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SOFTWARE

NETVAULT

APM/plugin user's guide

for the
DB2 APM

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APM/Plugin User's Guide for the DB2 APM

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The DB2 APM

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VS.0.0 About the DB2 Application Plugin Module

As storage environments have experienced rapid growth, so has the importance of data management and storage. The increasing size and number of DB2™ applications brings to the forefront the need for a storage management solution that protects important corporate assets while keeping the application running and available. NetVault's DB2 Universal Database™ Application Plugin Module (APM™) increases application availability by providing fast, online backups of DB2 databases. The main features included in the APM are described below:

- **Online Mode** - With NetVault's **DB2 APM**, user databases remain online and fully accessible during backup operations, minimizing downtime for users.
- **Offline Mode** - Access to the database is in exclusive mode; only the NetVault backup job itself can be connected to the database.
- **Support for Multi-instances** - The **DB2 APM** makes it possible to view and navigate all available DB2 instances for backup and restore.
- **Multiple Backup Modes** - Supports variations of a DB2 backup, including full, incremental and delta backups, as well as backups of transaction logs.
- **Selectable Database Backup/Restore Operations** - The **DB2 APM** allows for the backup of tablespaces and/or archived log files. It also allows for the restore of entire tablespaces, archived logs or a selected tablespace.
- **Ability to Restore Database to Another DB2 Server** - The **DB2 APM** makes it possible to restore a database to a different server.

Important: Databases can only be restored to a different DB2 server with the identical installation set up and configuration as the original.

DB.0.1 Target Audience

DB2 database administrator skills are not generally required for routine backup operations. However, initial configuration and recovery operations may require database administrator experience.

Important: It is also recommended that any relevant DB2 documentation be readily available for backup and recovery strategies.



VS.1.0 | Installing the DB2 APM

To install the **DB2 APM**, follow the instructions detailed in the sections that follow.

DB.1.1 | Pre-Installation Requirements

Before installing the **DB2 APM**, ensure that the following requirements are met:

Important: DB2 64-bit APM Restriction - A restriction pertaining to backing up both 32-bit and 64-bit instances on the same DB2 UDB server exists with the 64-bit version of the **DB2 APM**. Upgrade or migrate any existing 32-bit instances to 64-bit.

- **NetVault Server/Client Software** - Must be installed and configured.
- **DB2 Database in ARCHIVAL Logging Mode** - The “**logretain**” database configuration parameter must be in recovery mode. To set up this environment, follow the steps below:
 1. From the DB2 Server, launch a terminal session and navigate to the following directory (where “...” pertains to the complete installation path of DB2):

..\SQLLIB\BIN

2. Access the DB2 command prompt by issuing the command “**DB2**” at the terminal session prompt.
3. From the DB2 prompt, input the following command to connect to the local instance of the desired database:

update db cfg for <database_name> using logretain ON

Important: An initial backup (using the DB2 backup command or the **DB2 APM**) is required to take the databases out of backup pending state. If necessary, contact a DB2 database administrator for assistance in turning on **logretain** mode.

- **Trackmod Database Configuration Parameter** - The DB2 “**trackmod**” configuration should be enabled to allow for incremental backups. To set up this environment, follow the step below:
 1. With the DB2 prompt still active after the previous procedure, issue the following command:

update db cfg for <database_name> using trackmod ON

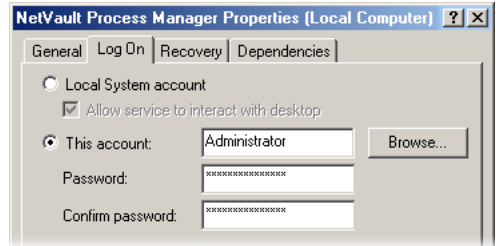
Important: Once the “**trackmod**” parameter is enabled, an initial full backup is required before an incremental can be performed.

- **Userexit Database Configuration Parameter** - This parameter is default set to **OFF** and must remain set to **OFF**.

Figure DB-1:
The Service window for the NetVault Process Manager service as seen in Windows 2000/2003

- **Setup the NetVault Process Manager (Windows-based O/S Only) -** Setting up the NetVault Process Manager consists of setting the correct logon information for the service when running in a Windows-based O/S environment. The procedure for accessing the **Services** windows to accomplish this is discussed in the steps that follow:

1. Select **Start>Settings>Control Panel>Administrative Tools>Services** to display the list of services running on this machine. Double-click on **NetVault Process Manager** service to open its associated window.
2. Select the **Log On** tab.
3. Select **This Account** and input the account name associated with the **Administrator** login for the target machine.
4. In the **Password** field (and **Confirm Password** Field) input the password associated with the **Administrator** account input in **This Account**.



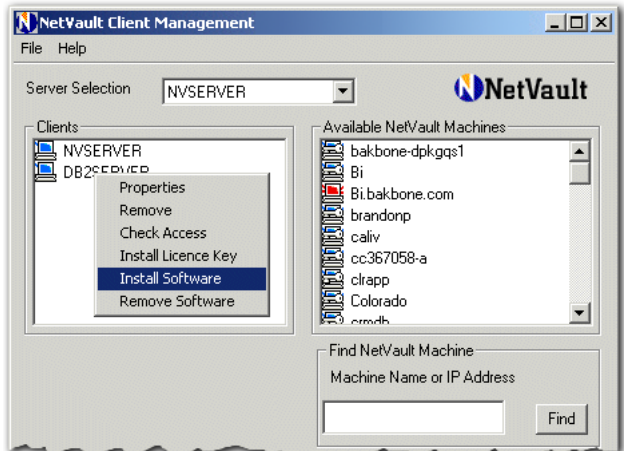
Important: The account name and its associated password value referenced here must be the administrator login values as well as the values used to connect to the DB2 instance.

5. Click on **OK** to apply the change.

DB.1.2 Installation Procedure

Figure DB-2:
The Client Management window of the NetVault GUI

1. From the machine acting as the NetVault Server, open the NetVault **Client Management** window by clicking the **Client Management** button on the NetVault GUI (or select **Client Management** from the **Administration** pull-down menu).
2. Right-click on the desired NetVault machine in the **Clients** window and select **Install Software** from the pop-up menu.

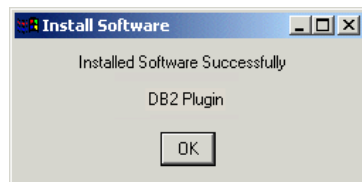


3. Navigate to the location of the **“.npk”** installation file (e.g., the NetVault APM Installation CD or the directory where the file was downloaded). Select the file (e.g., **db2xxxx.npk**) and click on **Open** to proceed.

Important: Based on the operating system being used, the directory path for this software may vary, but the file required for installation of this APM should be entitled **“db2xxxx.npk”** (where **“xxxx”** represents various software platforms and version numbers).

Figure DB-3:
The confirmation dialog box that appears after a successful installation

4. The installation process will occur automatically and once it has completed, a successful installation message will appear in the **Install Software** dialog box.
5. The **DB2 APM** is now installed.



DB.1.3 Removing the DB2 APM

1. From the machine acting as the NetVault Server, open the NetVault **Client Management** window by clicking the **Client Management** button on the NetVault GUI (or select **Client Management** from the **Administration** pull-down menu).
2. Right-click on the NetVault server in the **Clients** list to reveal the pop-up menu and select **Remove Software**.

