

DB2 Recovery Expert for z/OS
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Information Management software

DB2 Recovery Expert for z/OS

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Executive Summary

Any CEO, CFO, or CIO could tell you that the interruption of business activities because of system downtime can cost a company millions of dollars per minute. Not only is the company subject to loss of productivity and critical data, but it also faces the problems of loss of revenue, customer dissatisfaction, and quite possibly the eventual loss of the company itself if the problem is not resolved quickly.

Companies cannot afford to be without a backup and recovery solution and the first steps to countering the impact of critical system downtime is developing a plan to protect all the essential business processes and functions to ensure business continuity.

When creating a plan for outages it is important to invest in recovery solutions that provide protection for the daily operations and consider the cost for downtime when a system outage occurs so you can implement the quickest, least costly method of recovery. IBM DB2® Recovery Expert for z/OS® provides a simple, self-managing recovery solution that enables database recovery operations with minimal disruption. These features provide intelligent analysis of altered, incorrect or missing database assets that include tables, indexes, and data. DB2 Recovery Expert for z/OS also automates the process of rebuilding these assets to a specified point in time, often without taking the database or the business operations offline.

Additionally, the need to keep database data available for processing and to quickly recover in the event of a failure has driven the industry to come up with more innovative ways to protect this data. Storage subsystems provide advanced techniques that allow data to be mirrored or copied almost instantly without taking it offline. But until recently, no product has tightly integrated the features of storage subsystems with database technology to create a seamless tool for backup and recovery purposes. With these tools, database systems are then able to leverage the storage processor's full potential. The backup and restore functions can be performed almost exclusively in the storage processor at the volume level. This allows for a complete "system-level" backup and restore function to complete in a fraction of the time it has taken in the past, while ensuring continuous DB2 data availability. These new tools manage this backup and restore process by driving the underlying storage subsystem functions.

IBM DB2 Recovery Expert for z/OS v2.1 introduces System Backup and Restore Services which allows you to back up and restore entire DB2 subsystems using the advanced techniques provided by storage subsystems. System Backup and Restore Services uses the DB2 BACKUP SYSTEM utility, IBM FlashCopy[®] facilities, or TimeFinder/Mirror and TimeFinder/Snap facilities to provide full backups of DB2 data and logs on a DB2 subsystem.

How does IBM Recovery Expert for z/OS help?

IBM DB2 Recovery Expert for z/OS has a straightforward Microsoft® Windows® interface that provides powerful reporting and automated recovery capabilities for productive database maintenance and high data availability. Menus make recovery to a specific point-in-time simple and easy to effect. The tool creates recovery options that include rolling changes forward or backward from an image copy, whichever is the most efficient in a given situation. Not only does the tool provide options in recovery scenarios, it also makes recommendations as to which option is relatively the least expensive in any given situation. This expert functionality helps save you time and money by helping you make better decisions.

IBM DB2 Recovery Expert for z/OS simplifies complex and laborious operations such as reversing undesired data changes including those that have cascaded to related tables, and rebuilding database assets that have been accidentally dropped and therefore do not exist in the DB2 system catalog. Additional capabilities and functionality:

1. You can also use object profiles developed with the IBM DB2 Automation Tool to recover a set of objects using IBM DB2 Recovery Expert for z/OS.
2. DB2 Recovery Expert for z/OS generates all necessary Job Control Language (JCL), submits it, and allows you to track progress as recovery proceeds.
3. The log analysis function also helps you determine “quiet times,” thereby ensuring that the objects you recover have no activity occurring against them.

4. IBM DB2 Recovery Expert for z/OS also includes the IBM DB2 Grouper component which provides a method to discover related sets of tables. This ensures that all relevant objects are recovered together thereby maintaining data integrity.
5. Recovery Expert for z/OS System Backup and Restore service supports the recovery of the entire DB2 subsystem using the RESTORE SYSTEM utility.

IBM DB2 Recovery Expert for z/OS restores all missing objects related to the objects selected for recovery. By default, Recovery Expert for z/OS will always recover missing objects related through DB2 object dependencies. The basic objects of recovery supported by Recovery Expert for z/OS are tables, table spaces and table space partitions. The Recovery Expert for z/OS GUI client allows you to specify aggregate objects such as databases, storage groups, plans and packages, DB2 Grouper sets, and DB2 Automation tool object profiles, which are then disassembled to the basic table space level unit of recovery.

What are System Backup and Restore services?

System Backup and Restore services has a simple ISPF interface that allows you to create “instant” point-in-time backups of an entire DB2 subsystem using fast replication-backed storage without having to take the subsystem offline or making it unavailable. Extensive validity checking of the DB2 subsystem being backed up is performed to ensure the integrity of each system backup. System Backup and Restore Services supports EMC, IBM, or any FlashCopy-capable storage array.

