 37.

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:

Step 1. See the error trace information in the `db2diag.log` file, located in the *INSTHOME*`/sqllib/db2dump` directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 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. The file system is not mounted using the specified Data Links Filesystem Filter.

Action:

The DB2 Data Links Manager Administrator should mount 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:

Step 1. See the error trace information in the `db2diag.log` file, located in the *INSTHOME*`/sqllib/db2dump` directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 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 page 37.

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:

Step 1. Log on to the system as the DB2 Data Links Manager Administrator.

Step 2. Enter the **dlfm shutdown** command to shutdown the Data Links server.

Step 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:

Step 1. See the error trace information in the `db2diag.log` file, located in the *INSTHOME*`/sqllib/db2dump` directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 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:

Step 1. See the error trace information in the `db2diag.log` file, located in the *INSTHOME*`/sqllib/db2dump` directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 2. Restart the Data Links File Manager (if needed).

Step 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:

Step 1. See the error trace information in the `db2diag.log` file, located in the *INSTHOME*`/sqllib/db2dump` directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 2. Restart the Data Links File Manager (if needed).

Step 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:

Step 1. See the error trace information in the `db2diag.log` file, located in the *INSTHOME*`/sqllib/db2dump` directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 2. Restart the Data Links File Manager (if needed).

Step 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:

Step 1. See the error trace information in the `db2diag.log` file, located in the *INSTHOME*`/sqllib/db2dump` directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 2. Restart the Data Links File Manager (if needed).

Step 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:

Step 1. See the error trace information in the db2diag.log file, located in the *INSTHOME*/sqllib/db2dump directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 2. Restart the Data Links File Manager (if needed).

Step 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:

Step 1. See the error trace information in the db2diag.log file, located in the *INSTHOME*/sqllib/db2dump directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 2. Restart the Data Links File Manager (if needed).

Step 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:

Step 1. See the error trace information in the db2diag.log file, located in the *INSTHOME*/sqllib/db2dump directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 2. Restart the Data Links File Manager (if needed).

Step 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:

Step 1. See the error trace information in the `db2diag.log` file, located in the *INSTHOME*`/sqllib/db2dump` directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 2. Restart the Data Links File Manager (if needed).

Step 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:

Step 1. See the error trace information in the `db2diag.log` file, located in the *INSTHOME*`/sqllib/db2dump` directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 2. Restart the Data Links File Manager (if needed).

Step 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:

Step 1. See the error trace information in the `db2diag.log` file, located in the *INSTHOME*`/sqllib/db2dump` directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 2. Restart the Data Links File Manager (if needed).

Step 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:

Step 1. See the error trace information in the `db2diag.log` file, located in the *INSTHOME*`/sqllib/db2dump` directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 2. Restart the Data Links File Manager (if needed).

Step 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:

Step 1. See the error trace information in the `db2diag.log` file, located in the *INSTHOME*`/sqllib/db2dump` directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 2. Restart the Data Links File Manager (if needed).

Step 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:

Step 1. See the error trace information in the `db2diag.log` file, located in the *INSTHOME*`/sqllib/db2dump` directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 2. Restart the Data Links File Manager (if needed).

Step 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:

Step 1. See the error trace information in the `db2diag.log` file, located in the *INSTHOME*`/sqllib/db2dump` directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 2. Restart the Data Links File Manager (if needed).

Step 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:

Step 1. See the error trace information in the `db2diag.log` file, located in the *INSTHOME*`/sqllib/db2dump` directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 2. Log on to the system as the DB2 Data Links Manager Administrator.

Step 3. Enter the **dlfm shutdown** command to shutdown the Data Links server.

Step 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:

Step 1. See the error trace information in the `db2diag.log` file, located in the *INSTHOME*`/sqllib/db2dump` directory (where *INSTHOME* is the home directory of the DB2 Data Links Manager Administrator).

Step 2. Log on to the system as the DB2 Data Links Manager Administrator.

Step 3. Enter the **dlfm shutdown** command to shutdown the Data Links server.

Step 4. Start the Data Links File Manager by entering the **dlfm start** command.

