

IDUG® 2004 – North America



**Enabling Your
On Demand DB2 World**

DB2 V8 System Point-in-Time Recovery

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Abstract

This presentation covers the steps necessary to perform system-level point-in-time recovery using the new DB2 z/OS V8 utilities: BACKUP SYSTEM and RESTORE SYSTEM. While it is developed for John Deere's SAP/R3 environment, it is applicable to other ERP products and to other DB2 z/OS applications where you may have to restore a complete DB2 subsystem to a prior point-in-time. JCL and output examples are included.

Content

- Why do I need system level point-in-time recovery?
- Hardware and software requirements for Backup and Restore.
- System PITR Backup and Restore utilities jcl and output examples.
- John Deere's System PITR experience during the DB2 z/OS V8 ESP.
- What's next for System PITR Backup and Restore?



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The context of this presentation is DB2 Version 8 z/OS with some storage management concepts. It is not SAP specific. This presentation assumes an intermediate knowledge level of DB2 on z/OS. It does not assume any more than an awareness of SAP or similar ERP environment.

The presentation will explore in detail and provide examples for the following:

DFSMSHsm Copy Pools

DFSMSHsm panels and commands

BACKUP SYSTEM utility

RESTORE SYSEM utility

Quiesce utility

DSNJU003 Change Log Inventory

DSNJU004 Print Log Map

Why Do I Need System PITR?

- SAP is not your typical DB2 legacy application.
- Referential Integrity is handled by the application.
- The entire SAP DB2 system is integrated.
- Can not recover individual objects to prior point-in-time; must recover entire DB2 system for data consistency.
- Effort today to recover entire SAP DB2 system is labor intensive, time consuming and prone to errors.
- Number of SAP objects keep growing.
 - SAP 4.6: 11,170 TS and 27,860 IX
 - SAP 4.7: 16,500 TS and 44,000 IX



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In a SAP environment the entire DB2 subsystem and all objects in it, including user data and the DB2 catalog and directory, are considered a single entity. The entire DB2 system needs to be backed up and recovered as a single entity. Prior to DB2 Version 8 this was accomplished with a split-mirror volume dump methodology using ‘-set log suspend’ and ‘-set log resume’ processing. This typically meant that recovering the DB2 system to a prior point-in-time was to restore the system to the last volume backup. This could result in substantial data loss within the system since log records would not be applied.

Why Do I Need System PITR?

- SAP DB2 Customer Technical Exchange identified the need for a more robust backup/recovery solution.
 - System-level backup and recover utilities to support point-in-time recovery to a user specified time.
 - Operate on volume basis.
 - Dasd vendor neutral solution.
- DB2 V8 for z/OS delivers two new utilities.
 - Backup System
 - Restore System

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In December 1999, eight companies running SAP on DB2 z/OS met with IBM and SAP in Walldorf, Germany. The discussions centered on issues that global companies were facing running SAP on the z/OS platform. One of the main issues this group identified was the need for a more robust backup/recovery solution at the DB2 system-level instead of the DB2 object level.

DB2 Version 8 delivers two new system utilities along with new storage management concepts to facilitate system-level point-in-time recovery and disaster recovery within the scope of a fully integrated DB2 subsystem or DB2 Data Sharing environment.

Hardware and Software Requirements

- RESTORE SYSTEM utility with LOGONLY option.
 - DB2 V8 New Function Mode.
 - Not supported in DB2 V8 Compatibility Mode.
 - Z/OS 1.3 and above.
 - Assumes you have dumped and restored the dasd volumes using a split-mirror backup process with ‘-set log suspend’ and ‘-set log resume’.



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The RESTORE SYSTEM utility with LOGONLY option specified is available in the DB2 Version 8 and z/OS 1.3 environment. This option assumes that you have managed the volume dumps and restores of the entire DB2 system using the ‘-set log suspend’ and ‘-set log resume’ process. This option will apply DB2 log records to the current set of DB2 volumes to the specified point-in-time that was requested.

The split-mirror backup process does not use the native DB2 Copy utility nor does it use the new Backup System utility. The split-mirror process uses software such as TimeFinder for EMC dasd and FlashCopy for IBM dasd. Additionally, ‘-set log suspend’ and ‘-set log resume’ are used to suspend database updates during the logical backup process. To use Restore System Logonly you must restore the dasd for the user data and DB2 catalog and directory. The dasd volumes containing the DB2 logs are not restored.

Hardware and Software Requirements

- **BACKUP SYSTEM and RESTORE SYSTEM (full function).**
 - DB2 V8 New Function Mode.
 - Not supported in DB2 V8 Compatibility Mode.
 - Disk control units support FlashCopy API.
 - Z/OS 1.5 and above.
 - DFSMS Copy Pools defined for data & logs.
 - DFSMS Copy Pool Backup storage group defined.
 - DFSMS managed datasets; including DB2 catalog & directory.
 - HSM BCDS record size of 6544.



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The full function use of the new **BACKUP SYSTEM** and **RESTORE SYSTEM** utilities require DB2 Version 8, z/OS 1.5 and support of the DFSMSHsm API by the dasd vendor. This results in an integrated DB2 process for backing up and restoring a DB2 system. The FlashCopy API is being utilized by other dasd vendors in addition to IBM to provide support for the Backup System and Restore System utilities.

John Deere Environment

- X96A - DB2 subsystem (non-data sharing).
- Volumes are SMS managed.
- Separate ICFCTLGs.
 - DB2X96A for user data, DB2 catalog and directory.
 - DB2X96L for logs and system load libraries.
- SMS Storage Groups.
 - DB2X96 - User data.
 - DB2X96S - DB2 Catalog & Directory and ICFCTLG DB2X96A.
 - DB2X96L - DB2 logs, BSDS, system executable libraries and ICFCTLG DB2X96L.

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X96A is a non-Data Sharing DB2 system. All volumes are SMS managed, including the DB2 catalog, directory and logs. This is a requirement for the BACKUP SYSTEM and RESTORE SYSTEM utilities. Prior to DB2 V8, this system had one ICFCTLG for all the datasets associated with this system. Due to the nature of the RESTORE SYSTEM utility this ICFCTLG needed to be split into two separate ICFCTLGs. (RESTORE SYSTEM and the need for separate catalogs will be covered in more detail in subsequent slides.) User data and the DB2 catalog and directory could reside in the same SMS storage group although we chose not to do so for this implementation.

ICFCTLGS

1. DB2X96A on X96S01 has aliases DB2X96.DSNDBC and DB2X96.DSNDBD.
2. DB2X96L on X96L01 has alias DB2X96.

SMS Storage Groups

DB2X96 contains volumes X96001 – X96024.

DB2X96S contains volumes X96S01 – X96S02.