The online interface produces reports of all of the current backup points and allows you to select which backup to restore. The product performs DB2 subsystem restores to either the point in time of the backup or to some point in-between using the DB2 logs.

You create “Backup Profiles” in which you save all the information and options needed to perform the system backup. “Helper” functions and online validity checking are available to guide you through the process of creating these profiles, including commands to fetch the volumes in use by the subsystem and to specify ranges of backup volumes. Each profile contains the number of “Backup Generations” or backups of the subsystem it supports. Each successive run of the profile is taken to the next generation.

You are able to use the product to generate the Job Control Language (JCL) to execute each backup profile. This JCL can then be used to perform the backup on a predetermined schedule without having to re-generate the JCL. In addition, the System Backup and Restore functionality offers extensive validation checking that makes the backup and restore more thorough and less error-prone. This is an advantage over IBM’s DB2 Automation Tool which currently does not have a validation process.

Extensive validity checking is performed before each backup to ensure a complete and accurate backup. IBM DB2 Recovery Expert for z/OS v2.1 confirms the following:

- *MVS user catalogs are included in the backup, thereby ensuring integrity of the restoration.*
- *All source and target volumes are valid.*
- *All source volumes are online and available for backup.*
- *Source and target volumes are the same device type and reside on the same type of devices.*
- *Target volumes for a backup are not in use by another backup profile.*
- *Log and object data are on separate volumes, that is, that DB2 log data and object data are cataloged in separate OS/390® user catalogs. If they are not, you can still back up the subsystem, but you can only restore the full subsystem (both logs and data).*
- *IBM DB2 Recovery Expert for z/OS v2.1 control information resides on a separate device from volumes being backed up; the control information is backed up in its own process.*
- *If using Symmetrix systems, it checks to make sure that the system hosting the source and target volumes are at the appropriate microcode version for backup.*

The key to being prepared for system downtime is to have the proper tools in place when a disaster occurs. IBM DB2 Recovery Expert for z/OS Version 2.1 offers the complete solution for accurate backups with the least costly method to restore your system.

Recovery solutions

Depending on your recovery needs, you can use a different recovery solution from DB2 Recovery Expert for z/OS. The table below outlines the capabilities of the different features of DB2 Recovery Expert. Keep in mind that many of the recovery solutions require you to have set things up properly beforehand to use a specific recovery feature.

Table 1: Recovery solutions			
	DB2 Recovery Expert GUI Client	System Backup and Restore services (with object recovery enabled)	System Backup and Restore services (without object recovery enabled)
DB2 subsystem	X	X	X
Volumes		X	X
Storage groups	X		
Databases	X		
Table spaces	X	X	
Table space partitions	X		
Index space partitions ¹	X		
Tables	X		
Indexes ¹	X	X	
Plans ²	X		
Packages ²	X		
DB2 Grouper sets ²	X		
DB2 Automation tool object profiles ²	X		

Notes:

1. Cannot be selected; indirectly recovered as other objects are recovered.
2. Can be selected, though only to indirectly select other DB2 objects.
Plans, packages, and profiles are not directly affected.

How does this impact daily business?

When you make a mortgage payment or buy something with your credit card online, the information enters the bank's system and eventually updates a DB2 database in the form of a transaction.

Each day, millions of new transactions update DB2 databases but the processing does not stop there. New transactions must be routed through any number of applications to complete the update. As an example, a credit card purchase must be sent to the appropriate bank processing center for the charge to appear on your statement. Most DB2 transactions require some kind of batch processing to put all the gears in motion to send you that new book you just ordered online.

Many data centers still rely on the IBM System z™ operating environment (z/OS) for batch processing to carry out the orders of millions of online transactions per day. You may be able to order that new book at 3:00 a.m., but your order will not be fully processed until the next day's batch cycle. You can think of it as a queue of orders lining up throughout the day to be fully processed all together throughout the night.

On the z/OS side of the house, a surprisingly high percentage of the time, nothing goes wrong. Millions of orders are processed and completed like clockwork day after day. Occasionally, a programming change, bad data, or a human error can cause a problem that would require the processing to be "backed out" and "rerun."

Typically, a "back out" is performed by restoring the "before" image of the databases and files to reset the applications to the point they were before that day's updates. The updated files are deleted or renamed and the backups of the files are restored and put back in place. Depending on how many files and how large the files are, this process can take anywhere from minutes to hours to complete. Once the databases and files are reset, a "rerun" of the application's batch processing occurs. This simply is a repeat of the processing already performed but without the glitch that caused the problem in the first place.

These occasional mishaps may be viewed as mini-disasters because they cause havoc within the data center and on the personnel involved. As you may deduce, this situation, if not handled properly, can indeed introduce new errors into the system and the process would have to be repeated all over again. In addition, the length of time it takes to reset and rerun can cause the data center to miss service level agreements (SLA) for the availability of the DB2 online system. In certain industries, such as financial institutions, a missed SLA could cause a company to be non-compliant with regulatory requirements resulting in excessive financial penalties.