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.

```
/*****************************************************************************
**
** 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 <sqlcli1.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" ;
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 ;
SQLUINTEGER 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
** Attribute #1) <My First Datalink>
** Attribute #2) <URL>
** Attribute #3) <HTTP://mycomputer.company.com/nfsdlink/userid/
**    HVJ5NXGC0WQ.I5KKB6;test_1.jpg>
** Attribute #4) </nfsdlink/userid/HVJ5NXGC0WQ.I5KKB6;test_1.jpg>
** Attribute #5) </nfsdlink/userid/test_1.jpg>
** Attribute #6) <HTTP>
** Attribute #7) <mycomputer.company.com>
**
** >Disconnecting .....
**
**
================================================================ */
```

Appendix C. How the DB2 Library Is Structured

The DB2 Universal Database library consists of SmartGuides, online help, books and sample programs in HTML format. This section describes the information that is provided, and how to access it.

To access product information online, you can use the Information Center. You can view task information, DB2 books, troubleshooting information, sample programs, and DB2 information on the Web. See "Accessing Information with the Information Center" on page 80 for details.

Completing Tasks with SmartGuides

SmartGuides help you complete some administration tasks by taking you through each task one step at a time. SmartGuides are available through the Control Center and the Client Configuration Assistant. The following table lists the SmartGuides.

Note: Create Database, Index, and Configure Multisite Update SmartGuide are available for the partitioned database environment.

SmartGuide	Helps You to...	How to Access...
Add Database	Catalog a database on a client workstation.	From the Client Configuration Assistant, click **Add**.
Back up Database	Determine, create, and schedule a backup plan.	From the Control Center, click with the right mouse button on the database you want to back up and select **Backup**->**Database using SmartGuide**.
Configure Multisite Update SmartGuide	Perform a multi-site update, a distributed transaction, or a two-phase commit.	From the Control Center, click with the right mouse button on the **Database** icon and select **Multisite Update**.
Create Database	Create a database, and perform some basic configuration tasks.	From the Control Center, click with the right mouse button on the **Databases** icon and select **Create**->**Database using SmartGuide**.

SmartGuide	Helps You to...	How to Access...
Create Table	Select basic data types, and create a primary key for the table.	From the Control Center, click with the right mouse button on the **Tables** icon and select **Create->Table using SmartGuide**.
Create Table Space	Create a new table space.	From the Control Center, click with the right mouse button on the **Table spaces** icon and select **Create->Table space using SmartGuide**.
Index	Advise which indexes to create and drop for all your queries.	From the Control Center, click with the right mouse button on the **Index** icon and select **Create->Index using SmartGuide**.
Performance Configuration	Tune the performance of a database by updating configuration parameters to match your business requirements.	From the Control Center, click with the right mouse button on the database you want to tune and select **Configure using SmartGuide**.
Restore Database	Recover a database after a failure. It helps you understand which backup to use, and which logs to replay.	From the Control Center, click with the right mouse button on the database you want to restore and select **Restore->Database using SmartGuide**.

Accessing Online Help

Online help is available with all DB2 components. The following table describes the various types of help. You can also access DB2 information through the Information Center. For information see "Accessing Information with the Information Center" on page 80.

Type of Help	Contents	How to Access...
Command Help	Explains the syntax of commands in the command line processor.	From the command line processor in interactive mode, enter: ? *command* where *command* is a keyword or the entire command. For example, `? catalog` displays help for all the CATALOG commands, while `? catalog database` displays help for the CATALOG DATABASE command.

Type of Help	Contents	How to Access...
Control Center Help *Client Configuration Assistant Help* *Event Analyzer Help* *Command Center Help*	Explains the tasks you can perform in a window or notebook. The help includes prerequisite information you need to know, and describes how to use the window or notebook controls.	From a window or notebook, click the **Help** push button or press the F1 key.

Message Help	Describes the cause of a message, and any action you should take.	From the command line processor in interactive mode, enter:
		
		`? XXXnnnnn`
		
		where *XXXnnnnn* is a valid message identifier.
		
		For example, `? SQL30081` displays help about the SQL30081 message.
		
		To view message help one screen at a time, enter:
		
		`? XXXnnnnn | more`
		
		To save message help in a file, enter:
		
		`? XXXnnnnn > filename.ext`
		
		where *filename.ext* is the file where you want to save the message help.