DB2X96L contains volumes X96L01 – X96L05.

Copy Pools

- New SMS construct.
- Contains SMS storage groups.
- Backup and restore with a single command.
- DB2 uses two copy pools; data and log.
- Specific naming conventions for DB2 copy pools.
 - DSN\$locn-name\$DB for data.
 - DSN\$locn-name\$LG for log.
- Separate ICFCTLGs for data and log.



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A copy pool can contain up to 256 storage groups.

Each copy pool must be associated with a copy pool backup storage group. A copy pool can be associated with only one copy pool backup storage group.

Each copy pool has a 'versions' attribute. This is the number of backup versions that are maintained on disk for that copy pool. The current limit within SMS is 85. However; 50 is the maximum number of backups that will be recorded in the BSDS.

Define separate ICFCTLGs for the data and log copy pools. During the course of the RESTORE SYSTEM utility the data copy pool will be restored to dasd. You want the associated ICFCTLG for these datasets also restored. (The log copy pool is not restored as part of the process.)

Copy Pool Backup Storage Group

- New SMS storage group type.
- Holds dasd volumes used to backup Copy Pools.
- Need sufficient number of volumes to backup all versions of a cpool.
- User process to dump the target volumes to tape for retention.



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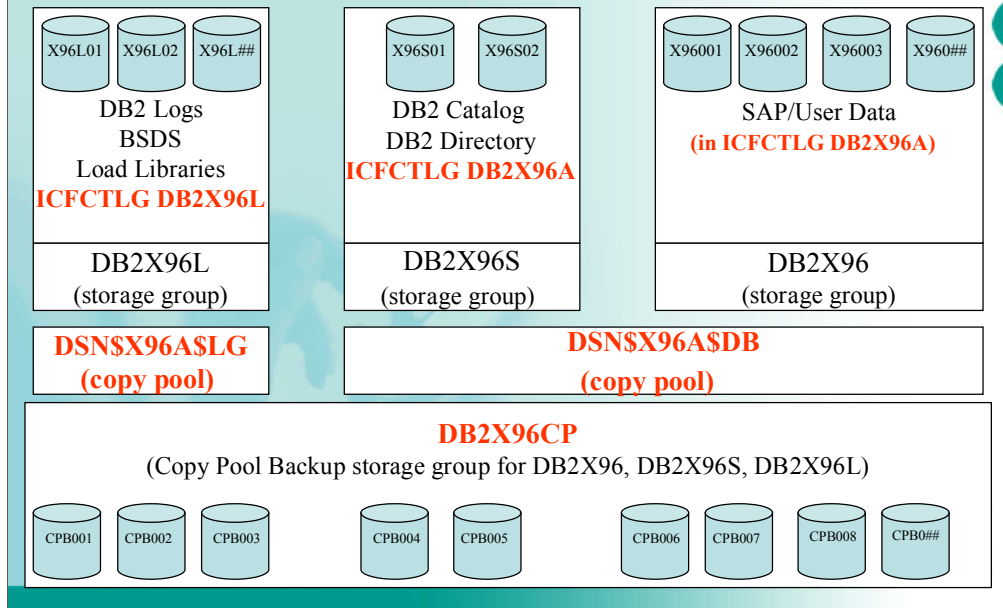


A copy pool backup storage group can have many copy pools associated with it. There is no specific DB2 naming convention for the copy pool backup storage group.

If you use the optional FRBACKUP PREPARE command then you will need to ensure that there are enough volumes in the copy pool backup storage group to support all the versions that have been defined in your DB and LG copy pools.

You can develop a user process to manage and to dump these volumes to tape. The backup process will write over the oldest version in the copy pool backup storage group. If you want to retain a backup for a longer period of time without having to back that with additional versions and physical dasd you can manage that by dumping the associated copy pool backup storage group volumes to tape.

John Deere Environment – X96A



This slide pictorially depicts the John Deere test environment that was used in examples through out this presentation. The DB2 subsystem is known as X96A. Physical volumes and their associated datasets have been put into three separate SMS managed storage groups. The SMS managed storage groups are DB2X96, DB2X96L and DB2X96S. Two separate ICFCTLGs have been created. ICFCTLG DB2X96L for datasets in the DB2X96L SMS storage group and ICFCTLG DB2X96A for datasets in both the DB2X96S and DB2X96 SMS storage groups. Two new SMS constructs are identified. DSN\$X96A\$LG associated with SMS storage group DB2X96L and DSN\$X96A\$DB associated with SMS storage groups DB2X96S and DB2X96. DB2 will use these two new constructs to invoke FRS backup and restore. DB2X96CP is a new SMS Copy Pool Backup storage group that contains the target volumes that will be used for backing up the source volumes.

System PITR Step by Step

1. DFSMS Panels & Commands.
2. **BACKUP SYSTEM utility.**
DSNJU004 (Print Log Map).
3. Quiesce utility.
4. DSNJU003(Change Log Inventory).
DSNJU004 (Print Log Map).
5. DB2 restart and Catalog commands.
6. **RESTORE SYSTEM utility.**
7. Recover - Rebuild - Restart.
DSNJU004 (Print Log Map).

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This slide represents a step by step methodology for preparing and executing a system-level point-in-time recovery. The next sections of this presentation will go into more detail and provide sample output for the utilities listed above.

DFSMS Options

ISMF PRIMARY OPTION MENU - z/OS DFSMS V1 R5

Enter Selection or Command ==> P

Select one of the following options and press Enter:

- 0 ISMF Profile - Specify ISMF User Profile
- 1 Data Set - Perform Functions Against Data Sets
- 2 Volume - Perform Functions Against Volumes
- 3 Management Class - Specify Data Set Backup and Migration Criteria
- 4 Data Class - Specify Data Set Allocation Parameters
- 5 Storage Class - Specify Data Set Performance and Availability
- 6 Storage Group - Specify Volume Names and Free Space Thresholds
- 7 Automatic Class Selection - Specify ACS Routines and Test Criteria
- 8 Control Data Set - Specify System Names and Default Criteria
- 9 Aggregate Group - Specify Data Set Recovery Parameters
- 10 Library Management - Specify Library and Drive Configurations
- 11 Enhanced ACS Management - Perform Enhanced Test/Configuration Management
- C Data Collection - Process Data Collection Function
- L List - Perform Functions Against Saved ISMF Lists
- P Copy Pool - Specify Pool Storage Groups for Copies**
- R Removable Media Manager - Perform Functions Against Removable Media
- X Exit - Terminate ISMF

Use HELP Command for Help; Use END Command or X to Exit.

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Z/OS 1.5 DFSMS introduces the new Copy Pool construct. This is option 'P' on the ISMF Primary Options Menu.