Most DB2 environments use some form of Image Copy backup for their DB2 files. This program copies either the entire content of the DB2 VSAM data set or the entries since the last backup to another file or files (one on disk and one on tape) for recovery from either mini-disasters like the one described above or major disasters when they need to recover offsite.

Again, depending on the number and size of the DB2 objects, the Image Copy backup processing can take anywhere from minutes to hours to complete. These processes are I/O intensive, meaning they read and write a large amount of data limited only by the speed allowed by the computer's peripheral devices.

While Image Copy backup has served the DB2 community well throughout the years, the sheer size and quantity of DB2 objects in today's z/OS environments are causing database administrators and their immediate management to search for new technologies that can get the job done faster. In addition, the demand by customers for 24x7 availability means that these occasional mishaps cannot be tolerated within the nightly batch processing window. These errors often mean that the updated DB2 online system will not be available to customers at the agreed upon time the next morning.

With the introduction of replication and mirroring technologies, creating exact copies of data has become faster and less disruptive to the DB2 online customer. In fact, both of these technologies can create duplicates on another set of volumes without the customer even knowing it is happening.

These technologies work differently but achieve the same results by using a combination of hardware and software to duplicate data from one direct access storage device (DASD) volume to another. The intent is to schedule the copy to occur at a point-in-time that is consistent for all of the data on the volume or all of the volumes in a specific storage group. This consistent point-in-time can then be used to quickly “reset” all of the files in the DB2 environment should a mishap occur.

Using DB2 Recovery Expert for z/OS Version 2.1, System Backup and Restore Services can help save hours of both backup and restore time (not to mention I/O and CPU consumption) for DB2 data, thus helping data centers meet their SLAs when mishaps occur.

DB2 Recovery Expert for z/OS Version 2.1

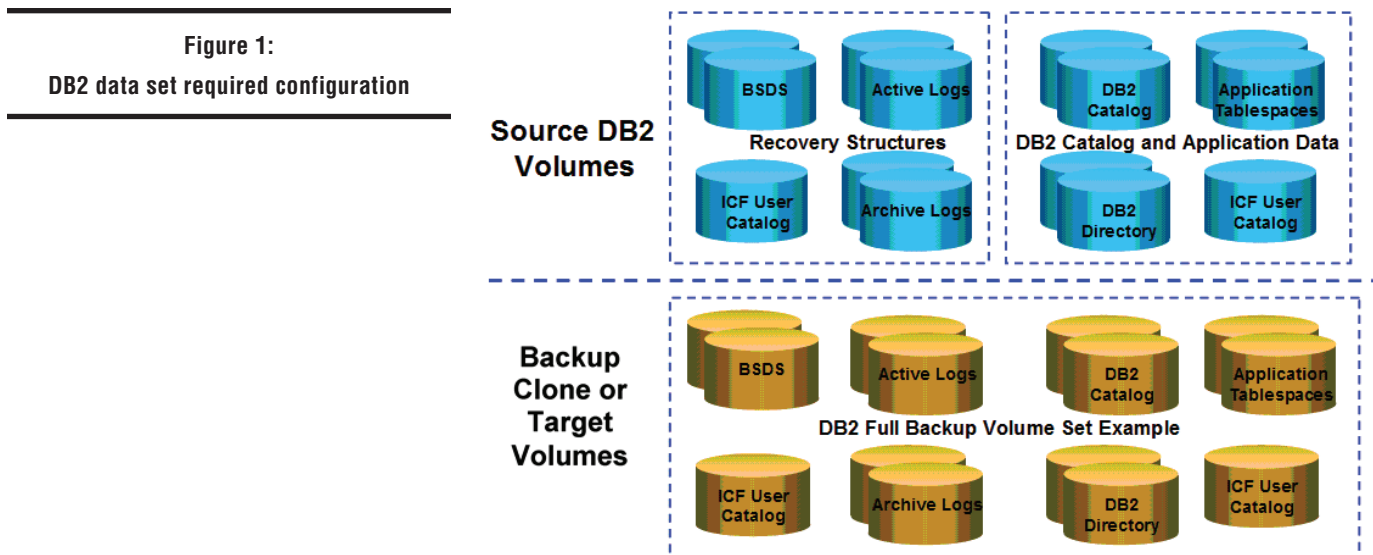
The DB2 for z/OS environment can experience different kinds of failures such as IRLM failures, z/OS or power failures, disk failures, application errors, DB2 subsystem failures, site failures, etc. When such failures occur, appropriate recovery procedures need to be executed swiftly and precisely to ensure minimal loss of data and minimal loss of system availability. This paper focuses in more depth to the benefits of IBM DB2 Recovery Expert for z/OS Version 2 and explains how this one product provides many solutions. It also gives specific information on the set up requirements for the System Backup and Restore services. Additionally it explains the many solutions of this one product which are:

- *Maintains a repository of where all files existed at the time of the backup so it can always restore objects from the system backup.*
- *Provides robust validation at the time of system backup to ensure the entire system is configured properly and was truly backed up.*
- *Provides an ISPF interface to perform the DB2 object restoration. You can predefine groups of objects into an object profile, these could be all objects related to an application. If and when the need to recover that application arises, you simply use the ISPF interface to restore the object profile. Recovery Expert then analyzes the recovery resources available and automatically generates recovery JCL for all objects in the profile. The JCL generated will restore the objects in the most effective manner, either from a system-level backup or from image copies.*

- Provides an analysis function to show you the DASD usage of your DB2 systems and what you need to fix before effectively implementing system-level backup and restore methods. This report is interactive and generates the commands necessary to configure the DB2 system properly.
- Produces summary and detail reports showing all the volumes backed up, and what kind of DB2 data they contained. These reports are saved in the System Backup & Restore repository and are associated with each system backup for later viewing.
- Provides an easy-to-use ISPF interface to set up and perform all aspects of the system-level backup and restore process.
- Automates the process of offloading the system level backup from disk to tape.
- Provides support to perform disaster recovery from either a system backup on tape or from image copies.

DB2 Subsystem Setup Requirements for System-Level Backup

There are specific requirements that your database system must meet in order to use the system-level backup and restore method. If they are not followed, disastrous results may occur at restore time. The following figure shows how DB2 system data sets must be configured:



Each DB2 system should have its recovery structures (meaning BSDS and Log data sets) separated on its own set of volumes. The DB2 catalog and application data should also be separated on its own set of volumes. This includes creating two separate MVS ICF user catalogs; one for the recovery data sets, and the other for DB2 catalogs and application data. These user catalog data sets contain MVS information about data sets such as their type and what volume(s) they reside on. These two groups of volumes and ICF catalogs should contain only data sets for one DB2 subsystem, or data that you wish to have backed up and restored along with DB2. If other MVS data is placed on these volumes or uses these MVS catalogs, it could be lost when a system-level restore is performed. You will also need a process in place to ensure that DB2 data sets have not been created outside of these groups of volumes, or they will not be included in the system backup.

DB2 Recovery Expert v2.1 for z/OS provides a Subsystem Setup tool that analyzes an existing subsystem and reports on its readiness for the system-level backup process. It also provides functions to help perform the steps necessary to change your DB2 configuration to satisfy these requirements. The following screen shows the main panel for the IBM DB2 Recovery Expert v2.1 for z/OS Subsystem product. From this panel you can enter option “M” to perform a Subsystem Setup analysis:

Figure 2: Recovery Expert main menu

```
ARYSMAIN          ----- Recovery Expert for DB2 z/OS -----
Option  ===> _

User: PDBOB - ARY

-----
B. System Backup Profiles
R. System Restore and Offload
O. Object Recovery Profiles
D. Disaster Recovery Profiles
M. DB2 Subsystem Analysis and Setup
S. Product Setup
X. Exit

Enter END command to return to ISPF.
```

The following screen shows the result of an IBM DB2 Recovery Expert v2.1 for z/OS Subsystem Setup analysis:

Figure 3: Subsystem Setup Information

```

ARYSSSID ----- Subsystem Setup Information ----- 2007/09/04 15:09:12
Option ==> Scroll ==> PAGE
-----
Subsystem: B81A Active: Yes Datas sharing: No
Date of Last Analysis: 09/04/2007 Analysis Recommended: Y
Message: Other non-DB2 data will be backed up and restored.
-----
New MVS User Catalogs to be used by this DB2 Subsystem
- Log/BSDS Cat1 RBR.CATALOG.RSPLEX0B.HAA.CAT1 Volume DEV01E
- DB2 Data Cat1 CATALOG.RSPLEX0B.B81A.CAT2 Volume RBRSA4
- Line Cmds: (C-Create, A-Add Alias, D-Dataset Disp, U-Update, V-View Alias)

Existing MVS User Catalogs used by this DB2 Subsystem
- Log Other CATALOG.RSPLEX0B.B81A.CAT1 Volume RBRSA4
- Data Other CATALOG.RSPLEX0B.B81A.CAT2 Volume RBRSA4
- Log Other CATALOG.RSPLEX0B.DB2.CAT1 Volume DBPB00
- Line Cmds: (D-Dataset Display, V-View Aliases)

Storage Copy Pools
- Data Copy Pool DSNSRS22B81A$DP
- Log Copy Pool DSNSRS22B81A$LG
- Backup Pool SGDBB4
- Backup Pool SGDBB3
- Line Cmds: (V-Volume List)

Boot Strap Datasets
- B81A - BSDS 1 B81ALOG.BSDS01 Volume RBRSA4
- B81A - BSDS 2 B81ALOG.BSDS02 Volume RBRSA4
- Line Cmds: (R-Rename BSDS, M-Move BSDS)

Active Log Datasets
- B81A - Log 1 B81ALOG.LOGCOPY1.DS01 Volume RBRSA4
- B81A - Log 1 B81ALOG.LOGCOPY1.DS02 Volume RBRSA4
- B81A - Log 1 B81ALOG.LOGCOPY1.DS03 Volume RBRSA4
- B81A - Log 2 B81ALOG.LOGCOPY2.DS01 Volume RBRSA4
- B81A - Log 2 B81ALOG.LOGCOPY2.DS02 Volume RBRSA4
- B81A - Log 2 B81ALOG.LOGCOPY2.DS03 Volume RBRSA4
- Line Cmds: (R-Rename Log, M-Move Log)

Alias used with associated MVS User Catalogs
Valid Primary Cmds: (Analyze, Reanalyze)

