IMS

THE WORLD DEPENDS ON IT

What's New in IMS Database Recovery:

Disaster, Time Stamp, & Coordinated

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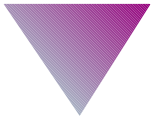
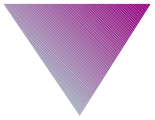


Topics

- Disaster recovery scenarios
- Time stamp recovery
- DB2 coordinated recovery
- A solution

Disaster Recovery Scenarios

- Static recovery point
- Incremental recovery point
- Continuous recovery point
- For all three:
  - Backup methodology
  - Disaster recovery methodology
  - Advantages
  - Disadvantages



Static Recovery Point

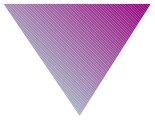
- **Backup methodology**
  - **Quiesce database activity**
  - **Image copy databases**
  - **Backup RECON**
  - **Ship image copies and RECON backups off-site**
- **Disaster recovery methodology**
  - **Restore RECON**
  - **Minor to moderate RECON cleanup operations**
  - **Recover databases**

Static Recovery Point ...

- **Advantages**
  - **Simplicity**
  - **Low cost**
  - **Works with data sharing**
  - **Can coordinate with DB2 if DB2 activity quiesced when IMS activity quiesced**
- **Disadvantages**
  - **Requires data outage**
  - **Maximum data loss**
  - **Minor to moderate RECON cleanup operations required**

Incremental Recovery Point

- **Backup methodology**
  - **Archived logs (SLDSs) shipped off-site periodically**
  - **RECON backups shipped off-site periodically**
  - **Image copies shipped off-site**
- **Disaster recovery methodology**
  - **Restore RECON**
  - **Major RECON cleanup operations**
  - **Recover databases**
  - **Identify in-flight UORs**
  - **Perform necessary backout operations**

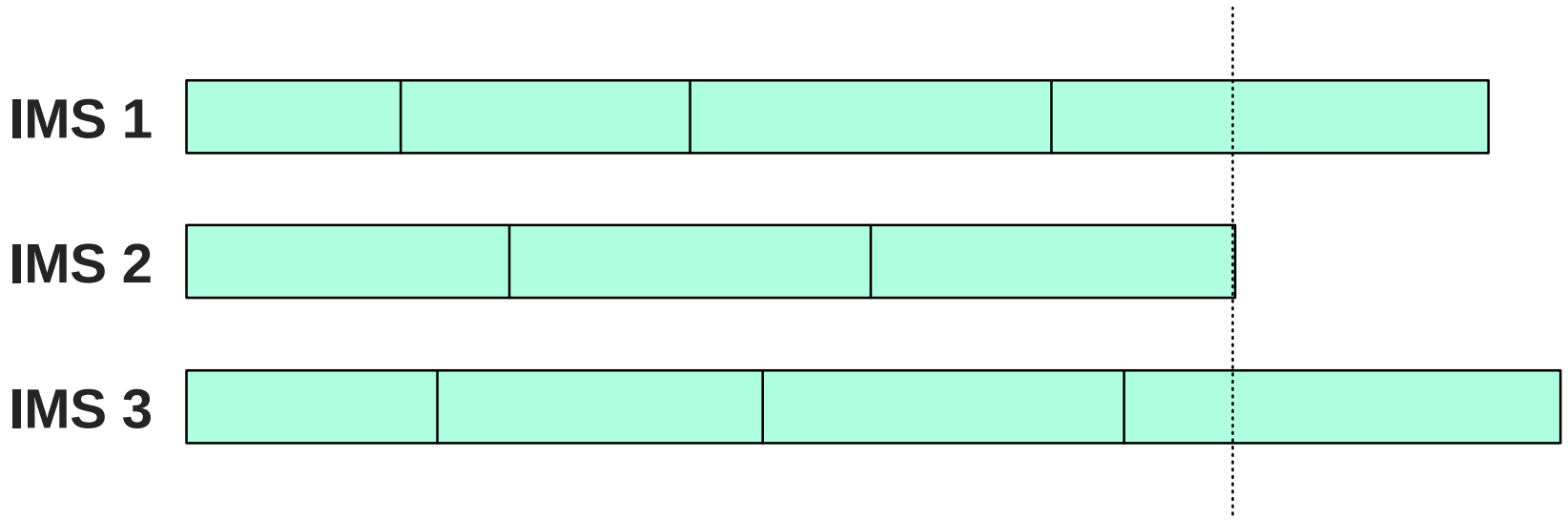


Incremental Recovery Point ...