DFSMS Database Copy Pool

COPY POOL APPLICATION SELECTION

Command ==>

To perform Copy Pool Operations, Specify:

CDS Name 'DXXV.D948.SMS.SCDS1'

(1 to 44 character data set name or 'Active')

Copy Pool Name **DSN\$X96A\$DB**

(For Copy Pool List, fully

or partially specified or * for all)

Select one of the following options :

- 3 1. List - Generate a list of Copy Pools
2. Display - Display a Copy Pool
3. Define - Define a Copy Pool
4. Alter - Alter a Copy Pool

If List Option is chosen,

Enter "/" to select option

Respecify View Criteria

Respecify Sort Criteria

Use ENTER to Perform Selection;

Use HELP Command for Help; Use END Command to Exit.

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The database copy pool name must be DSN\$locn-name\$DB.

This is the name of the copy pool that will be used to backup and restore the DB2 catalog, directory and user data.

DFSMS Database Copy Pool

```
                                COPY POOL DEFINE                                Page 1 of 3
Command ==>

SCDS Name . . . : DXXV.D948.SMS.SCDS1
Copy Pool Name : DSN$X96A$DB

To DEFINE Copy Pool, Specify:
  Description ==> COPYPOOL FOR X96 DATA AND SYSTEM VOLUMES
                ==>
  Number of Recoverable DASD Fast
  Replicate Backup Versions . . . . 1      (1 to 85 or blank)
  Storage Group Names: (specify 1 to 256 names)
  ==>   DB2X96   DB2X96S
  ==>
  ==>
  ==>
  ==>
  ==>
  ==>

Use ENTER to Perform Verification; Use DOWN Command to View next Panel;
Use HELP Command for Help; Use END Command to Save and Exit; CANCEL to Exit.
```

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'Versions' is the number of copies to keep on disk. You can specify up to 85 in DFSMS, but the DB2 BSDS limit is 50. You will also need the physical dasd volumes in the Copy Pool Backup storage group to back the number of versions specified in this panel.

In this panel you specify the names of the SMS storage groups which are used to manage the DB2 catalog, directory and user data.

DFSMS Log Copy Pool

```
COPY POOL APPLICATION SELECTION
Command ==>

To perform Copy Pool Operations, Specify:
CDS Name . . . . 'DXXV.D948.SMS.SCDS1'
                                     (1 to 44 character data set name or 'Active' )
Copy Pool Name  DSN$X96A$LG          (For Copy Pool List, fully
                                     or partially specified or * for all)

Select one of the following options :
3 1. List      - Generate a list of Copy Pools
   2. Display  - Display a Copy Pool
   3. Define   - Define a Copy Pool
   4. Alter   - Alter a Copy Pool

If List Option is chosen,
Enter "/" to select option      Respecify View Criteria
                                Respecify Sort Criteria

Use ENTER to Perform Selection;
Use HELP Command for Help; Use END Command to Exit.
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```



Log copy pool must be DSN\$locn-name\$LG

This is the name of the copy pool that will be used to backup the DB2 logs, BSDS and load libraries.

DFSMS Log Copy Pool

```
                                COPY POOL DEFINE                                Page 1 of 3
Command ==>

SCDS Name . . . : DXXV.D948.SMS.SCDS1
Copy Pool Name : DSN$X96A$LG

To DEFINE Copy Pool, Specify:
  Description ==> COPYPOOL FOR X96 LOG VOLUMES
                ==>
  Number of Recoverable DASD Fast
  Replicate Backup Versions . . . . 1      (1 to 85 or blank)
  Storage Group Names: (specify 1 to 256 names)
  ==>    DB2X96L
  ==>
  ==>
  ==>
  ==>
  ==>
```

Use ENTER to Perform Verification; Use DOWN Command to View next Panel;
Use HELP Command for Help; Use END Command to Save and Exit; CANCEL to Exit.

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'Versions' is the number of copies to keep on disk. You can specify up to 85 in DFSMS, but the DB2 BSDS limit is 50. You will also need the physical dasd volumes in the Copy Pool Backup storage group to back the number of versions specified in this panel.

In this panel you specify the name of the SMS storage group that is used to manage the DB2 logs, BSDS and system load libraries.

DFSMS Copy Pool List

COPY POOL LIST

Command ==>

Scroll ==> HALF

Entries 1-2 of 2

Data Columns 7-9 of 11

CDS Name : DXXV.D948.SMS.SCDS1

Enter Line Operators below:

LINE	OPERATOR	COPY POOL NAME	STORAGE GRP NAME	STORAGE GRP NAME	STORAGE GRP NAME	
---	(1)---	-----	(2)-----	--(7)---	--(8)---	--(9)---
		DSN\$X96A\$DB	DB2X96	DB2X96S	-----	
		DSN\$X96A\$LG	DB2X96L	-----	-----	
---	---	-----	-----	-----	-----	-----
					BOTTOM OF DATA	

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Copy Pool list of the newly defined data and log copy pools along with their associated SMS storage groups.

DFSMS Options

ISMF PRIMARY OPTION MENU - z/OS DFSMS V1 R5

Enter Selection or Command ==> 6

Select one of the following options and press Enter:

- 0 ISMF Profile - Specify ISMF User Profile
- 1 Data Set - Perform Functions Against Data Sets
- 2 Volume - Perform Functions Against Volumes
- 3 Management Class - Specify Data Set Backup and Migration Criteria
- 4 Data Class - Specify Data Set Allocation Parameters
- 5 Storage Class - Specify Data Set Performance and Availability
- 6 Storage Group - Specify Volume Names and Free Space Thresholds
- 7 Automatic Class Selection - Specify ACS Routines and Test Criteria
- 8 Control Data Set - Specify System Names and Default Criteria
- 9 Aggregate Group - Specify Data Set Recovery Parameters
- 10 Library Management - Specify Library and Drive Configurations
- 11 Enhanced ACS Management - Perform Enhanced Test/Configuration Management
- C Data Collection - Process Data Collection Function
- L List - Perform Functions Against Saved ISMF Lists
- P Copy Pool - Specify Pool Storage Groups for Copies
- R Removable Media Manager - Perform Functions Against Removable Media
- X Exit - Terminate ISMF

Use HELP Command for Help; Use END Command or X to Exit.

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Option 6 from the ISMF Primary Options Menu is used to define the Copy Pool Backup storage group.

DFSMS COPY POOL BACKUP

```
STORAGE GROUP APPLICATION SELECTION
Command ==>

To perform Storage Group Operations, Specify:
CDS Name . . . . . 'DXXV.D948.SMS.SCDS1'
                                     (1 to 44 character data set name or 'Active' )
Storage Group Name  DB2X96CP         (For Storage Group List, fully or
                                     partially specified or * for all)
Storage Group Type  COPY POOL BACKUP (VIO, POOL, DUMMY, COPY POOL BACKUP,
                                     OBJECT, OBJECT BACKUP, or TAPE)