```

The “**New MVS User Catalogs**” section allows you to specify a new ICF user catalog to be used for both the Log (Recovery) and Data portions of DB2. If the catalogs entered do not exist, the control cards to create them are generated.

The “**Existing MVS User Catalogs**” area shows the user catalogs that currently hold the entries for the DB2 subsystem data sets. It also indicates what type of data the user catalog contains. If a user catalog contains both Log and Data entries, it is highlighted in red. The line commands allow you to display all the MVS aliases used in this catalog or to display all the data sets currently residing in this catalog.

The “**Boot Strap Datasets**” display shows the current names of all the boot strap data sets in a DB2 subsystem or data sharing group and the volumes they reside on. The line commands allow you to rename a boot strap data set or to move the data set to another volume.

The “**Active Log Datasets**” display shows the current data set names of all active log data sets in a DB2 subsystem or data sharing group and the volumes they reside on. The line commands allow you to rename an active log and to move the log to another volume.

The “**Alias used with associated MVS User Catalogs**” display shows all of the aliases used for a given DB2 subsystem and the catalogs they reside in. The type of data (Data, Log, or Other) using this alias is also shown. The line commands allow you to move the catalog entries (mergecat) of an alias out of the displayed catalog to another catalog. If you created a new user catalog for one of these aliases, these entries are removed from the displayed catalog and moved to the newly created catalog.

The “**Volumes used by this DB2 Subsystem**” section shows all volumes currently holding data sets for this DB2 subsystem and what type of data each holds:

- *DATA* signifies any application or DB2 catalog data set.
- *DCAT* signifies a user catalog for *DATA*.
- *ALOG* signifies an active log data set.
- *ACAT* signifies a user catalog for an active log.
- *ARCL* signifies an archive log data set.
- *RCAT* signifies a user catalog for an archive log.
- *OTHER* signifies a non-DB2 data set resides on this volume.
- *SYM* signifies that this volume resides on a Symmetrix subsystem.

Using line commands, you can generate jobs to move data sets from one volume to another.

Any data shown in red indicates a severe problem with the subsystem setup that needs to be addressed before performing a system-level backup. Any data shown in light blue indicates a potential problem that needs to be investigated to determine if it needs attention.

Backup Profiles

When a DB2 subsystem has been properly configured for system-level backup, DB2 Recovery Expert v2.1 for z/OS provides an ISPF interface to create and manage backup profiles. A backup profile contains all the information and options needed to perform a system-level backup of a single DB2 subsystem. The profile management interface is shown below:

Figure 4: Backup Profile Display

```
ARY$BPRD ----- Backup Profile Display ----- 2007/09/04 15:15:34
Option ==> Scroll ==> PAGE
-----
Profile Like *
Creator Like PDB0B Row 1 of 1 >
-----
Cmd Name Creator SSID Updt
-----
B81A BACKUP PROFILE PDB0B B81A U
***** Bottom of Data *****
```

The Backup Profile display screen allows you to build, create, delete, rename, update or view a Backup Profile. You can limit the Profiles being displayed by entering a Profile or Creator or by using an “*” as a wildcard character. The “Build” line command builds the job control language (JCL) to execute a backup profile. The backup profiles are stored in the IBM DB2 Recovery Expert v2.1 for z/OS metadata repository and are stored separately from DB2 data so they are not affected by the system backup and restore process. DB2 Recovery Expert v2.1 for z/OS provides a method to automate the backup and restore of the IBM DB2 Recovery Expert v2.1 for z/OS repository files and to facilitate their movement to an offsite recovery location.