- **Advantages**
  - **Low cost**
  - **No data outage**
- **Disadvantages**
  - **Medium data loss**
  - **Moderate to major complexity**
    - **Major RECON cleanup operations**
    - **Identify required backout operations**
  - **Difficult to coordinate with DB2**
  - **Won't work with IMS data sharing**

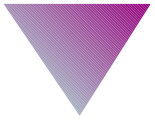
IMS Data Sharing Implications

- Data sharing implies multiple log data streams
  - Log data streams do not have a common end point
- Log data streams need to be trimmed to a common point
  - No IMS utility available to trim logs



Continuous Recovery Point (RSR, etc.)

- **Backup methodology**
  - **Log data transmitted off-site when written to OLDS**
  - **RECON updates transmitted off-site**
  - **Image copies shipped off-site**
- **Disaster recovery methodology**
  - **Perform RSR take over**
  - **Recover databases if not shadowed**
  - **Perform necessary backout operations by**
    - **/ERE of online systems**
    - **Batch Backout utility**



Continuous Recovery Point ...

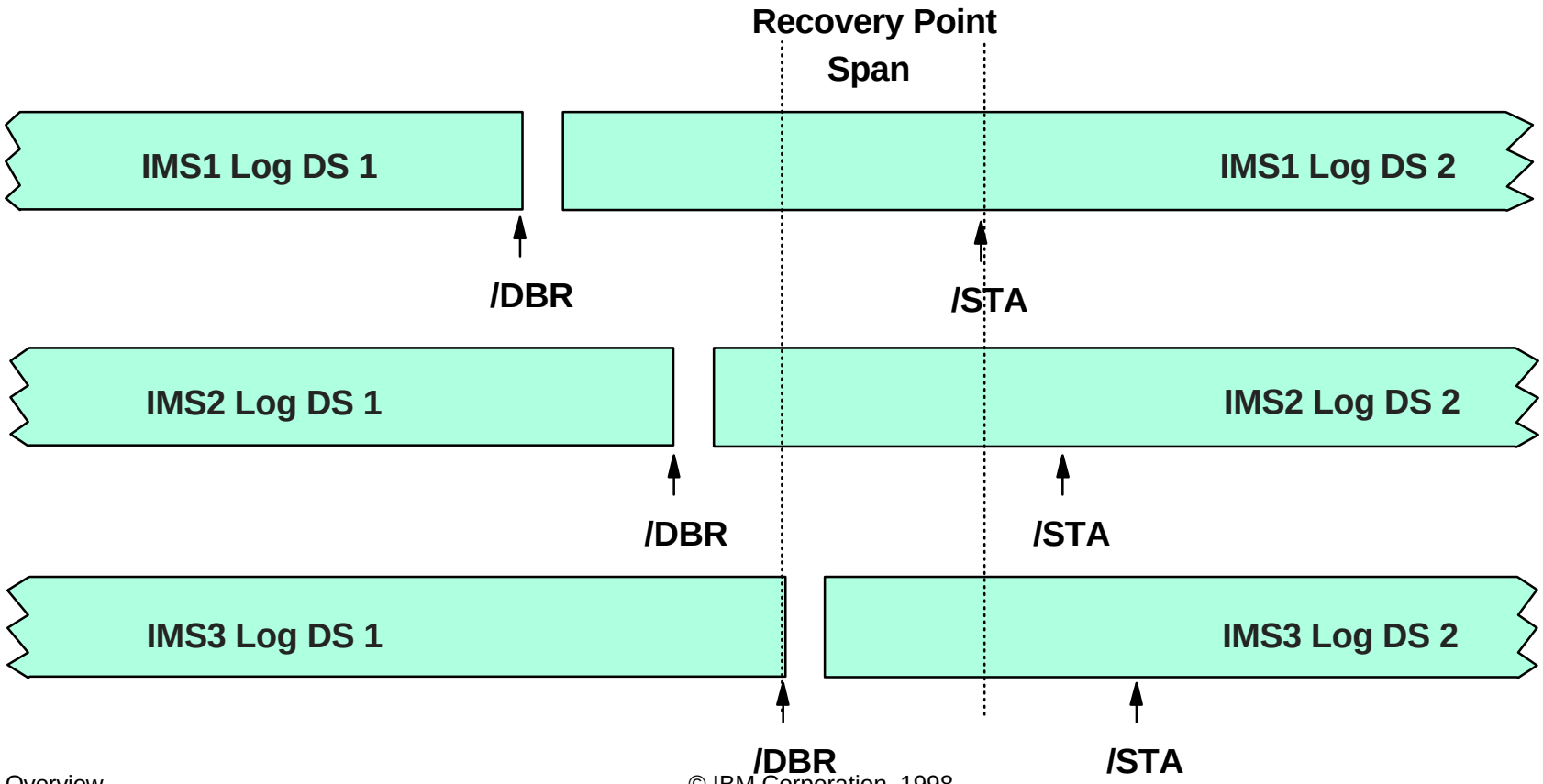
- **Advantages**
  - **Minimal data loss**
  - **No RECON cleanup operations**
  - **IMS data sharing supported**
- **Disadvantages $$$**
  - **Transmission bandwidth costs**
  - **Off-site processor costs**
  - **Off-site DASD costs if database shadowing**