Select one of the following options :
2 1. List      - Generate a list of Storage Groups
   2. Define   - Define a Storage Group
   3. Alter    - Alter a Storage Group
   4. Volume   - Display, Define, Alter or Delete Volume Information

If List Option is chosen,
Enter "/" to select option      Respecify View Criteria
                                Respecify Sort Criteria

Use ENTER to Perform Selection;
Use HELP Command for Help; Use END Command to Exit.
```



Additional panels for the 'DEFINE' of the Copy Pool Backup are not reflected in this presentation.

The copy pool backup storage group does not need to contain the DB2 location name. This name can be a generic name and can be used for more than one DB2 system.

DFSMS Storage Group

```
STORAGE GROUP APPLICATION SELECTION
Command ==>

To perform Storage Group Operations, Specify:
CDS Name . . . . . 'DXXV.D948.SMS.SCDS1'
                                     (1 to 44 character data set name or 'Active' )
Storage Group Name  DB2X96          (For Storage Group List, fully or
                                     partially specified or * for all)
Storage Group Type  (VIO, POOL, DUMMY, COPY POOL BACKUP,
                   OBJECT, OBJECT BACKUP, or TAPE)

Select one of the following options :
 3 1. List   - Generate a list of Storage Groups
   2. Define - Define a Storage Group
   3. Alter  - Alter a Storage Group
   4. Volume - Display, Define, Alter or Delete Volume Information

If List Option is chosen,
  Enter "/" to select option      Respecify View Criteria
                                   Respecify Sort Criteria

Use ENTER to Perform Selection;
Use HELP Command for Help; Use END Command to Exit.
```

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You will need to associate a copy pool backup storage group with each SMS storage group that manages the physical DB2 volumes. In our example this would need to be done for DB2X96, DB2X96L and DB2X96S.

DFSMS Storage Group

```
POOL STORAGE GROUP ALTER
Command ==>

SCDS Name . . . . . : DXXV.D948.SMS.SCD51
Storage Group Name  : DB2X96
To ALTER Storage Group, Specify:
Description ==> DB2X96 POOL OF SAP
==>
Auto Migrate . . . N (Y, N, I or P)  Migrate Sys/Sys Group Name . . CPU7
Auto Backup . . . N (Y or N)         Backup Sys/Sys Group Name . . CPU7
Auto Dump . . . . N (Y or N)         Dump Sys/Sys Group Name . . .
Overflow . . . . . N (Y or N)        Extend SG Name . . . . .
Copy Pool Backup SG Name . . . DB2X96CP
(1 to 8 characters)
Dump Class . . . .
Dump Class . . . .
Dump Class . . . .
Allocation/migration Threshold: High . . 90 (1-99)      Low . . 1 (0-99)
Guaranteed Backup Frequency . . . . . NOLIMIT (1 to 9999 or NOLIMIT)

ALTER SMS Storage Group Status . . . N (Y or N)
Use ENTER to Perform Verification and Selection;
Use HELP Command for Help; Use END Command to Save and Exit; CANCEL to Exit.
```

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The Storage Group Name is associated with one Copy Pool Backup SG Name.

DFSMS Storage Group List

```

                                STORAGE GROUP LIST
Command ==>                               Scroll ==> HALF
                                         Entries 1-4
                                         Data Columns
of 4
3-6 of 43
CDS Name : DXXV.D948.SMS.SCDS1

Enter Line Operators below:

LINE          STORGRP  SG          VIO
VIO          AUTO      NAME        TYPE        MAXSIZE  UNIT
OPERATOR     NAME
MIGRATE
--- (1) ----
(4) --          (5) -          -- (6) ----          ----- (3) -----
                                         -----
                                         DB2X96          POOL
                                         NO
                                         DB2X96CP       COPY POOL BACKUP -----
                                         DB2X96L       POOL
                                         NO
                                         DB2X96L       POOL
                                         NO
                                         DB2X96L       POOL
                                         NO

```

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This panel lists the SMS storage groups and type that will be used by the X96A system.

DFSMSHsm Commands

- FRBACKUP
 - FRBACKUP COPYPOOL(cpname) PREPARE
 - FRBACKUP COPYPOOL(cpname) EXECUTE TOKEN(token)
- FRRECOV
 - FRRECOV COPYPOOL(cpname) VERIFY(Y)
 - FRRECOV TOVOLUME(volser) FROMCOPYPOOL(cpname)
 - FRRECOV COPYPOOL(cpname) GEN(x) VERIFY(Y)
- FRDELETE

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This slide does not contain the entire syntax of the commands. It's intent is for presentation and discussion purposes only.

DB2 will initiate the FRBACKUP through the BACKUP SYSTEM utility and the FRRECOV through the RESTORE SYSTEM utility.

FRBACKUP COPYPOOL commands are processed serially, but volumes within the copy pool are processed in parallel. The FRBACKUP PREPARE is an optional command that can be used to validate the environment prior to the FRBACKUP EXECUTE.

FRRECOV COPYPOOL will restore all volumes of the copy pool.

FRRECOV with TOVOLUME can be used to restore a single volume.

FRRECOV with the GEN parameter can be used to restore the entire system; database and log copy pools. This would be useful in a D/R situation where you need to restore the entire system to the last backup.

FRDELETE is used for decreasing the number of versions of a copy pool, freeing up copy pool versions that are no longer needed, or when the copy pool is renamed.

DFSMSHsm Copy Pool Commands

- F HSM, QUERY COPYPOOL(cpname)
- Useful for determining status of the physical copy.