SQL Help	Explains the syntax of SQL statements.	From the command line processor in interactive mode, enter: `help statement` where *statement* is an SQL statement. For example, **help** SELECT displays help about the SELECT statement. **Note:** SQL help is not available on UNIX-based platforms.
SQLSTATE Help	Explains SQL states and class codes.	From the command line processor in interactive mode, enter: **?** *sqlstate* or **?** *class-code* where *sqlstate* is a valid five-digit SQL state and *class-code* is the first two digits of the SQL state. For example, `? 08003` displays help for the 08003 SQL state, while `? 08` displays help for the 08 class code.

DB2 Information – Hardcopy and Online

The table in this section lists the DB2 books. They are divided into two groups:

Cross-platform books
These books contain the common DB2 information for all platforms.

Platform-specific books
These books are for DB2 on a specific platform. For example, there are separate *Quick Beginnings* books for DB2 on OS/2, on Windows NT, and on the UNIX-based platforms.

Cross-platform sample programs in HTML
These samples are the HTML version of the sample programs that are installed with the SDK. They are for informational purposes and do not replace the actual programs.

Most books are available in HTML and PostScript format, or you can choose to order a hardcopy from IBM. The exceptions are noted in the table.

On OS/2 and Windows platforms, HTML documentation files can be installed under the doc\html subdirectory. Depending on the language of your system, some files may be in that language, and the remainder are in English.

On UNIX platforms, you can install multiple language versions of the HTML documentation files under the doc/%L/html subdirectories. Any documentation that is not available in a national language is shown in English.

You can obtain DB2 books and access information in a variety of different ways:

View See "Viewing Online Information" on page 79.

Search See "Searching Online Information" on page 82.

Print See "Printing the PostScript Books" on page 82.

Order See "Ordering the Printed Books" on page 83.

Name	Description	Form Number File Name for Online Book	HTML Directory
	Cross-Platform Books		

Name	Description	Form Number File Name for Online Book	HTML Directory
Administration Guide	*Administration Guide, Design and Implementation* contains information required to design, implement, and maintain a database. It also describes database access using the Control Center(whether local or in a client/server environment), auditing, database recovery, distributed database support, and high availability. *Administration Guide, Performance* contains information that focuses on the database environment, such as application performance evaluation and tuning. You can order both volumes of the *Administration Guide* in the English language in North America using the form number SBOF-8922.	Volume 1 SC09-2839 db2d1x60 Volume 2 SC09-2840 db2d2x60	db2d0
Administrative API Reference	Describes the DB2 application programming interfaces (APIs) and data structures you can use to manage your databases. Explains how to call APIs from your applications.	SC09-2841 db2b0x60	db2b0
Application Building Guide	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. This book combines the *Building Applications* books for the OS/2, Windows, and UNIX-based environments.	SC09-2842 db2axx60	db2ax
APPC, CPI-C and SNA Sense Codes	Provides general information about APPC, CPI-C, and SNA sense codes that you may encounter when using DB2 Universal Database products. **Note:** Available in HTML format only.	No form number db2apx60	db2ap

Name	Description	Form Number File Name for Online Book	HTML Directory
Application Development Guide	Explains how to develop applications that access DB2 databases using embedded SQL or JDBC, how to write stored procedures, user-defined types, user-defined functions, and how to use triggers. It also discusses programming techniques and performance considerations. This book was formerly known as the *Embedded SQL Programming Guide*.	SC09-2845 db2a0x60	db2a0
CLI Guide and Reference	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.	SC09-2843 db2l0x60	db2l0
Command Reference	Explains how to use the command line processor, and describes the DB2 commands you can use to manage your database.	SC09-2844 db2n0x60	db2n0
Data Movement Utilities Guide and Reference	Explains how to use the Load, Import, Export, Autoloader, and Data Propogation utilities to work with the data in the database.	SC09-2858 db2dmx60	db2dm
DB2 Connect Personal Edition Quick Beginnings	Provides planning, installing, and configuring information for DB2 Connect Personal Edition.	GC09-2830 db2c1x60	db2c1
DB2 Connect User's Guide	Provides concepts, programming and general usage information about the DB2 Connect products.	SC09-2838 db2c0x60	db2c0
Connectivity Supplement	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, and on how to use DRDA application servers with DB2 Connect application requesters. **Note:** Available in HTML and PostScript formats only.	No form number db2h1x60	db2h1
Glossary	Provides a comprehensive list of all DB2 terms and definitions. **Note:** Available in HTML format only.	No form number db2t0x50	db2t0