When a backup profile is created, the following “Update Backup Profile” screen is shown:

Figure 5: Update Backup Profile

```

ARYSBPRU ===== Update Backup Profile ===== 2007/09/04 15:11:28
Option ==>
-----
Creator: PDBOB      Name: B81A BACKUP PROFILE      User: PDBOB
Share Option: U    (Upd,View,No)  Description: BACKUP THE B81A SUBSYSTEM
-----
DB2 Subsystem ==> B81A      Backup Options
Current Generation==> 00
Backup Method ==> D (Bcv/Snap/Flash/Db2)  Setup Needed ==> Y
Backup Scope ==> E (Full/Data)      Issue Log Suspend ==> N (Yes/No)
Backup Generations==> 04 (01 - 99)  Validate DB2 Vols ==> Y (Yes/No)
Offload Options ==> N (Yes/No/Update)  Enable Obj Restore==> N (Yes/No)
-----
Volume Mappings
-----
Source  Dev  Src  Target
Cmd  Volumes  Type  Unit  Volumes  Message Area
RBRSA0 3390-1 6420 RBRC A0
RBRSA1 3390-1 6421 RBRC A1
RBRSA2 3390-1 6422 RBRC A2
RBRSA3 3390-1 6423 RBRC A3
RBRSA4 3390-1 6424 RBRC A4
RBRSA5 3390-1 6425 RBRC A5
RBRSA6 3390-1 6426 RBRC A6
RBRSA7 3390-1 6427 RBRC A7
RBRSA8 3390-1 6428 RBRC A8
RBRSA9 3390-1 6429 RBRC A9
RBRSA0 3390-1 6430 RBRC B0
RBRSA1 3390-1 6431 RBRC B1
RBRSA2 3390-1 6432 RBRC B2
RBRSA3 3390-1 6433 RBRC B3
-----
Valid Line Cmds: (I-Insert, D-Delete)
    
```

You enter the DB2 subsystem that you want to back up and various options for the backup.

Backup options

Backup Method

The Target Volume Type can be BCV, Snap, Flash or a DB2 System Backup. A BCV target uses EMC Timefinder Mirroring technology, Snap uses EMC Timefinder Clone (Full volume copy) technology, Flash uses the Native FlashCopy API and the DB2-type backup uses the IBM DB2 Backup System utility.

Backup Scope

You must decide if a Full or Data type copy should be executed. A Data-type backup directs IBM DB2 Recovery Expert v2.1 for z/OS to backup only volumes containing the DB2 catalogs and application data while the full backup type creates a backup containing all DB2 volumes, log and data.

Backup Generations

The Backup Generations option allows you to specify how many system-level backups you want to keep on DASD at one time.

Offload Options

This option allows you to specify options on how the backup should be unloaded to tape.

Current Generation

When you first create a profile, this field is set to 0. After the profile has been built and submitted, this field contains the generation that is currently mirroring DB2.

Setup Needed

When you create a profile, the Setup “Needed” field is set to Y. The profile setup process must be executed the first time a profile is built and the resulting job submitted. The profile setup process performs extensive validity checking on the profile, ensuring a proper DB2 system configuration. Once a profile setup has been performed, this field contains an N. If you update a profile and change the volume configuration, number of generations, or backup type, re-running profile setup is required and this field is reset to Y.

Issue Log Suspend

For backup consistency, you can optionally specify that IBM DB2 Recovery Expert v2.1 for z/OS issue the DB2 LOG SUSPEND command to suspend logging while the backup is taken to guarantee consistency. This should be used if consistency cannot be guaranteed by the hardware or if not using the DB2-type backup.

Validate DB2 Volumes

You can also choose if you want Recovery Expert to perform DB2 Volume Validation with each backup. This process determines if all the DB2 source volumes are included in the backup and if the data has been properly segregated as described earlier.

Enable Object Restore

You can choose to enable System Backup and Restore Service's object-level recovery from backups created by this profile. During backup, System Backup and Restore saves information to its repository about object data sets that allows objects to be individually restored later.

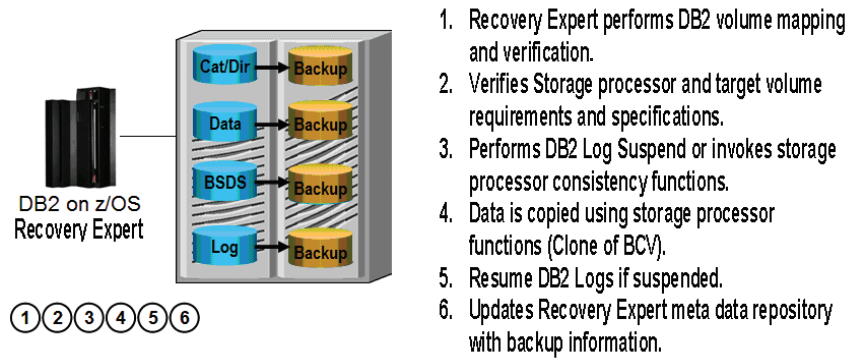
Volume Mappings

The Volume Mappings section contains a listing of all the volumes DB2 is using. You can enter the "VOLUME" primary command to have Recovery Expert determine the list of source volumes, or you can enter them manually. For each source volume, a target unit is specified (one for each Backup Generation) to control what volumes contain the backup. The "TARGET" line command can be used to specify ranges of units and Recovery Expert automatically pairs the appropriate size and type of target unit with each DB2 source volume.