```
F HSM,QU CP(DSN$X96A$DB)
ARC1821I NONE OF THE VOLUMES IN COPY POOL
ARC1821I (CONT.) DSN$X96A$DB ARE IN AN ACTIVE
ARC1821I (CONT.) FLASHCOPY RELATIONSHIP
```

- F HSM,LIST CP(DSN\$X96A\$DB)
- Provides detailed information for each backup version of the copy pool.

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The HSM commands 'Query Copypool' and 'List Copypool' can be used to determine the status of the physical backup and volumes of the associated copypool.

OUTPUT from F HSM,LIST CP command:

COPYPOOL = DSN\$X96A\$DB

VERSION	VALID	VTOCENQ	DATE	TIME
003	Y	N	2004/02/16	13:51:25

TOKEN (C) =C'X96A.H....;.....'

TOKEN (H) =X'E7F9F6C1BAC8DD3A52135E63001DB1171090'

SGNAME	SOURCE	TARGET	SOURCE	TARGET
DB2X96	X96001	- CPB001	X96002	- CPB002..
DB2X96	X96005	- CPB005	X96006	- CPB006..
DB2X96	X96009	- CPB009	X96010	- CPB010..
DB2X96	X96013	- CPB013	X96014	- CPB014..
DB2X96S	X96S01	- CPB025	X96S02	- CPB026..

BACKUP SYSTEM Utility

- BACKUP SYSTEM FULL or
BACKUP SYSTEM DATA ONLY
- DB2 initiates the FRBACKUP command.
 - FRBACKUP COPYPOOL(DSN\$X96A\$DB) ...
 - FRBACKUP COPYPOOL(DSN\$X96A\$LG) ...
- SYSCTRL or SYSADM authority required.
- DB2 does not take any quiesce points.
- Backup is to the target volumes in the Copy Pool Backup storage group.



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BACKUP SYSTEM replaces the current DB2 Version 7 split-mirror volume dump methodology that uses the '-set log suspend' and '-set log resume'.

BACKUP SYSTEM DATA ONLY will backup the DSN\$X96A\$DB copy pool only. This is the pool that is used by RESTORE SYSTEM.

BACKUP SYSTEM FULL will backup the DSN\$X96A\$DB copy pool and the DSN\$X96A\$LG copy pool. The database copy pool is always backed up first, followed by the log copy pool. RESTORE SYSTEM can use this backup as well. This backup is also useful for D/R purposes and SAP system cloning.

BACKUP SYSTEM Utility

- DFSMSHsm updated with 'token' value.
- DB2 BSDS 'Backup History' is updated.
 - DB2 D/S submitting member's BSDS is updated.
 - DB2 keeps track of 50 backups in the BSDS.
- RBLP (Recovery Based Log Point) recorded in DBD01 Page 0.
 - Most recent system checkpoint prior to BACKUP SYSTEM.
 - Used for log apply during RESTORE SYSTEM.
 - DB2 Data Sharing recommend specifying system checkpoint in MINUTES.

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A successful BACKUP SYSTEM results in a token being established with DFSMSHsm to identify the backup, updates being made to the BSDS to record the backup within DB2 and the RBLP value being recorded in DBD01 Page 0.

The RBLP value will be used by the RESTORE SYSTEM utility during log apply phase. The RBLP is the most recent system checkpoint and will be used as the starting point for applying log records.

In a DB2 Data Sharing environment it is recommended that the system checkpoint frequency and type be specified as minutes instead of number of log records. This can be specified in the installation panel 'DSNTIPL' with the 'Checkpoint Freq' and 'Frequency Type' parameters. If one member of the data sharing group is not frequently updated (a read-only member or a stand-by failover member) this could result in the RBLP being an 'older' or more 'stale' value. Specifying the checkpoint frequency as minutes will help this.

BACKUP SYSTEM Sysout (1)

```
DSNU000I DSNUGUTC - OUTPUT START FOR UTILITY, UTILID =  
          X96A.BKUPSYS  
DSNU1044I DSNUGTIS - PROCESSING SYSIN AS EBCDIC  
DSNU050I DSNUGUTC - BACKUP SYSTEM FULL  
DSNU1600I DSNUVBBD - BACKUP SYSTEM UTILITY FOR DATA  
          STARTING,  
          COPYPOOL = DSN$X96A$DB  
          TOKEN = X'E7F9F6C1BAAF725F60A7E106001C3D582090'  
DSNU1614I DSNUVBBD - BACKUP SYSTEM UTILITY FOR DATA  
          COMPLETED SUCCESSFULLY,  
          COPYPOOL = DSN$X96A$DB  
          TOKEN = X'E7F9F6C1BAAF725F60A7E106001C3D582090'  
          ELAPSED TIME = 00:00:23.
```



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Sample sysout from BACKUP SYSTEM FULL.

JCL

```
//DSNUPROC EXEC DSNUPROC,REGION=0K,  
//   UTPROC=",UID='X96A.BKUPSYS',SYSTEM='X96A'  
//STEPLIB DD DSN=DB2X96.SSPGM,DISP=SHR  
//SYSPRINT DD SYSOUT=(,  
//UTPRINT DD SYSOUT=(,  
//SYSUDUMP DD SYSOUT=(,  
//SYSIN DD *  
  BACKUP SYSTEM FULL  
/*
```

BACKUP SYSTEM Sysout (2)

```
DSNU1600I DSNUVBBD - BACKUP SYSTEM UTILITY FOR LOGS
          STARTING,
          COPYPOOL = DSN$X96A$LG
          TOKEN = X'E7F9F6C1BAAF725F60A7E106001C3D582090'.
DSNU1614I DSNUVBBD - BACKUP SYSTEM UTILITY FOR LOGS
          COMPLETED SUCCESSFULLY,
          COPYPOOL = DSN$X96A$LG
          TOKEN = X'E7F9F6C1BAAF725F60A7E106001C3D582090'
          ELAPSED TIME = 00:00:09.
DSNU1602I DSNUVBBD - BACKUP SYSTEM UTILITY COMPLETED,
          ELAPSED TIME = 00:00:33.
DSNU010I DSNUGBAC - UTILITY EXECUTION COMPLETE, HIGHEST
          RETURN CODE=0
```

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Continuation of sample sysout from BACKUP SYSTEM FULL.

DSNJU004 Sysout – BSDS Backup History

```

BACKUP SYSTEM UTILITY HISTORY
      SUBSYSTEM ID X96A
      20:03:12 JANUARY 30, 2004
      START STCK          DATA COMPLETE  DATA/LOG
      DATA              LOG              RBLP          LRSN          DATE
-----
BAAF725F60A7E106  BAAF7275EF9EF603  001C3D582090  001C3D582090  2004/01/27
      TOKEN = E7F9F6C1BAAF725F60A7E106001C3D582090
BAA928EADE2A7E26  BAA92904E3FE8D66  001C3A22B090  001C3A22B090  2004/01/22
      TOKEN = E7F9F6C1BAA928EADE2A7E26001C3A22B090

COMPLETE
      LTIME      LOCATION NAME
-----
      08:40:47  X96A

      08:40:17  X96A
    
```

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Sample sysout from DSNJU004 which shows two system-level backups have been recorded in the X96A BSDS. The ending bytes of the token contain the RBLP.

In a Data Sharing environment the submitting data sharing member of the BACKUP SYSTEM will have the backup history recorded in that data sharing member's BSDS.

The BSDS 'Backup System Utility History' will record up to 50 entries.

JCL

```

//BSDSLIST EXEC PGM=DSNJU004,COND=(4,LT)
//STEPLIB DD DSN=DB2X96.SSPGM,DISP=SHR
//SYSUT1 DD DISP=SHR,DSN=DB2X96.BSDS01
//SYSPRINT DD SYSOUT=(,)
    