Figure DB-4:
The Remove Software dialog box

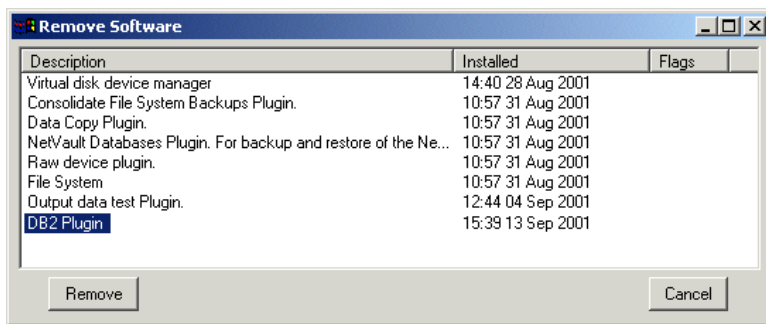
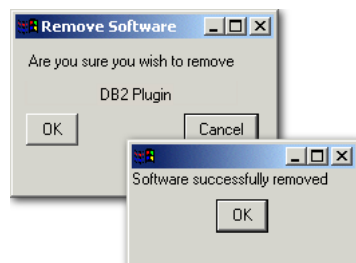


Figure DB-5:
The two dialog boxes issued during the removal process for this APM

3. Select the **DB2 Plugin** item from the displayed list and click the **Remove** button.
4. A dialog box will appear asking for confirmation of the remove command. Click on **OK** to proceed (or **Cancel** to abort). Clicking **OK** results in the removal of the software and a confirmation message will appear. Click **OK** to close this dialog box and return to the **Client Management** window.



DB.2.0 Configuration of the DB2 APM

DB.2.1 Phase 1: Configuration in the NetVault GUI

Through the use of the NetVault GUI, it is necessary to set a single configuration option prior to using the **DB2 APM**. Follow the instructions below in order to access and set this option.

1. Open the **Backup** window by clicking the **Backup** button on the command toolbar (or by selecting the **Backup** option from the **Operations** pull-down menu).
2. Open the desired client on which the APM is installed by double-clicking on it (or right-clicking on it and selecting **Open** from the pop-up menu).
3. Right-click on the **DB2 APM** and select **Configure** from the pop-up menu.
4. The **Configure** window will launch displaying the **DB2 Server Plugin** tab which contains the following option:

- **DB2 Installation Directory** - this field contains the path to the installation of DB2. The value `"/usr/IBMDB2/V8.1"` is shown which is the default installation directory for the DB2 software. If the software was installed to any directory other than this, input the exact path to it here.

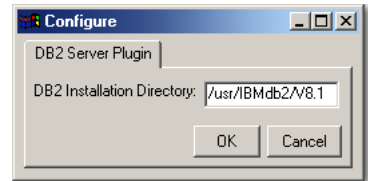


Figure DB-6:
When the Configure command is selected from the pop-up menu, the Configure window is made available

Important: If the correct directory path is not input in this field, the APM is unusable and attempts to access it will result in an error message (e.g., DB2 installation directory is incorrect. Use Plugin Configure to modify).

DB.2.2 Phase 2: Configuration Outside of NetVault

The following sections illustrate some configuration options that can be performed from the DB2 Server in order to protect its database.

DB.2.2.a How to Avoid the Accidental Dropping of a DB2 Database Table

To avoid the accidental dropping of a DB2 database table, the clause **“add restrict on drop”** can be added to it. With this clause added, it will not be possible to drop the table. The steps below outline the procedure required to accomplish this.

Important: To successfully perform this operation, the user must know the exact name of the table that is to be targeted.

1. From the DB2 Server, launch a terminal session and navigate to the following directory (where “...” pertains to the complete installation path of DB2):

...\SQLLIB\BIN

2. Access the DB2 command prompt by issuing the command “**DB2**” at the terminal session prompt.
3. From the DB2 prompt, input the following command to connect to the local instance of the desired database:

connect to <local database name>

4. Once successfully connected, input the following command:

alter table <table name> add restrict on drop

Once the previous command has been executed, a message stating that “**The SQL command completed successfully**” should be displayed and the selected table is now protected.

Important: This same clause can be employed when creating a new table, in order to add this protection. To accomplish this, Steps 1 -3 would be followed to connect to the desired DB2 database, but the following command would be input in place of what is shown in Step 4 (all on a single line):

**create table <table name> (<table-specific information>
in <user space> with restrict on drop**

For complete details on what is required for the “<table-specific>” and “<user space>” information, please see the relevant DB2 documentation.

Removing the Drop Restriction Clause

Once the clause outlined in the previous section has been added to the desired table, the tablespace **and** the database that contains them **can not** be dropped, until this restriction on the table is removed. To remove the clause, follow the steps below:

1. If necessary, connect to the local instance of the desired database by following **Steps 1 - 3** in the section, *How to Avoid the Accidental Dropping of a DB2 Database Table* on page 9.
2. Once connected, input the following command:

alter table <table name> drop restrict on drop

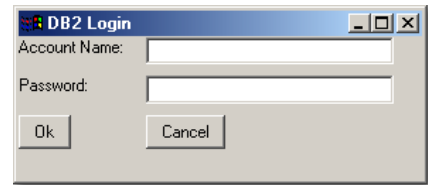
With the previous command input and executed, a message stating that “**The SQL command completed successfully**” should be displayed and the drop restriction will be removed.

VS.3.0 Backing Up Data with the DB2 APM

To perform a backup using the **DB2 APM**, follow these steps:

1. Open the NetVault Backup window by clicking the **Backup** button on the command toolbar (or by selecting the **Backup** option from the **Operations** pull-down menu). The NetVault Backup window displays the list of clients in the Selections tab.
2. Right-click on the client on which the APM is installed and choose **Open** from the pop-up menu (or double-click on it) to open it and display a list of installed APMs.
3. Double-click the **DB2 APM** to open it and display the DB2 Instance(s) within.
4. An entire DB2 Instance can be selected for a backup or it can be opened to browse its contents. To open an instance, double-click on it (or right-click on it and select **Open** from the pop-up menu).
5. The **DB2 Login** dialog box will launch requiring the appropriate **Account Name** and **Password** to connect to the selected DB2 Instance.

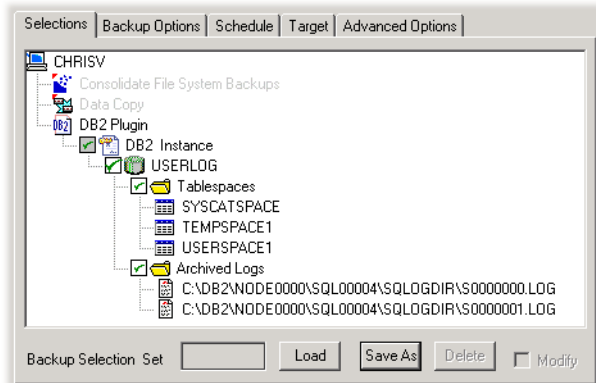
Figure DB-7:
The DB2 Login dialog box



Important: It may be necessary to see the DB2 database administrator for this information.