DB2 Recovery Expert v2.1 for z/OS System Backup Process

Once a backup profile has been created, the first action should be to submit the profile for execution with the “SETUP” parameter. This instructs IBM DB2 Recovery Expert v.2.1 for z/OS to perform extensive validity checking on the profile. IBM DB2 Recovery Expert v2.1 for z/OS dynamically determines all of the volumes that DB2 is currently using, ensure that the DB2 data and logs are properly segregated, ensure that all data resides on fast replication volumes, and ensure that backup volumes of the appropriate configuration exist and are accessible to MVS. Once a profile has been created and the setup process has been performed, the profile can be submitted to perform repeated system backups whenever they are desired. The setup process must be repeated only if the profile is updated.

Figure 6: System Backup Process



The above diagram gives a high-level overview of the IBM DB2 Recovery Expert v2.1 for z/OS system backup process. The blue volumes on the left represent the DB2 volumes containing all DB2 data sets. The gold volumes represent a backup “set” or generation.

IBM DB2 Recovery Expert v2.1 for z/OS produces both a Summary and Detail report for each system backup it takes. The summary report shows the options that were in effect, the RBA/LRSN of the backup, and the last DB2 system checkpoint RBA/LRSN before the backup. The detail report shows each DB2 source volume, including what type of data it holds, and what volume holds its backup. The backup reports are saved in the IBM DB2 Recovery Expert v2.1 for z/OS repository and are viewable from the ISPF interface.

Figure 7: Backup Report Display

```

ARY$BREP ----- Backup Report Display ----- 2007/09/04 15:28:23
Option ==> _____ Scroll ==> PAGE
----- Row 1 of 69 +>
Rocket System Backup and Recovery for DB2 on z/OS
Backup Summary Report

Utility Executed:..... Backup
Profile Name:..... PDDUDE.B81E - VANILLA SNAP
DB2 Subsystem:..... B8E1
DB2 Version:..... 0810
Backup Type:..... Snap
Backup Contains:..... Object Data and Log Data
Nbr of Controllers:..... 01
Lowest Microcode Level:.. 5x71
Nbr of Volumes:..... 0044
Backup LRSN:..... C1134575BF47
Last Checkpoint LRSN:.... C113456F1691
Backup Date:..... 08/20/2007
Backup Time:..... 12:30:24
Consistency Method:..... EMC Consistent Snap
Supports Object Restore:.. Yes

Rocket System Backup and Recovery for DB2 on z/OS
Backup Volume Detail Report

<--DB2 Source Volume--> <-Snap--> <-----Data Types----->
Volser Ucb# Sym# Devtyp Ucb# Sym# Obj OCat ALog ACat RLog RCat
-----
BDS000 6040 1040 3390-1 630C 130C Yes No No No No No
BDS001 6041 1041 3390-1 630D 130D Yes No No No No No
BDS002 6042 1042 3390-1 630E 130E Yes No No No No No
BDS003 6043 1043 3390-1 630F 130F Yes No No No No No
BDS004 6044 1044 3390-1 6310 1310 Yes No No No No No
BDS005 6045 1045 3390-1 6311 1311 Yes No No No No No
BDS006 6046 1046 3390-1 6312 1312 Yes No No No No No
BDS007 6047 1047 3390-1 6313 1313 Yes No No No No No
BDS008 6048 1048 3390-1 6314 1314 Yes No No No No No
BDS009 6049 1049 3390-1 6315 1315 Yes No No No No No
BDS00A 604A 104A 3390-1 6316 1316 Yes No No No No No
BDS00B 604B 104B 3390-1 6317 1317 Yes No No No No No
BDS00C 604C 104C 3390-1 6318 1318 Yes No No No No No
    
```

DB2 Recovery Expert v2.1 for z/OS System Restore Process

Figure 8: Restore System Display

```

ARY$REST  ----- Restore System Display ----- 2007/09/04 15:29:44
Option ==> _____ Scroll ==> PAGE

DB2 Subsystem ID * _____

-----
Select a row from the list of recovery points displayed below.
To enter an RBA/LRSN and have a recovery point automatically
selected for you, enter the RESTORE primary command followed
by a DB2 subsystem ID.
-----

                                Row 1 of 8  >
Cmd  Date       Time      Data  Mixed  On   On   Obj   Nbr
-----|-----|-----|-----|-----|-----|-----|-----|-----|-----
-   08/20/2007  12:30:24  No   No   Yes  No   Yes  Snap  0044
      SSID: B8E1  RBA/LRSN: C1134575BF47
-   07/16/2007  15:47:27  No   No   No   Yes  Yes  Snap  0044
      SSID: B8E1  RBA/LRSN: C0E770374722
-   07/16/2007  13:43:55  No   No   No   Yes  Yes  Snap  0044
      SSID: B8E1  RBA/LRSN: C0E7549B6B6D
-   07/14/2007  07:30:33  No   No   No   Yes  Yes  Snap  0044
      SSID: B8E1  RBA/LRSN: C0E47D71A6B8
***** Bottom of Data *****