Name	Description	Form Number File Name for Online Book	HTML Directory
Installation and Configuration Supplement	Guides you through the planning, installation, and set up of platform-specific DB2 clients. This supplement contains information on binding, setting up client and server communications, DB2 GUI tools, DRDA AS, distributed installation, and the configuration of distributed requests and access methods to heterogeneous data sources.	GC09-2857 db2iyx60	db2iy
Message Reference	Lists messages and codes issued by DB2, and describes the actions you should take.	GC09-2846 db2m0x60	db2m0
Replication Guide and Reference	Provides planning, configuration, administration, and usage information for the IBM Replication tools supplied with DB2.	SC26-9642 db2e0x60	db2e0
SQL Getting Started	Introduces SQL concepts, and provides examples for many constructs and tasks.	SC09-2856 db2y0x60	db2y0
SQL Reference, Volume 1 and Volume 2	Describes SQL syntax, semantics, and the rules of the language. Also includes information about release-to-release incompatibilities, product limits, and catalog views. You can order both volumes of the *SQL Reference* in the English language in North America with the form number SBOF-8923.	SBOF-8923 Volume 1 db2s1x60 Volume 2 db2s2x60	db2s0
System Monitor Guide and Reference	Describes how to collect different kinds of information about databases and the database manager. Explains how to use the information to understand database activity, improve performance, and determine the cause of problems.	SC09-2849 db2f0x60	db2f0
Troubleshooting Guide	Helps you determine the source of errors, recover from problems, and use diagnostic tools in consultation with DB2 Customer Service.	S10J-8169	db2p0

Name	Description	Form Number File Name for Online Book	HTML Directory
What's New	Describes the new features, functions, and enhancements in DB2 Universal Database, Version 6.0, including information about Java-based tools.	SC09-2851 db2q0x60	db2q0
	Platform-Specific Books		
Administering Satellites Guide and Reference	Provides planning, configuration, administration, and usage information for satellites.	GC09-2821 db2dsx60	db2ds
DB2 Personal Edition Quick Beginnings	Provides planning, installation, migration, and configuration information for DB2 Universal Database Personal Edition on the OS/2, Windows 95, and Windows NT operating systems.	GC09-2831 db2i1x60	db2i1
DB2 for OS/2 Quick Beginnings	Provides planning, installation, migration, and configuration information for DB2 Universal Database on the OS/2 operating system. Also contains installing and setup information for many supported clients.	GC09-2834 db2i2x60	db2i2
DB2 for UNIX Quick Beginnings	Provides planning, installation, migration, and configuration information for DB2 Universal Database on UNIX-based platforms. Also contains installing and setup information for many supported clients.	GC09-2836 db2ixx60	db2ix
DB2 for Windows NT Quick Beginnings	Provides planning, installation, migration, and configuration information for DB2 Universal Database on the Windows NT operating system. Also contains installing and setup information for many supported clients.	GC09-2835 db2i6x60	db2i6
DB2 Enterprise - Extended Edition for UNIX Quick Beginnings	Provides planning, installation, and configuration information for DB2 Enterprise - Extended Edition for UNIX. Also contains installing and setup information for many supported clients.	GC09-2832 db2v3x60	db2v3

Name	Description	Form Number File Name for Online Book	HTML Directory
DB2 Enterprise - Extended Edition for Windows NT Quick Beginnings	Provides planning, installation, and configuration information for DB2 Enterprise - Extended Edition for Windows NT. Also contains installing and setup information for many supported clients.	GC09-2833 db2v6x60	db2v6
DB2 Connect Enterprise Edition for OS/2 and Windows NT Quick Beginnings	Provides planning, migration, installation, and configuration information for DB2 Connect Enterprise Edition on the OS/2 and Windows NT operating systems. Also contains installation and setup information for many supported clients. This book was formerly part of the *DB2 Connect Enterprise Edition Quick Beginnings.*	GC09-2828 db2c6x60	db2c6
DB2 Connect Enterprise Edition for UNIX Quick Beginnings	Provides planning, migration, installation, configuration, and usage information for DB2 Connect Enterprise Edition in UNIX-based platforms. Also contains installation and setup information for many supported clients. This book was formerly part of the *DB2 Connect Enterprise Edition Quick Beginnings.*	GC09-2829 db2cyx60	db2cy
DB2 Data Links Manager for AIX Quick Beginnings	Provides planning, installation, configuration, and task information for DB2 Data Links Manager for AIX.	GC09-2837 db2z0x60	db2z0
DB2 Data Links Manager for Windows NT Quick Beginnings	Provides planning, installation, configuration, and task information for DB2 Data Links Manager for Windows NT.	GC09-2827 db2z6x60	db2z6
DB2 Query Patroller Administration Guide	Provides administration information on DB2 Query Patrol.	SC09-2859 db2dwx60	db2dw
DB2 Query Patroller Installation Guide	Provides installation information on DB2 Query Patrol.	GC09-2860 db2iwx60	db2iw
DB2 Query Patroller User's Guide	Describes how to use the tools and functions of the DB2 Query Patrol.	SC09-2861 db2wwx60	db2ww