6. With the instance open, it is possible to choose individual databases for a backup. Simply click the relevant check box on each database or database item. As well, the databases themselves can be opened to reveal their individual contents.
7. It is recommended that a **Backup Selection Set** of selected items be created. If future **Incremental** or **Delta** backups are to be performed of the data selected here, this Selection Set is required for their use. For details on this process, please see the *NetVault Administrator's Guide*.

Figure DB-8:
The Selections tab of the NetVault Backup dialog box



8. Click the **Backup Options** tab to specify these options. For complete details on these options, see the section *The Backup Options Tab* on page 12.
9. The remaining tab selections (e.g., **Schedule**, **Target** and **Advanced Options**) contain additional options that can be set as desired (These parameters are not unique to the **DB2 APM**. For more information on these tabs, please see the *NetVault Administrator's Guide*).
10. Enter a suitable name for the job in the **Job Title** box and start the backup job by clicking the **Submit** button on the command toolbar.

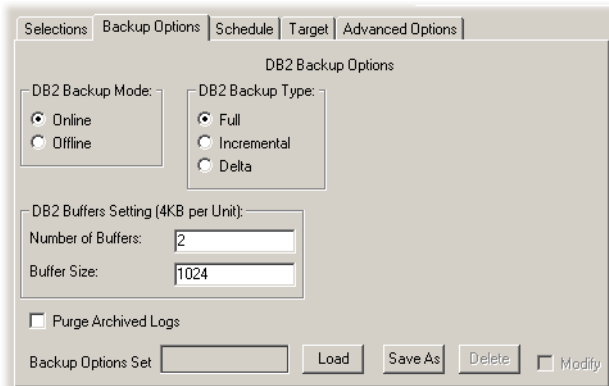
DB.3.1 The Backup Options Tab

This tab contains additional options that can be set in regards to data items selected for a backup in the Selections tab. The following options are available:

DB.3.1.a DB2 Backup Mode Frame

Figure DB-9:
The Backup
Options tab

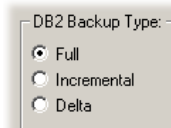
- **Online Option** - Select this option to allow other applications and users to be connected to the tablespace or tablespace partition while the backup is in progress.
- **Offline Option** - Select this option to prevent other applications and users from connecting to the tablespace or tablespace partition while the backup is in progress.



DB.3.1.b Backup Type Frame

Figure DB-10:
DB2 Backup
Type Frame of
the Backup
Options tab

- **Full Option** - With this option selected, a complete backup of the items selected in the **Selections** tab of the **Backup** window will occur.
- **Incremental Option** - Once selected, only data that is new or changed since the last **Full** backup was performed will be included. Therefore, a faster backup that also requires less space is the end result. For details on the use of this form of backup, please see the section *The Restore Options Tab* on page 16.
- **Delta Option** - With this option selected, NetVault will only include data that is new or changed since the **last** backup performed, **regardless of type** (e.g.,



whether the last backup was a Full, Incremental or Delta). Therefore, a faster backup that also requires less space is the end result. For details on the use of this form of backup, please see the section *The Restore Options Tab* on page 16.

DB.3.1.c DB2 Buffers Setting (4KB per Unit) Frame

Figure DB-11:
DB2 Buffers
Setting Frame
of the Backup
Options tab

- **Number of Buffers Field** - If using multiple buffers and I/O channels, specify at least twice as many buffers as channels to ensure that the channels do not have to wait for data. Increasing the number of buffers will result in the backup operation completing faster.
- **Buffer Size Field** - This field allows for the setting of the size of the buffers, in order to make them a multiple of the tablespace extent size.

DB2 Buffers Setting (4KB per Unit):

Number of Buffers:

Buffer Size:

Important: Increasing the value specified for either option may cause the restore operation to use more memory and additional processing time.

DB.3.1.d Purge Archived Logs Option

Figure DB-12:
Purge
Archived Logs
checkbox

Select this option only if it is necessary to remove old archived logs once the backup has completed.

Purge Archived Logs

Important: Selecting the **Purge Archived Logs** option will delete ALL the archived logs except the active logs. Only the number of logs specified in the **Logs to Keep Before Active Log** option will not be deleted.

DB.3.1.e Logs to Keep Before Active Log Option (DB2 APM Ver. 2.4 and Later Only)

Figure DB-13:
Logs to Keep
Before Active
Log option

For users of the **DB2 APM** version 2.4 and later, it is possible to select this option to specify the number of logs preceding the current active database log in the server that will not be purged. 1-999 logs can be specified. This option is grayed out and disabled until the **Purge Archived Logs** option is enabled.

Logs to Keep before Active Log:

DB.3.2 Using Incremental/Delta Backups

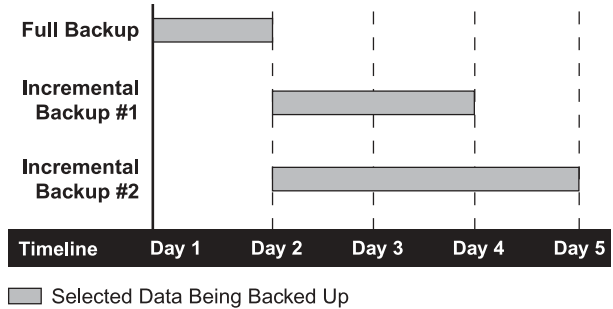
The following procedures detail the steps necessary to perform either an incremental or delta backup.

DB.3.2.a Incremental Backups

The following steps detail the procedure necessary to perform an incremental backup.

Figure DB-14:
An Incremental backup strategy

1. **Run a full backup.**
This will fully backup all selected data.
2. **Run incremental backups as required.**
Each new incremental will create a backup of all data that has changed since the most recent **full** backup (see the figure).

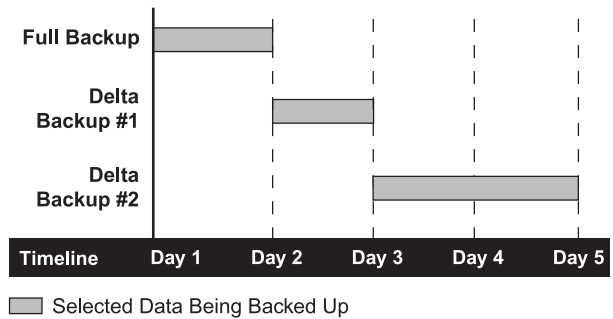


Important: This procedure requires a larger amount of time to create each backup, but it offers the fastest recovery, as only the *most recent incremental* and the *original full* backups need to be restored to bring a system back to its most recent state.

DB.3.2.b Delta Backups

Figure DB-15:
A Delta backup strategy

1. **Run a full backup.**
This will fully backup all selected data.
2. **Run the initial delta backup.** This will create a backup of the data that has changed since the most recent **full** backup.
3. **Run additional delta backups (as required).** This will backup all selected data that is new or changed since the most recent delta backup.