```

Quiesce Utility

- Use Quiesce utility to determine recovery points.
- Quiesce on a dummy object.
- RBA used for non-Data Sharing.
- LRSN used for Data Sharing.



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The Quiesce utility is a useful tool for establishing potential recovery times on the system. In our production SAP DB2 z/oS environment we run the Quiesce utility once every hour. The RBA or LRSN (Data Sharing environment) can be used from this Quiesce utility as the log point for the system-level point-in-time recovery.

Quiesce Sysout

```
DSNU000I DSNUGUTC - OUTPUT START FOR UTILITY, UTILID =  
          QUIESCE.DUMMY  
DSNU1044I DSNUGTIS - PROCESSING SYSIN AS EBCDIC  
DSNU050I DSNUGUTC - QUIESCE TABLESPACE DDXSAP01.GDXDUMMY  
          WRITE YES  
DSNU477I -X96A DSNUQUIA - QUIESCE SUCCESSFUL FOR TABLESPACE  
          DDXSAP01.GDXDUMMY  
DSNU474I -X96A DSNUQUIA - QUIESCE AT RBA 001C3E84250C AND AT  
          LRSN 001C3E84250C  
DSNU475I DSNUQUIB - QUIESCE UTILITY COMPLETE, ELAPSED TIME=  
          00:00:00  
DSNU010I DSNUGBAC - UTILITY EXECUTION COMPLETE, HIGHEST  
          RETURN CODE=0
```

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Sample sysout from Quiesce utility.

JCL

```
//X96QUIES EXEC  
PGM=DSNUTILB,PARM='X96A,QUIESCE.DUMMY',REGION=1024K  
//STEPLIB DD DSN=DB2X96.SSPGM,DISP=SHR  
//SYSPRINT DD SYSOUT=(,)  
//SYSUDUMP DD SYSOUT=(,)  
//SYSIN DD *  
          QUIESCE TABLESPACE DDXSAP01.GDXDUMMY WRITE YES
```

DSNJU003 Change Log Inventory

- Used to create the conditional restart control record.
- New option added for system point-in-time recovery.

CRESTART CREATE SYSPITR=log-point

- Non-Data Sharing log-point is RBA.
- Data Sharing log-point is LRSN.
- Each Data Sharing member must have SYSPITR created.
- System enters 'System Recover Pending Mode' on restart.
- Can only run 'RESTORE SYSTEM' utility.

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DSNJU003 with SYSPITR establishes a log truncation point in preparation for running the RESTORE SYSTEM utility.

Each data sharing member of a data sharing group must have a SYSPITR CRCR created with the same log truncation point (lrsn).

(Also see CRESTART CREATE SYSPITR with CHKPTRBA option at the end of this presentation.)

DSNJU003 Sysout

```
DSNJCNVB CONVERSION PROGRAM HAS RUN DDNAME=SYSUT1
DSNJCNVB CONVERSION PROGRAM HAS RUN DDNAME=SYSUT2
CRESTART CREATE,SYSPITR=001C3E84250C
DSNJ408I DSNRJFCK CHECKPOINT RBA FOUND, RBA = 001C3D5C7000,
TIME = 18:42:11 JANUARY 27, 2004
DSNJ411I DSNRJRCR CRESTART CREATE FOR CRCRID = 0004, DDNAME =
SYSUT1
DSNJ408I DSNRJFCK CHECKPOINT RBA FOUND, RBA = 001C3D5C7000,
TIME = 18:42:11 JANUARY 27, 2004
DSNJ411I DSNRJRCR CRESTART CREATE FOR CRCRID = 0004, DDNAME =
SYSUT2
DSNJ225I CRESTART OPERATION COMPLETED SUCCESSFULLY
DSNJ200I DSNJU003 CHANGE LOG INVENTORY UTILITY PROCESSING
COMPLETED SUCCESSFULLY
```

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Sample sysout of DSNJU003 Change Log Inventory utility.

JCL

```
//DSNJU03A EXEC PGM=DSNJU003,REGION=0M
//STEPLIB DD DISP=SHR,DSN=DB2X96.SSPGM
//SYSUT1 DD DISP=SHR,DSN=DB2X96.BSDS01
//SYSUT2 DD DISP=SHR,DSN=DB2X96.BSDS02
//SYSPRINT DD SYSOUT=(,)
//SYSABEND DD SYSOUT=(,)
//SYSIN DD *
CRESTART CREATE,SYSPITR=001C3E84250C
```

DSNJU004 Sysout (1) – CRCR

CONDITIONAL RESTART CONTROL RECORD

18:52:46 JANUARY 27, 2004

**** ACTIVE CRCR RECORD ****

CRCR IDENTIFIER 0004

USE COUNT 0

RECORD STATUS

CRCR ACTIVE

CRCR NOT USED

PROCESSING STATUS

FORWARD = YES

BACKOUT = YES

SYSPITR SYSTEM LEVEL RECOVERY MODE RESTART

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Sample sysout of DSNJU004 utility showing CRCR inserted from the previous DSNJU003 utility.

JCL

```
/BSDSLIST EXEC PGM=DSNJU004  
//STEPLIB DD DSN=DB2X96.SSPGM,DISP=SHR  
//SYSUT1 DD DISP=SHR,DSN=DB2X96.BSDS01  
//SYSPRINT DD SYSOUT=(,)
```

DSNJU004 Sysout (2) - CRCR

STARTRBA	NOT SPECIFIED	
ENDRBA	NOT SPECIFIED	
ENDLRSN	001C3E84250C	← SYSPITR
EARLIEST REQUESTED RBA	000000000000	
FIRST LOG RECORD RBA	000000000000	
ORIGINAL CHECKPOINT RBA	000000000000	
NEW CHECKPOINT RBA (CHKPTRBA)	001C3D5C7000	
END CHECKPOINT RBA	001C3D5C9770	
CRCR CREATED	18:52:45 JANUARY 27, 2004	
TIME OF CHECKPOINT	18:42:11 JANUARY 27, 2004	
RESTART PROGRESS	STARTED	ENDED
	=====	=====
CURRENT STATUS REBUILD	NO	NO
FORWARD RECOVERY PHASE	NO	NO
BACKOUT RECOVERY PHASE	NO	NO

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Continuation of sample sysout of DSNJU004.

DB2 Restart with Active CRCR

X96AMSTR 16 DSNJ245I -X96A CONDITIONAL RESTART RECORD
INDICATES TRUNCATION AT
X96AMSTR RBA 001C3E84250C. REPLY Y TO CONTINUE, N TO
CANCEL
X96AMSTR DSNR003I -X96A RESTART...PRIOR CHECKPOINT
RBA=001C3D5C7000
X96AMSTR DSNR050I -X96A DSNRRPRC DB2 STARTED IN
SYSTEM RECOVER PENDING MODE
X96AMSTR DSNR002I -X96A RESTART COMPLETED

(DDF will not be active and SPAS will not be started.)



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DB2 Started in Access Maint and System Recovery Pending Mode.

Can only run RESTORE SYSTEM utility at this point. Only access allowed is INSTALL SYSADM.

DB2 'DDF' will not be active and the DB2 'SPAS' address space will not be started as part of the DB2 system-level conditional restart.

Catalog Commands

F CATALOG,OPEN