Name	Description	Form Number File Name for Online Book	HTML Directory
	Cross-Platform Sample Programs in HTML		
Sample programs in HTML	Provides the sample programs in HTML format for the programming languages on all platforms supported by DB2 for informational purposes (not all samples are available in all languages). Only available when the SDK is installed. See *Application Building Guide* for more information on the actual programs. **Note:** Available in HTML format only.	No form number	db2hs/c db2hs/cli db2hs/clp db2hs/cpp db2hs/cobol db2hs/cobol_mf db2hs/fortran db2hs/java db2hs/rexx

Notes:

1. The character in the sixth position of the file name indicates the language of a book. For example, the file name `db2d0e60` indicates that the *Administration Guide* is in English. The following letters are used in the file names to indicate the language of a book:

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. For late breaking information that could not be included in the DB2 books:
   - On UNIX-based platforms, see the `Release.Notes` file. This file is located in the `DB2DIR/Readme/%L` directory, where `%L` is the locale name and DB2DIR is:
     - `/usr/lpp/db2_06_01` on AIX
     - `/opt/IBMdb2/V6.1` on HP-UX, Solaris, SCO UnixWare 7, and Silicon Graphics IRIX
     - `/usr/IBMdb2/V6.1` on Linux.
   - On other platforms, see the `RELEASE.TXT` file. This file is located in the directory where the product is installed.
   - Under Windows `Start` menu

Viewing Online Information

The manuals 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 on all platforms other than SCO UnixWare 7:

- If you are running DB2 administration tools, use the Information Center. See "Accessing Information with the Information Center" on page 80 for details.
- Select the `Open Page` menu item of your Web browser. The page you open contains descriptions of and links to DB2 information:
  - On UNIX-based platforms, open the following page:

    `file:/`*`INSTHOME`*`/sqllib/doc/`*`%L`*`/html/index.htm`

    where *%L* is the locale name.
  - On other platforms, open the following page:

    `sqllib\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 on the **DB2 Online Books** icon. Depending on the system you are using, the icon is in the main product folder or the Windows Start menu.

To view online books or sample programs on the SCO UnixWare 7:

- DB2 Universal Database for SCO UnixWare 7 uses the native SCOhelp utility to search the DB2 information. You can access SCOhelp by the following methods:
  - entering the ″scohelp″ command on the command line,
  - selecting the `Help` menu in the Control Panel of the CDE desktop or
  - selecting `Help` in the Root menu of the Panorama desktop

  For more information on SCOhelp, refer to the *Installation and Configuration Supplement*.

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.

Depending on your system, you can access the Information Center from the:

- Main product folder
- Toolbar in the Control Center
- Windows Start menu
- Help menu of the Control Center

The Information Center provides the following kinds of information. Click the appropriate tab to look at the information:

Tasks	Lists tasks you can perform using DB2.
Reference	Lists DB2 reference information, such as keywords, commands, and APIs.
Books	Lists DB2 books.
Troubleshooting	Lists categories of error messages and their recovery actions.
Sample Programs	Lists sample programs that come with the DB2 Software Developer's Kit. If the Software Developer's Kit is not installed, this tab is not displayed.
Web	Lists 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 some search capabilities, so you can look for specific topics, and filter capabilities to limit the scope of your searches.

For a full text search, click the Search button of the Information Center follow the *Search DB2 Books* link in each HTML file.

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 by double-clicking its icon on the Windows or OS/2 desktop.