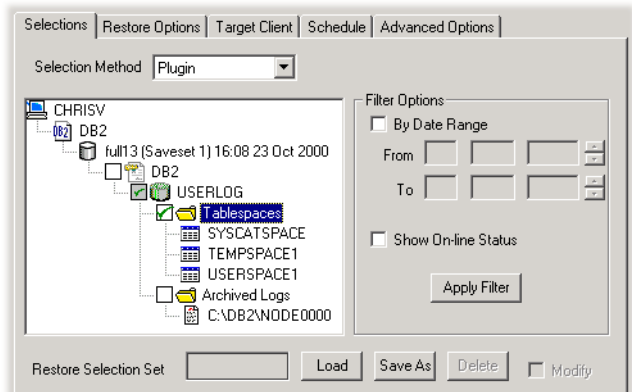
Important: This procedure offers the fastest backup time available, although recovery time may be affected. To bring a system back to its most recent state, the original full backup must be restored in addition to each individual Delta backup, in the order they were performed.

VS.4.0 Restoring Data with the DB2 APM

To perform a restore using the **DB2 APM**, follow these steps:

1. Open the **Restore** window by clicking the **Restore** button on the command toolbar (or by choosing **Restore** from the **Operations** pull-down menu). The **Restore** window will display a list of clients which have restorable data in the **Selections** tab.
2. Right-click on the client from which the desired backup was performed, and choose **Open** from the pop-up menu (or double-click on it) to display a list of the APMs used to perform successful backups.
3. Open the **DB2 APM** by double-clicking on it (or by right-clicking on it and select **Open** from the pop-up menu) to display backup savesets created with the APM.
4. Open the desired backup saveset (by either double-clicking on it or right-clicking it and selecting **Open** from the pop-up menu and locate the desired DB2 instance).
5. The entire instance can be selected for a restore or it can be opened to reveal the individual databases backed up in it. As well, these individual databases can be opened to reveal their selectable contents. Locate the desired items for a restore and select them as necessary.
6. Click the **Restore Options** tab to display these options. For complete details on the options available in this tab, see the section *The Restore Options Tab* on page 16.
7. The remaining tab selections (e.g., **Schedule**, **Target** and **Advanced Options**) contain additional options that can be set as desired (These parameters are not unique to the **DB2 APM** and for information on their use, please see the *NetVault Administrator's Guide*).
8. Enter a suitable name for the job in the **Job Title** box and start the backup job by clicking the **Submit** button on the command toolbar.

Figure DB-16:
Selections tab
displaying a
list of APMs
used to
perform
successful
backups



Important: When restoring data, the DB2 database administrator must be present to apply additional DB2-specific recovery procedures.

DB.4.1 The Restore Options Tab

Figure DB-17:
The Restore
Options tab

This tab is comprised of two sub-tabs and defaults to the **Options** sub-tab. The following options are contained in this tab:

- **Backup Type** - Backup saveset data selected in the **Selections** tab can be one of three types (e.g., Full, Incremental and Delta). This describes what type of backup was performed on the selected item.

- **Restore Type Frame**

- ❖ **Restore All Spaces in the Database option**

Select this option in order to restore all tablespaces in a selected database.

- ❖ **Restore Only Tablespace-level Backup Images**

Select this option when performing a restore of a selected tablespace.

- **Restore Mode Frame**

- ❖ **Offline option**

Select this option to **prevent** other applications and users from connecting to the database or tablespace(s) during a restore.

- ❖ **Online option**

Select this option to **allow** other applications and users to connect to the database or tablespace(s) during a restore.

- **Incremental Restore Option**

This option alerts NetVault that a full backup being recovered is a portion of an incremental scheme (rather than a standalone full backup recovery). Select this option for the full backup restore phase of an incremental restore scheme. For a detailed description, please see the section *Restoring from an Incremental/Delta Backup* on page 18.

Figure DB-18:
The
Incremental
Restore
Option

Incremental Restore

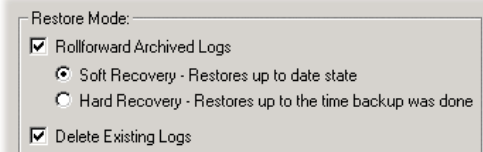
DB.4.1.a Archived Logs Options Frame

- **Rollforward Archived Logs checkbox** - When restoring the **Archived Logs** item (as selected in the **Selections** tab), select this option in order to apply the transaction log files.

Important: An **Online** restore allows users to access a database while it is being restored. However, **Rollforward** operations require a high level of access and outside user access to a target tablespace may be limited while the **Rollforward** phase of the restore is in progress. Therefore, if the **Rollforward Archived Logs** option is enabled with an **Online** restore, tablespaces that are currently being restored to may not be accessible to outside users until the restore completes.

*Figure DB-19:
The Archived
Logs Options
frame*

- **Soft Recovery option** - Select this option when recovering the Archive Logs item in order to restore the existing logs to their most up-to-date state.
- **Hard Recovery option** - Select this option when recovering the **Archive Logs** item in order to restore these logs to the point in time the backup was performed (thereby over-writing the existing **Archive Log** files).
- **Delete Existing Logs checkbox** - Select this item to delete all existing log files.



Restore Mode:

- Rollforward Archived Logs
- Soft Recovery - Restores up to date state
- Hard Recovery - Restores up to the time backup was done
- Delete Existing Logs

DB.4.1.b DB2 Buffers Setting (4KB per Unit) Frame

- **Number of Buffers field** - If using multiple buffers and I/O channels, specify at least twice as many buffers as channels to ensure that the channels do not have to wait for data. Increasing the number of buffers causes the restore operation to complete more quickly.
- **Buffer Size field** - Set the size of the buffers to be a multiple of the tablespace extent size.

Important: Increasing the value specified for either option causes the restore operation to use more memory and additional processing time.

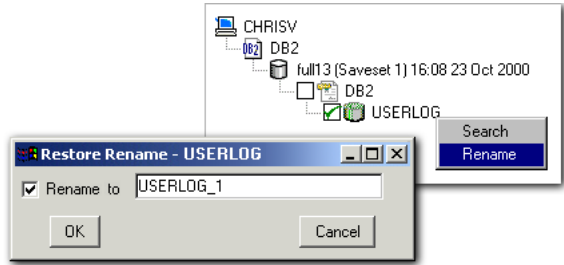
DB.4.2 Renaming a Database During a Restore

Through the use of the **Rename** command accessed via a pop-up menu in the **Selections** tab, it is possible to rename a database item during a restore. This is useful when restoring a database in order to avoid overwriting an existing one.

Figure DB-20:
When the *Rename* command is selected from the pop-up menu, the *Restore Rename* dialog box is made available

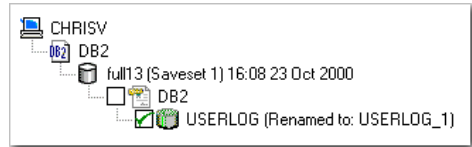
1. From the **Selections** tab of the **Restore** window, open the desired backup saveset to reveal the individual databases contained within.

2. Right-click on the desired database and select **Rename** from the pop-up menu.



3. In the **Restore Rename** dialog box, input a new name value and click **OK** to apply the change (or **Cancel** to abort) and return to the **Selections** tab.

4. Note that the database item will be accompanied by renaming information in parenthesis (e.g., Renamed to: USERLOG_1 as in the figure).



5. Continue on with the restore as explained in the section *Restoring Data with the DB2 APM* on page 15.

Figure DB-21:
The *Restore Rename* dialog box containing a renamed item

Important: Only complete database items can be renamed for a restore. It is not possible to rename a database's individual table items.