```
CATALOG IEC348I ALLOCATED CATALOGS
CATALOG * FLAGS -VOLSER-USER-CATALOG NAME
CATALOG * YSI-R- X96S01 0001 ICFCTLG.DB2X96A
CATALOG * YSI-R- X96L01 0001 ICFCTLG.DB2X96L
CATALOG * YSI-R- SH9D25 0001 ICFCTLG.IMS90
CATALOG * YSI-R- T90P04 0001 ICFCTLG.IPCS
```

F CATALOG,UNALLOCATE(ICFCTLG.DB2X96A)



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The DB2 RESTORE SYSTEM utility will restore the database cypool. If the ICFCTLG associated with the database copy pool is open then the volume restore will fail for that disk. Use the commands indicated above to determine if the catalog is open and if so, then close the catalog prior to running the RESTORE SYSTEM utility.

RESTORE SYSTEM Utility

- RESTORE SYSTEM or
RESTORE SYSTEM LOGONLY
- Recovers the DB2 system to a specified point-in-time.
- DB2 initiates the FRRECOV command.
 - FRRECOV COPYPOOL(DSN\$X96A\$DB) ...
 - DSN\$X96A\$LG, log copy pool, is not restored
- INSTALL SYSADM authority required.
- Handles ‘create’, ‘drop’ and ‘log no’ events.



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RESTORE SYSTEM is used to recover the DB2 system or data sharing members to a specified point-in-time. If you want to restore the system to the last backup without applying the DB2 logs you can use the hsm command to restore the copy pools. This could be used for a disaster recovery situation.

```
FRRECOV COPYPOOL(cpname) GEN(x) Verify(Y)
```

RESTORE SYSTEM will restore the DSN\$locn-name\$DB copy pool by initiating the FRRECOV command. The log copy pool is not restored as part of the RESTORE SYSTEM utility. RESTORE SYSTEM LOGONLY will not initiate the FRRECOV and will assume that the volumes have been previously restored.

RESTORE SYSTEM Utility

- Applies logs from RBLP to SYSPITR value of CRCR.
- DB2 D/S members active since last backup must be started.
- Objects not recovered from 'log no' events:
 - LOAD LOG NO, REORG, CREATE INDEX
 - RECP for databases & 'Copy Yes' Indexes
 - RBDP for 'Copy No' indexes
- Objects placed on LPL for extend errors during log apply process.
- If there are objects in RECP, RBDP or LPL the utility will complete with Return Code = 4.

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The log apply process will apply log records from the RBLP value up to the SYSPITR specified in the CRCR (Conditional Restart Control Record) from the DSNJU003 utility run.

Objects that RESTORE SYSTEM is not able to recover will need to be recovered or rebuilt outside of this utility.

RESTORE SYSTEM Sysout (1)

```
DSNU000I DSNUGUTC - OUTPUT START FOR UTILITY, UTILID =  
X96A.SRESTORE  
DSNU1044I DSNUGTIS - PROCESSING SYSIN AS EBCDIC  
DSNU050I DSNUGUTC - RESTORE SYSTEM  
DSNU1606I DSNUVBRD - RESTORE SYSTEM UTILITY STARTING,  
COPYPOOL = DSN$X96A$DB  
TOKEN =  
X'E7F9F6C1BAAF725F60A7E106001C3D582090'.  
DSNU1627I DSNUVBRD - RESTORE SYSTEM PRE-LOG APPLY  
COMPLETED SUCCESSFULLY,  
COPYPOOL = DSN$X96A$DB  
TOKEN = X'E7F9F6C1BAAF725F60A7E106001C3D582090'  
ELAPSED TIME = 00:00:15.
```

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Sample sysout of the RESTORE SYSTEM utility.

JCL

```
//DSNUPROC EXEC DSNUPROC,REGION=0K,TIME=1440,  
//  UTPROC='',UID='X96A.SRESTORE',SYSTEM='X96A'  
//STEPLIB DD DSN=DB2X96.SSPGM,DISP=SHR  
//SYSPRINT DD SYSOUT=(,)  
//UTPRINT DD SYSOUT=(,)  
//SYSUDUMP DD SYSOUT=(,)  
//SYSIN DD *  
RESTORE SYSTEM  
/*
```


RESTORE SYSTEM Sysout (2)

DSNU1604I -X96A DSNUVARL - RESTORE SYSTEM PHASE LOG
APPLY STARTED AT LOG POINT = X'001C3D582090'

DSNU1629I -X96A DSNUVARL - DB2 PUT ONE OR MORE OBJECTS
INTO THE RECOVER-PENDING STATE, THE REBUILD-PENDING
STATE OR THE LOGICAL PAGE LIST DURING THE LOG APPLY
PHASE.

DSNU1628I DSNUVBRD - RESTORE SYSTEM PHASE LOG APPLY
COMPLETED, ELAPSED TIME = 00:01:42.

DSNU010I DSNUGBAC - UTILITY EXECUTION COMPLETE,
HIGHEST RETURN CODE=4



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Continuation of sample sysout of RESTORE SYSTEM utility.

Consider putting a '-dis database restrict' step in your jobstream. This will list the objects that DB2 was not able to recover as part of the RESTORE SYSTEM utility.

JCL