```

The IBM DB2 Recovery Expert v2.1 for z/OS Restore System Display shows the information on all the system-level backups that have been taken. It shows the date and time the backup was taken and details the options that were selected for each backup. You can filter the display by subsystem identifier to only show backups for a particular system. The ISPF interface allows you to view the report that is associated with the backup and to delete the metadata for any unwanted backups. When performing a restore, you can use this screen to display the available restore points that can be selected. You may also enter the “RESTORE” primary command on this screen. It allows you to specify a DB2 system ID and the RBA or timestamp to which you want to restore it. IBM DB2 Recovery Expert v2.1 for z/OS then automatically selects the appropriate system-level backup to restore.

Figure 9: Restore Options

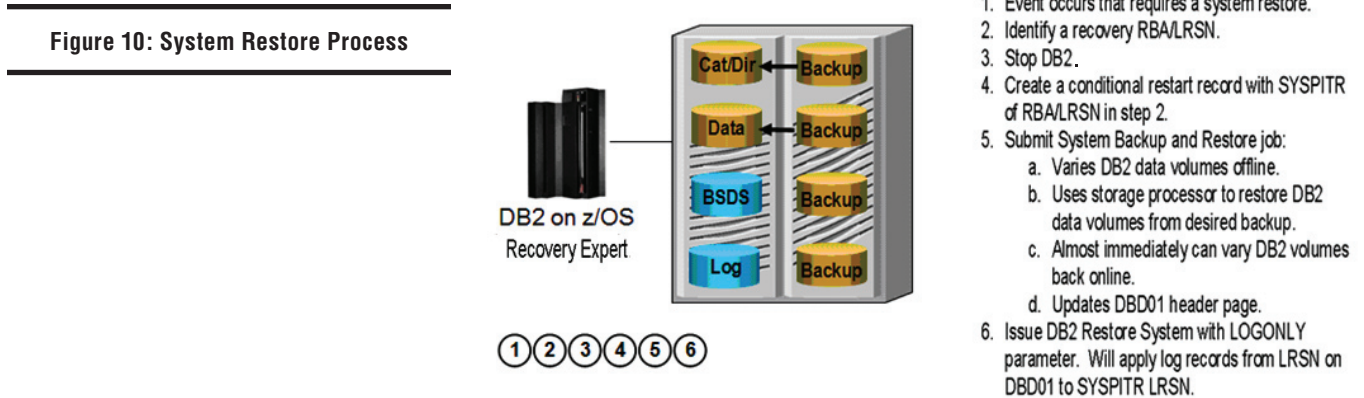
```
Restore Options
Restore Only Data          Y
Select a Recovery Point   N
Recover to RBA/LRSN      C1134575BF47

Select whether to Restore Data and Logs or Data only. If
restoring Data and Logs you will not be able to select a
Timestamp Recovery Point or change the Recover to RBA/LRSN.

Press ENTER to generate the Restore Job or PF3 to Cancel
```

When a backup point is selected, the above screen is shown. You have the option to restore just the volumes that contain DB2 object data or both Log and Data volumes. If just data volumes are restored, you can also choose an RBA/LRSN to restore to by specifying an RBA/LRSN. The “Select a Recovery Point” option produces a screen showing all archive log points and DB2 checkpoints that have been taken since the backup. This assists you in selecting the appropriate RBA/LRSN to restore to. If both logs and data are restored, DB2 is started and any units of work that were “in-flight” at the time of the backup are rolled back. When the restore point is chosen, IBM DB2 Recovery Expert v2.1 for z/OS generates three jobs that perform the system-level restore. The first job runs DSNJU003 to insert a conditional restore record with the RBA/LRSN value that you want to restore the system to. The second job runs the IBM DB2 Recovery Expert v2.1 for z/OS restore process and restores the DB2 volumes back to states they were in when the system backup job was run.

The third job runs the new System Restore utility with the LOGONLY parameter. This instructs the utility to perform only the Log Apply phase of the system restore process since IBM DB2 Recovery Expert v2.1 for z/OS has already done the volume-level restores. The following is a diagram showing the IBM DB2 Recovery Expert v2.1 for z/OS System Restore process:



The value stored in the DBD01 header page is the RBA/LRSN of the most recent DB2 checkpoint taken before the system-level backup. The new RESTORE SYSTEM LOGONLY job starts applying log records starting with the value in the DBD01 header page and keeps applying them until it reaches the RBA/LRSN that you specified. This ensures that the complete DB2 system has been restored to the specified RBA/LRSN when complete.



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