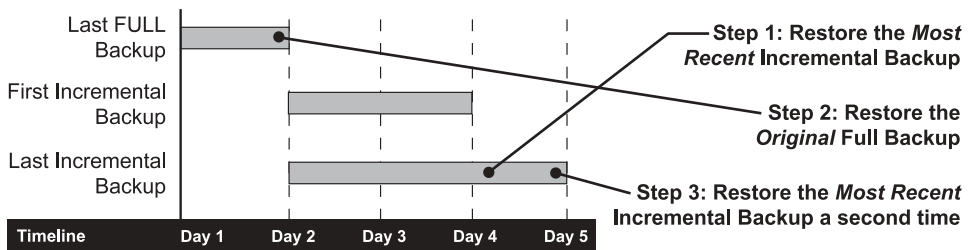
DB.4.3 Restoring from an Incremental/Delta Backup

Two procedures are given here describing how to recover from either form of backup (e.g., Incremental or Delta) as well as rules that apply to each.

DB.4.3.a Restoring from an Incremental Backup

An incremental backup scheme is one in which an initial full backup was performed and then subsequent incrementals were performed at later dates. Each time a new incremental backup is performed all data new or changed since the original full is incorporated in the backup. Therefore, it is only necessary to recover the original full backup and the most recent incremental in order to bring a system to its most recent state. Follow the instructions in this section to accomplish this.

Figure DB-22:
An example of the steps necessary to recover from an Incremental Backup Scheme



1. **Restore the *Most Recent Incremental Backup*** - This backup must be restored first and all other incrementals should be ignored. Ensure that items selected in the **Selections** tab as well as **Restore Options** are set as detailed in the table below. (Note that the **Incremental Restore** option will be default selected, and greyed-out.)

Items in the Selections Tab		Restore Options	
Select	Do Not Select	Selected	De-selected
<ul style="list-style-type: none"> <input checked="" type="checkbox"/> The Tablespaces item <i>ONLY</i> 	None Necessary	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Incremental Restore (default selected) 	<ul style="list-style-type: none"> <input type="checkbox"/> Rollforward Archived Logs <input type="checkbox"/> Delete Existing Logs

2. **Restore the *Last Full Backup*** - Using the procedure detailed in the section *Restoring Data with the DB2 APM* on page 15. Ensure that items selected in the **Selections** tab as well as **Restore Options** are set as detailed in the table below:

Items in the Selections Tab		Restore Options	
Select	Do Not Select	Selected	De-selected
<ul style="list-style-type: none"> <input checked="" type="checkbox"/> The Tablespaces item <i>ONLY</i> 	<ul style="list-style-type: none"> <input type="checkbox"/> Full Databases <input type="checkbox"/> Archived Logs item 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Incremental Restore 	<ul style="list-style-type: none"> <input type="checkbox"/> Rollforward Archived Logs <input type="checkbox"/> Delete Existing Logs

3. **Restore the *Most Recent Incremental Backup a second time*** - Again, ignoring all previous incrementals. Ensure that items selected in the **Selections** tab as well as **Restore Options** are set as detailed in the table below. (Note that the **Incremental Restore** option is now default selected, and greyed-out.)

Items in the Selections Tab		Restore Options	
Select	Do Not Select	Selected	De-selected
<ul style="list-style-type: none"> <input checked="" type="checkbox"/> The Tablespaces item <input checked="" type="checkbox"/> Archived Logs item 	None Necessary	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Incremental Restore (default selected) <input type="checkbox"/> Rollforward Archived Logs <input type="checkbox"/> Delete Existing Logs 	None Necessary

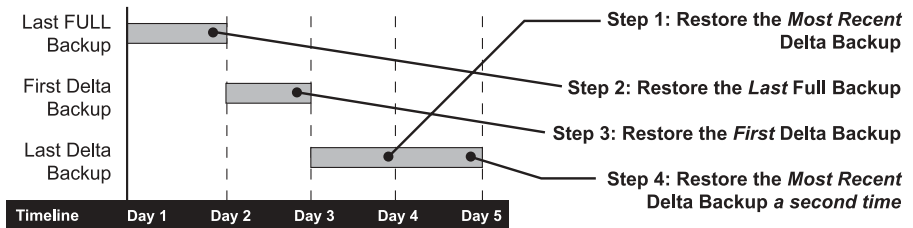
4. With the **Rollforward Archived Logs** option selected, choose the appropriate form of recovery for these logs (for details on the **Hard** and **Soft Recovery** modes, please see the section *The Restore Options Tab* on page 16). With this item selected at this phase of the restore, the **Archived Logs** will be restored to their most recent state.

DB.4.3.b Restoring from a Delta Backup

A delta backup scheme is one in which an initial full backup was performed and then subsequent deltas were performed at later dates. Each time a new delta backup is performed all data new or changed since the last delta is incorporated in the backup. Therefore, with a delta backup scheme, it is necessary to first recover the most recent delta backup followed by the original full backup and then all delta backups, *in the order they were performed* (including the most recent one, a second time), in order to bring a system to its most recent state. Follow the instructions below to accomplish this.

1. **Restore the Last Delta Backup** - This backup must be restored first for this process to work properly. Ensure that items selected in the **Selections** tab as well as the **Restore Options** are set as detailed in the table below. (Note that the **Incremental Restore** option will be default selected, and greyed-out.)

Figure DB-23:
An example of the steps necessary to recover from a Delta Backup Scheme



Items in the Selections Tab		Restore Options	
Select	Do Not Select	Selected	De-selected
<input checked="" type="checkbox"/> The Tablespaces item <i>ONLY</i>	<input checked="" type="checkbox"/> Full Database <input checked="" type="checkbox"/> Archived Logs item	<input checked="" type="checkbox"/> Incremental Restore (default selected)	<input checked="" type="checkbox"/> Rollforward Archived Logs <input checked="" type="checkbox"/> Delete Existing Logs

2. **Restore the Last Full Backup** - Using the procedure detailed in the section *Restoring Data with the DB2 APM* on page 15). Ensure that items chosen in the **Selections** tab as well as **Restore Options** are set as detailed in the following table.

Items in the Selections Tab		Restore Options	
Select	Do Not Select	Selected	De-selected
<input checked="" type="checkbox"/> The Tablespaces item <i>ONLY</i>	<input checked="" type="checkbox"/> Full Database <input checked="" type="checkbox"/> Archived Logs item	<input checked="" type="checkbox"/> Incremental Restore	<input checked="" type="checkbox"/> Rollforward Archived Logs <input checked="" type="checkbox"/> Delete Existing Logs

3. **Restore the *FIRST* Delta Backup** - Ensure that items chosen in the **Selections** tab as well as **Restore Options** are set as detailed in the table below (note that the **Incremental Restore** option is now default selected, and greyed-out).

Items in the Selections Tab		Restore Options	
Select	Do Not Select	Selected	De-selected
<ul style="list-style-type: none"> ■ The Tablespaces item <i>ONLY</i> 	<ul style="list-style-type: none"> ■ Full Database ■ Archived Logs item 	<ul style="list-style-type: none"> ■ Incremental Restore (default selected) 	<ul style="list-style-type: none"> ■ Rollforward Archived Logs ■ Delete Existing Logs

4. **Restore Subsequent Delta Backups** - Restore each additional delta backup, in the order it was backed up, after the first. Ensure that items chosen in the **Selections** tab as well as **Restore Options** are set as detailed in the table on the following page (as with the first delta backup restore the **Incremental Restore** option is default selected, and greyed-out).