Refer to the release notes if you experience any other problems when searching the HTML information.

Note: Search function is not available in the Linux and Silicon Graphics environments.

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, use the following instructions:

1. Copy all files and subdirectories from \sqllib\doc\html on your local system to a Web server. Each book has its own subdirectory containing 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, see the NetQuestion Appendix in *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. Once you are able to view the book files, you should bookmark commonly viewed topics. Among those, 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 setting up a search, see the NetQuestion Appendix in *Installation and Configuration Supplement* book.

Searching Online Information

To search for information in the HTML books, you can do the following:

- Click on **Search the DB2 Books** at the bottom of any page in the HTML books. Use the search form to find a specific topic. This function is not available in the Linux or Silicon Graphics IRIX environments.
- Click on **Index** at the bottom of any page in an HTML book. Use the index to find a specific topic in the book.
- Display the table of contents or index of 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 80 for details.

Printing the PostScript Books

If you prefer to have printed copies of the manuals, you can decompress and print PostScript versions. For the file name of each book in the library, see the table in "DB2 Information – Hardcopy and Online" on page 72. Specify the full path name for the file you intend to print.

On OS/2 and Windows platforms:

1. Copy the compressed PostScript files to a hard drive on your system. The files have a file extension of `.exe` and are located in the `x:\doc\`*`language`*`\books\ps` directory, where x: is the letter representing the CD-ROM drive and *language* is the two-character country code that represents your language (for example, EN for English).
2. Decompress the file that corresponds to the book that you want. Each compressed book is a self-extracting executable file. To decompress the book, simply run it as you would run any other executable program. The result from this step is a printable PostScript file with a file extension of `.ps`.

3. Ensure that your default printer is a PostScript printer capable of printing Level 1 (or equivalent) files.
4. Enter the following command from a command line:

   ```
   print filename.ps
   ```

On UNIX-based platforms:

1. Mount the CD-ROM. Refer to your *Quick Beginnings* manual for the procedures to mount the CD-ROM.
2. Change to `/cdrom/doc/%L/ps` directory on the CD-ROM, where */cdrom* is the mount point of the CD-ROM and *%L* is the name of the desired locale. The manuals will be installed in the previously-mentioned directory with file names ending with `.ps.Z`.
3. Decompress and print the manual you require using the following command:
   - For AIX:

     ```
     zcat filename | qprt -P PSPrinter_queue
     ```

   - For HP-UX, Solaris, or SCO UnixWare 7:

     ```
     zcat filename | lp -d PSPrinter_queue
     ```

   - For Linux:

     ```
     zcat filename | lpr -P PSPrinter_queue
     ```

   - For Silicon Graphics IRIX:

     ```
     zcat < filename | lp -d PSPrinter_queue
     ```

   where *filename* is the full path name and extension of the compressed PostScript file and *PSprinter_queue* is the name of the PostScript printer queue.

   For example, to print the English version of *DB2 for UNIX Quick Beginnings* on AIX, you can use the following command:

   ```
   zcat /cdrom/doc/en/ps/db2ixe60.ps.Z | qprt -P ps1
   ```

Ordering the Printed Books

You can order the printed DB2 manuals either as a set or individually. There are two sets of books available. The form number for the entire set of DB2 books is `SBOF-8926-00`. The form number for the books listed under the heading ″Cross-Platform Books″ is `SBOF-8924-00`.

Note: These form numbers only apply if you are ordering books that are printed in the English language in North America.

You can also order books individually by the form number listed in “DB2 Information – Hardcopy and Online” on page 72. To order printed versions,

contact your IBM authorized dealer or marketing representative, or phone 1-800-879-2755 in the United States or 1-800-IBM-4YOU in Canada.

Appendix D. Notices

Any reference to an IBM licensed program in this publication is not intended to state or imply that only IBM's licensed program may be used. Any functionally equivalent product, program or service that does not infringe any of IBM's intellectual property rights may be used instead of the IBM product, program, or service. Evaluation and verification of operation in conjunction with other products, except those expressly designated by IBM, is the user's responsibility.

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If you have a technical problem, please take the time to review and carry out the actions suggested by the *Troubleshooting Guide* before contacting DB2 Customer Support. Depending on the nature of your problem or concern, this guide will suggest information you can gather to help us to serve you better.

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