```
//X96DISDB EXEC PGM=IKJEFT01,DYNAMNBR=50,COND=(4,LT)
//STEPLIB DD DSN=DB2X96.SSPGM,DISP=SHR
//SYSTSPRT DD SYSOUT=(,)
//SYSPRINT DD SYSOUT=(,)
//SYSTSIN DD *
DSN SYSTEM(X96A)
-DIS DB(*) SP(*) RESTRICT LIMIT(*)
```

RECOVER – REBUILD - RESTART

- -DIS Util(*) and terminate any active utilities.
- -DIS DB(*) SP(*) LIMIT(*) RESTRICT
 - Consider adding this as the last step of the RECOVER SYSTEM job.
- RECOVER or REBUILD objects in RECP, RBDP or LPL.
- RESTART DB2 (including all data sharing members).



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After the RESTORE SYSTEM utility has been executed the DB2 system and DB2 data sharing members will need to be restarted. This will remove the System Access(Maint). In addition any active utilities need to be terminated and objects recovered or rebuilt that were placed in RECP, RBDP or LPL status.

DSNJU004 Sysout (1) - CRCR

CONDITIONAL RESTART CONTROL RECORD
20:10:18 JANUARY 27, 2004
ACTIVE CRCR RECORD ****
NO CRCR RECORDS ARE ACTIVE
CRCR IDENTIFIER 0004
USE COUNT 1
RECORD STATUS
CRCR NOT ACTIVE
SUCCESSFUL RESTART
PROCESSING STATUS
FORWARD = YES
BACKOUT = YES

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Sample sysout of DSNJU004 showing CRCR after system-level point-in-time recovery.

DSNJU004 Sysout (2) - CRCR

SYSPTR SYSTEM LEVEL RECOVERY MODE RESTART	
STARTRBA	NOT SPECIFIED
ENDRBA	NOT SPECIFIED
ENDLRSN	001C3E84250C
TRUNCATION RBA (FROM ENDLRSN)	001C3E842540
EARLIEST REQUESTED RBA	000000000000
FIRST LOG RECORD RBA	000000000000
ORIGINAL CHECKPOINT RBA	001C3E8475C3
NEW CHECKPOINT RBA (CHKPTRBA)	001C3D5C7000
END CHECKPOINT RBA	001C3D5C9770

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Continuation of DSNJU004 sample sysout.

DSNJU004 Sysout (3) - CRCR

CRCR CREATED	18:52:45	JANUARY 27, 2004	
BEGIN RESTART	19:19:09	JANUARY 27, 2004	
END RESTART	19:19:33	JANUARY 27, 2004	
TIME OF CHECKPOINT	18:42:11	JANUARY 27, 2004	
RESTART PROGRESS		STARTED	ENDED
		=====	=====
CURRENT STATUS REBUILD		YES	YES
FORWARD RECOVERY PHASE		YES	YES
BACKOUT RECOVERY PHASE		YES	YES



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Continuation of DSNJU004 sample sysout.

John Deere's DB2 V8 ESP Experience

- DB2 V8 ESP code received July 2003.
- System PITR testing began August 2003.
- Z/OS 1.5 ESP code installed October 2003.
- Testing Environment
 - SAP 4.6 w/ DB2 Data Sharing on EMC dasd (150 Gb).
 - SAP 4.7 non-Data Sharing on IBM ESS dasd (60Gb).
 - SAP 4.7 w/ DB2 Data Sharing on IBM ESS dasd.
- Test Scenarios
 - Z/OS 1.3 - RESTORE SYSTEM LOGONLY with IBM ESS and EMC dasd.
 - Z/OS 1.5 – RESTORE SYSTEM LOGONLY with EMC dasd.
 - Z/OS 1.5 – BACKUP SYSTEM and RESTORE SYSTEM with IBM ESS dasd.

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John Deere Experience – Restart Checkpoint Not Found.

- DB2 records 100 system checkpoints in BSDS.
- If your log-point for SYSPITR is outside of this range, DSNJU003 will fail:
 - DSNJ407E DSNRJFCK NO VALID CHECKPOINT RBA FOUND
- Must manually get a valid system checkpoint RBA using DSN1LOGP (Log Print) for each DB2 system including all data sharing members.
- DSNJU003 Syntax:

```
CRESTART CREATE SYSPITR=log-point,      (RBA, LRSN if D/S)  
                                CHKPTRBA=system-chkpt (RBA of each D/S member)
```

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DB2 records 100 system checkpoints in BSDS.

If your log-point for SYSPITR is outside of this range, DSNJU003 will fail:

```
DSNJ407E DSNRJFCK NO VALID CHECKPOINT RBA FOUND
```

```
DSNJ411I DSNRJRCR CRESTART CREATE FOR CRCRID=0004, DDNAM =  
SYSUT1
```

```
DSNJ221I PREVIOUS ERROR CAUSED CRESTART OPERATION TO BE  
BYPASSED
```

```
DSNJ201I DSNJU003 CHANGE LOG INVENTORY UTILITY PROCESSING WAS  
UNSUCCESSFUL
```

Must manually get a valid system checkpoint RBA using DSN1LOGP (Log Print) for each DB2 system including all data sharing members.

Run DSNJU003 with following syntax:

```
CRESTART CREATE, SYSPITR=log-point,CHKPTRBA=system-chkpt
```

Where log-point is the RBA for non-Data Sharing and LRSN for Data Sharing and system-chkpt is the RBA value for each DB2 system or Data Sharing member of the system checkpoint log record. (In the DB2 Data Sharing environment the Lrsn value for SYSPITR will be the same but the RBA value for CHKPTRBA will be different for each member.)

What's Next for System PITR?

- IBM's indicated direction but no stated time frame:
 - DFSMSHsm automatically manage FlashCopy target volumes to tape.
 - Use volume level backups as source for DB2 object level recovery.
 - Manage multiple data Copy Pools.



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What's Next for System PITR?

- John Deere's wish list (no implied commitment by IBM):
 - Ability to provide date and timestamp in addition to RBA or LRSN for RESTORE SYSTEM utility.
 - Enhanced output to RESTORE SYSTEM.
 - Date and time system recovered to.
 - DB2 logs used during log apply process.
 - List db objects that were restored.
 - Identify by name objects in RECP, RBDP, LPL.
 - DSNJU003 utility update CRCR with proper system checkpoint when SYSPITR specified is out of the range.



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Additional Resources

- IBM RedBook:
‘DB2 for z/OS V8: Through the Looking Glass and What SAP Found There’ (SG24-7088)
Chapter 7 – System Point-in-Time Backup and Recovery
- Jim Teng’s Presentation:
G13: DB2 Managed Backup/Recovery using ESS Flashcopy
Thursday, May 13, 2004 at 10:00am



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Summary

- Why do I need system level point-in-time recovery?
- Hardware and Software Requirements
- New BACKUP SYSTEM and RESTORE SYSTEM utilities
- John Deere's Experience with DB2 V8 ESP.
- Future enhancements for system-level point-in-time recovery with BACKUP SYSTEM and RESTORE SYSTEM utilities.



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DB2 V8 System Point-In-Time Recovery

Session I8

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Please fill out your session evaluation.

Thank you for attending.



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Bryan Paulsen is a 25-year IT employee of John Deere. Currently Bryan is a technical consultant at John Deere specializing in DB2 z/OS for the DB2 Classic and DB2 SAP environments. His most recent project has been system-level point-in-time recovery for the DB2 z/OS V8 ESP at John Deere. Bryan's past experiences at John Deere include DB2 systems programming, project manager for migrating SAP/R3 to DB2 z/OS and division manager for SAP Basis. Bryan is an IBM Certified Database Administrator for DB2 Universal Database V8.1 for z/OS. Bryan received the Best User Speaker award for IDUG 2004 North America.