Items in the Selections Tab		Restore Options	
Select	Do Not Select	Selected	De-selected
<ul style="list-style-type: none"> ■ The Tablespaces item <i>ONLY</i> 	<ul style="list-style-type: none"> ■ Full Database ■ Archived Logs item 	<ul style="list-style-type: none"> ■ Incremental Restore (default selected) 	<ul style="list-style-type: none"> ■ Rollforward Archived Logs ■ Delete Existing Logs

5. **Restore the *LAST* Delta Backup a second time** - Restore the most recent (i.e., last performed) delta backup a second time, ensuring that items chosen in the **Selections** tab as well as **Restore Options** match those detailed in the table below.

Items in the Selections Tab		Restore Options	
Select	Do Not Select	Selected	De-selected
<ul style="list-style-type: none"> ■ The Tablespaces item ■ Archived Logs Item 	<ul style="list-style-type: none"> None Necessary 	<ul style="list-style-type: none"> ■ Incremental Restore (default selected) ■ Rollforward Archived Logs ■ Delete Existing Logs (if desired) 	<ul style="list-style-type: none"> None Necessary

6. With the **Rollforward Archived Logs** option selected, choose the appropriate form of recovery for these logs. (For details on the **Hard** and **Soft Recovery** modes, please see the section *The Restore Options Tab* on page 16.) When selected at this phase of the restore, the **Archived Logs** will be restored to their most recent state.

Important: It is possible to mix the different types of Incremental backup (e.g., restoring both delta and incremental backups) in a recovery scheme in order to achieve a desired result. It is important to note however that if a combination is used, the restore order as well as the data items included in each phase is crucial to achieving the desired result.

VS.5.0 Other Backup and Restore Procedures

This section offers instructions on optional backup and restore procedures that can be used with the DB2 APM.

DB.5.1 Working with Dropped DB2 Database Tables

In the event that a database table is accidentally dropped (i.e., the procedure outlined in the section, *How to Avoid the Accidental Dropping of a DB2 Database Table* on page 9 was not applied and a necessary table was dropped), the procedures outlined in this section can be followed to recover it.

Important: A standard restore of a DB2 backup using the DB2 APM will not recover any tables that have been dropped. The Pre-Requisite procedure and one of the methods outlined in this section must be followed to properly recover it.

DB.5.1.a Pre-Requisite: Set Dropped Table Recovery Configuration

In DB2, a database is composed of individual tablespaces (e.g., a tablespace could be entitled, “**userspace1**”). Each individual table that makes up the database is created in these tablespaces.

To allow for the recovery of a table that has been dropped, the **Dropped Table Recovery** configuration option *must be* enabled for the tablespace that housed the dropped table. This configuration option is enabled by default for tablespaces that were properly created using the DB2 command prompt. For tablespaces created using the **DB2 Control Center** graphical user interface, the create tablespace wizard will allow the user to enable this option.

The steps below outline how to verify that the **Dropped Table Recovery** option is enabled. If it is not, additional steps are provided to show how to enable it.

1. From the DB2 Server, launch a terminal session and navigate to the following directory (where “...” pertains to the complete installation path of DB2):

...\\SQLLIB\\BIN

2. Access the DB2 command prompt by issuing the command “**DB2**” at the terminal session prompt.
3. From the DB2 prompt, input the following command to connect to the local instance of the desired database:

connect to <local database name>

4. Issue the following command to reveal a list of the tablespaces in the current database and their current **Dropped Table Recovery** configuration status:

```
select tbspace, drop_recovery from syscat tablespaces
```

If the desired tablespace reveals a result of “N” (no) in the **Drop_Recovery** column, the **Dropped Table Recovery** configuration must be enabled for it (please continue to Step 5). If a “Y” (yes) is revealed, the tablespace is properly configured for recovery of dropped tables, and either of the two methods outlined in the following sections can be used to perform the recovery.

5. From the DB2 prompt, issue the following command to enable this configuration option:

```
alter tablespace <tablespace name> dropped table recovery on
```

6. To verify that the configuration was applied correctly, repeat **Step 4**, above. A value of “Y” should now appear for the desired tablespace.

Important: A single tablespace can accommodate multiple database tables. Therefore, once this configuration option has been applied to the desired tablespace, all dropped tables can be recovered.

DB.5.1.b Recovery Method 1: Soft Recovery

The following steps illustrate how to use the NetVault GUI, in conjunction with the DB2 command prompt to perform a soft recovery of a dropped database table. With a soft recovery, the data in other tables within the target tablespace is rolled forward up to the most current transaction log. This will preserve any current data that exists in other tables of the tablespace from being overwritten when the backup is restored.

Important: Prior to beginning this procedure, the DB2 administrator must know the name of the table that was dropped.

Step 1: Gather Dropped Table Information

1. Repeat Steps 1 - 3, as illustrated in the section, *Pre-Requisite: Set Dropped Table Recovery Configuration* on page 22.
2. At the DB2 prompt, input the following command to reveal dropped tables:

```
list history dropped table all for db <database name>
```

A list of information will be revealed in a table format, including the name of any dropped tables and the User Space(s) in which they existed. Make note of the following values, for each dropped table:

- **Dropped Table Name**
- **User Space in which Each Dropped Table was Contained**

- **Backup ID**
- **All DDL Parameters** (the entire series of information revealed at the “DDL:” prompt)

Figure DB-24:
 The command noted above was issued for a DB2 database entitled “database_1”. The end result revealed that the table “EMPLOYEES” has been dropped from a user space entitled “USERSPACE1”

```
DB2=>list history dropped table all for db database_1

List History File for sample

Number of matching file entries = 1

Op Obj Timestamp+Sequence Type Dev Earliest Log Current Log Backup ID
-----
D T 20050718114619                000000000000bb000002000d
-----
“ADMINISTRATOR”.“EMPLOYEES” resides in 1 tablespace(s):

00001 USERSPACE1
-----
Comment: DROP TABLE
Start Time: 20050718114619
End Time: 20050718114619
-----
00001

DDL: CREATE TABLE “ADMINISTRATOR”.“EMPLOYEES” (“NAME” CHAR(20)
NOT NULL, “PROFESSION” VARCHAR(30)) IN “USERSPACE1”;
-----
DB2=>
```

Important: If multiple tables have been dropped from a database, they will **all** be listed when this command is issued, along with all other associated information. To recover all of these tables, ensure that all of them, as well as their associated information is noted.

Step 2: Restoring the Tablespaces in NetVault

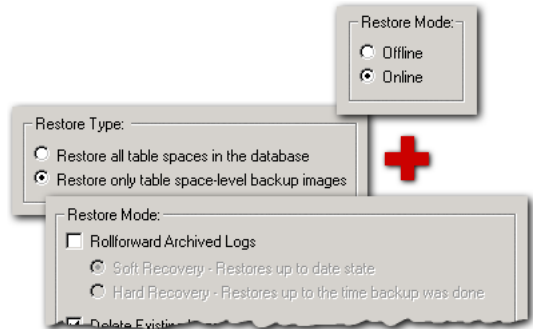
1. From the NetVault Server, launch the GUI and access the **Restore** window.
2. In the list of Clients revealed in the **Selections** tab, locate the DB2 Server and open it. Open the **DB2 APM** and navigate down to the backup saveset level of the selection tree.
3. Locate the desired backup saveset and open it (i.e., the one that contains the desired backup of the user space which houses the dropped table). drill down to the tablespace level of the selection tree. Select only those

tablespaces that contained dropped tables (i.e., each tablespace noted in **Step 2**).

Important: If the archived logs for a database were removed from the database directory on the the DB2 Server, select them for inclusion in the restore as well, if applicable (e.g., the **Archived Logs** are available for selection in the selected backup saveset).

Figure DB-25:
Settings that
need to be
made in the
Restore
Options tab

4. Select the **Restore Options** tab and ensure that the following apply:
 - Set the **Restore Mode** to **Online**.
 - The **Restore Only Tablespace-level Backup Images** option is **selected**
 - The **Rollforward Archived Logs** option is **de-selected**.
5. Ensure that the default schedule option of **Immediate** is set in the **Schedule** tab, input a valid name for the restore job in the **Job Title** field and click on the **Submit** button to launch the job.



Step 3: Check the Roll Forward Pending Status for Restored Tablespaces

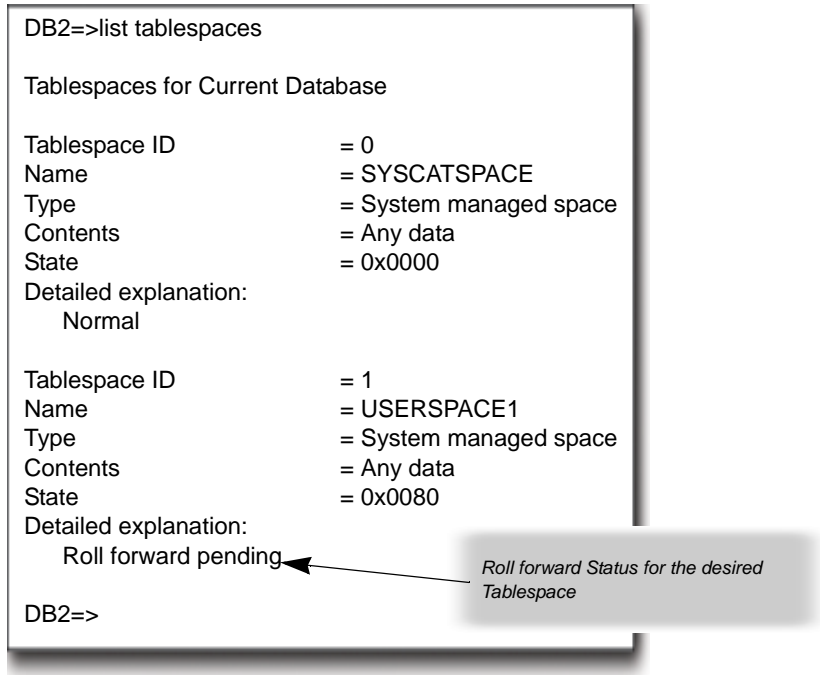
It is necessary to ensure that the Roll Forward state of all target tablespaces is currently at “Pending”. To accomplish this, perform the following steps:

1. From the DB2 Server, access the DB2 prompt as outlined in Steps 1 - 3 *Pre-Requisite: Set Dropped Table Recovery Configuration* on page 22 (if applicable).
2. Issue the following command from the DB2 prompt:

list tablespaces

Each available tablespace will be listed with various information pertaining to it displayed. The “**Detailed Explanation**” offered for each target tablespace should be displayed as “**Roll Forward Pending**”.

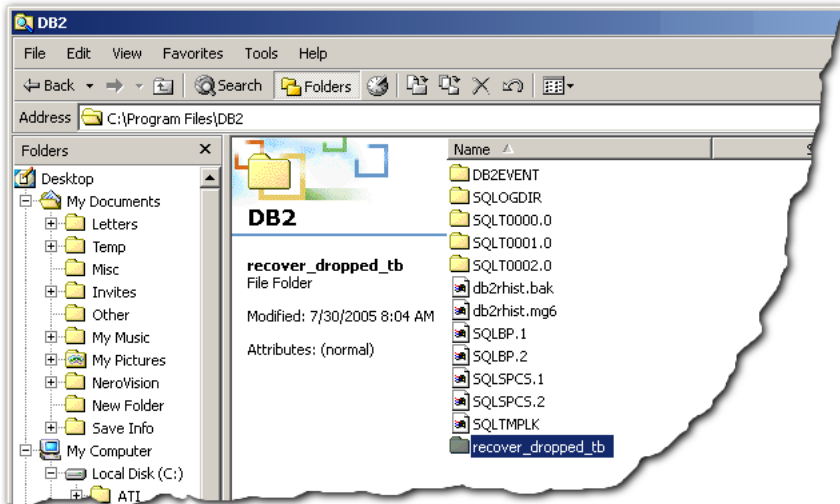
Figure DB-26: Once the "list tablespaces" command is executed, information pertaining to each available tablespace will be revealed. complete with information about the current Roll Forward status of each



Step 4: Create a Target Recovery Path

From the DB2 Server, create a new directory that will house the recovery of the dropped table for this procedure. With the directory created, make note of the exact path to it.

Figure DB-27: Create a new directory and not the exact path to it (in the case of this Windows-based example, the noted path would be "C:\Program Files\DB2\recover_dropped_tb")



Step 5: Set the Roll Forward State

The next step requires that the rollforward status for each target tablespace be set to its most current state, using the “recover dropped table” clause. To accomplish this follow the steps outlined below:

1. Access the DB2 prompt as outlined in Steps 1 - 3 *Pre-Requisite: Set Dropped Table Recovery Configuration* on page 22 (if applicable).
2. Input the following command at the DB2 prompt (please see the bullet points below the command syntax for descriptions of the “< >” variables):

rollforward database <database name> to end of logs and complete tablespace <tablespace name> recover dropped table <backup_id> to “<path>”

- **<database name>** - The name of the current database (i.e., the database currently logged into).
 - **<tablespace name>** - The name of the tablespace in which the dropped table existed (i.e., as noted in *Step 1: Gather Dropped Table Information* on page 23).
 - **<backup_id>** - This refers to the “**Backup ID**” information gathered in *Step 1: Gather Dropped Table Information* on page 23.
 - **“<path>”** - This refers to the complete path to the directory created in *Step 4: Create a Target Recovery Path* on page 26, and it should be enclosed in quotes (“ ”).
3. In the list of information displayed, ensure that the **Rollforward Status** value reveals a result of “**not pending**”.

Figure DB-28:
Using all of the gathered information from previous steps, the proper Roll Forward command is issued

```
DB2=>rollforward database sample to end of logs and complete tablespace
(userspace1) recover dropped table 00000000000bb000002000d to
"C:\Program Files\DB2\recover_dropped_tb"

Rollforward Status
Input database alias           = database_1
Number of nodes have returned status = 1
Node number                    = 0
Rollforward status            = not pending
Next log file to be read      =
Log files processed           = -
Last committed transaction    = 2005-07-15-09.18.35.000000
DB20000I The ROLLFORWARD command completed successfully.
DB2=>
```

Current
Roll
Forward
status

Step 6: Re-create the Dropped Table

It is next necessary to manually re-create the dropped table. This can be performed, by issuing the following command from the DB2 prompt:

```
create table <DDL Parameters>
```

- **<DDL Parameters>** - This refers to all of the information revealed to the left of the “DDL: CREATE TABLE” text, as noted in *Step 1: Gather Dropped Table Information* on page 23.

Step 7: Import Data from the Recovery Path Directory

It is now necessary to import the data into the re-created table from the recovery directory. To accomplish this, input the following command at the DB2 prompt:

```
import from “<path>\NODE0000\data” of del messages  
  <file name> insert into <table name>
```

- **<path>** - This refers to the complete path to the directory created in *Step 4: Create a Target Recovery Path* on page 26, and it should be enclosed in quotes (“ ”).
- **<table name>** - The name of the dropped table that was re-created in *Step 6: Re-create the Dropped Table* on page 28.
- **<file name>** - This pertains to any file and the complete path to it, that exists outside of the target database and contains relevant progress information for the import process that is to be used.

Important: Please refer your *DB2 Administrator Guide* for a complete reference of all of the options available for use with the **Import** command.

Step 8: Verifying Data Exists in the Re-Created Table

From the DB2 prompt, issue the following command to reveal the re-create table and ensure that all relevant data exists in it.

```
select * from <table name>
```

Continue issuing this command for each table that was recovered to verify that its data was also successfully recovered.

Step 9: Recovering Any Additional Dropped Tables

Follow all the steps illustrated in sections, *Step 5: Set the Roll Forward State* on page 27 through *Step 8: Verifying Data Exists in the Re-Created Table* on page 28 for each remaining dropped table that is to be recovered.

DB.5.1.c Recovery Method 2: Hard Recovery

The following steps illustrate how to use the NetVault GUI, in conjunction with the DB2 command prompt to perform a hard recovery of a dropped database table. In a hard recovery, data in the tables of the target tablespace will be rolled forward to the point in time the backup was taken. Changes to the tables within the target tablespace that occurred between the time the backup was taken and the time this recovery is performed, will be lost. However, this procedure requires the least amount of steps and time to perform.

Important: Due to the loss of data issue noted above, it is recommended that the Rename/Relocate functionality explained in the section, *Renaming a Database During a Restore* on page 17 be used in conjunction with this procedure. This way the hard recovery will be performed to an alternate location, and newer data will not be lost.

Step 1: Determine the Target Tablespace(s)

1. Repeat Steps 1 - 3, as illustrated in the section, *Pre-Requisite: Set Dropped Table Recovery Configuration* on page 22.
2. At the DB2 prompt, input the following command to reveal dropped tables:

list history dropped table all for db <database name>

A list of information will be revealed in a table format, including the name of any dropped tables and the User Space(s) in which they existed. Make note of the names of any tablespace(s) that contain any dropped tables.

Figure DB-29:
The command noted above was issued for a DB2 database entitled "database_1". The end result revealed that the table "EMPLOYEES" has been dropped from a user space entitled "USER-SPACE1"

```
DB2=>list history dropped table all for db database_1
List History File for sample
Number of matching file entries = 1
Op  Obj  Timestamp+Sequence Type  Dev  Earliest Log  Current Log  Backup ID
-----
D   T   20050718114619                000000000000bb000002000d
-----
"ADMINISTRATOR"."EMPLOYEES" resides in 1 tablespace(s):
00001 USERSPACE1
-----
Comment: DROP TABLE
Start Time: 20050718114619
End Time: 20050718114619
-----
00001
-----
DDL: CREATE TABLE "ADMINISTRATOR"."EMPLOYEES" ("NAME" CHAR(20)
NOT NULL, "PROFESSION" VARCHAR(30)) IN "USERSPACE1";
-----
DB2=>
```

Dropped Table

Tablespace that contained the Dropped Table

Important: If multiple tables have been dropped from a database, they will **all** be listed when this command is issued, along with all other associated information. To recover all of these tables using this procedure, ensure that all of these tables and their associated tablespaces are noted.

Step 2: Take the DB2 Database Offline

A hard recovery requires that the DB2 database be taken offline prior to performing a restore with the NetVault GUI, to accomplish this, issue the following command from the DB2 prompt:

disconnect all

A message should be returned stating, “**The SQL DISCONNECT command completed successfully**”.

Step 3: Restoring the Tablespaces in NetVault

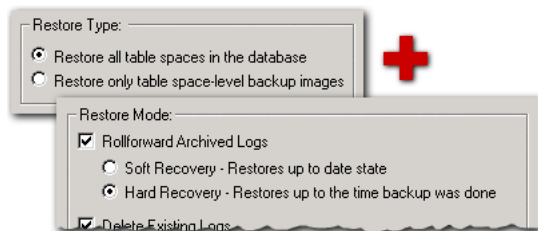
1. From the NetVault Server, launch the GUI and access the **Restore** window.
2. In the list of Clients revealed in the **Selections** tab, locate the DB2 Server and open it. Open the **DB2 APM** and navigate down to the backup saveset level of the selection tree.
3. Locate the desired backup saveset and open it (i.e., the one that contains the desired backup of the user space which houses the dropped table). drill down to the tablespace level of the selection tree. Select only those tablespaces that contained dropped tables (i.e., each tablespace noted in *Step 1: Determine the Target Tablespace(s)* on page 29).

Important: If the archived logs for a database were removed from the database directory on the the DB2 Server, select them for inclusion in the restore as well, if applicable (e.g., the **Archived Logs** are available for selection in the selected backup saveset).

Figure DB-30:
Settings that
need to be
made in the
Restore
Options tab

4. Select the **Restore Options** tab and ensure that the following apply:

- The **Restore All Tablespaces in the Database** option is **selected**
- The **Rollforward Archived Logs** option is **selected**, with the **Hard Recovery - Restores Up to the Time the Backup was Done** option selected.



5. Ensure that the default schedule option of **Immediate** is set in the **Schedule** tab, input a valid name for the restore job in the **Job Title** field and click on the **Submit** button to launch the job.

Step 4: Re-Connect to the Database and Verifying Restored Data

1. Repeat Steps 1 - 3, as illustrated in the section, *Pre-Requisite: Set Dropped Table Recovery Configuration* on page 22.
2. At the DB2 prompt, issue the following command to list all of the currently available tablespaces and review the information revealed:

list tablespaces

3. From the DB2 prompt, issue the following command to reveal the restored table and ensure that all relevant data exists in it.

select * from <table name>

Continue issuing this command for each table that was recovered to verify that its data was also successfully recovered.

VS.6.0 Troubleshooting

The following table describes commonly encountered problems and possible solutions. In those cases where an error occurs and is not described in this table, view the job log to extract the DB2 error number and then refer to the relevant DB2 documentation for the resolution.

Action	Error	Explanation/Solution
Backup fails to run	<i>The database is currently in use (Offline backup is not allowed).</i>	No other application or user should connect to the database.
Backup fails to run	<i>Online backup is not allowed.</i>	Either the userexit or logretain database configuration parameter, or both, is not set to "on".
Backup Error	<i>Unable to Get Contact Addresses for "host_name" when running a remote backup.</i>	The DB2 APM Client cannot obtain a connection with the NetVault Server. It is necessary to add the IP address and the host information of the NetVault Server to the hosts file (..\etc\hosts).