Time Stamp Recovery

- Recovery of a database to an earlier state
  - At 4:00 PM, recover the database to the state it was in at 2:00 PM
  - Typically used to recover from application defects
- Should be avoided, especially in online environments
- Requires prior existence of a recovery point
  - Database update activity quiesced from all systems
  - Data outage
- Creation of recovery point requires coordinated actions on all data sharing systems

Recovery Point Creation (Data Sharing)

- /DBD or /DBR database and force OLDS switch on all sharing systems
- /STA database on all systems



Time Stamp Recovery Points

- **Two main problems**
  - **Creation of a recovery point results in a temporary data outage**
  - **Recovery point has to exist prior to the need for a recovery point**
- **Result: You rarely have one when you need it!**

IMS - DB2 Coordinated Recovery

- If IMS UORs update both IMS databases and DB2 tables, recoveries must be performed to the same state
  - Disaster recovery
  - Time stamp recovery
- IMS and DB2 produce independent log data streams
  - No utility to trim logs to a consistent state
  - Coordinated recoveries difficult, if not impossible, without quiescing both IMS and DB2 activity

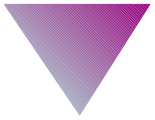
A Solution

- Reality imposes a number of constraints in
  - Incremental recovery point disaster recovery
  - Time stamp recovery
  - Coordinated IMS - DB2 recovery
- Solution:

Change reality!

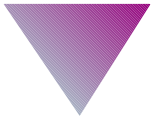
IMS/ESA Recovery Saver for MVS/ESA

- **IMS Recovery Saver changes reality by conditioning a set of IMS logs and a copy of the RECON to allow IMS databases to be recovered to any time stamp**
  - **Trims IMS log data streams to a common time stamp**
    - **DB consistency with IMS/ESA Version 5 logs**
    - **DB/DC consistency with IMS/ESA Version 6 logs**
  - **Updates the RECON to indicate that all IMS activity ceased at the common time stamp**
- **Allows incremental recovery point disaster recovery methodology to work in a data sharing environment**
- **Allows time stamp recovery to any time stamp**
- **Assists in coordinated IMS - DB2 recovery**



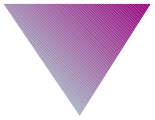
IMS RS Overview

- Analyzes control statement input
- Determines what has to be done based on RECON content
- Analyzes input log data sets
- Revalidates log truncation time based on log contents
- Creates truncated output log data sets
- Determines in-flight and in-doubt units of recovery
- Performs all required RECON maintenance operations



Process - Disaster Recovery

- Restore RECON backup
  - New production RECON
- Execute IMS RS
- Perform full recoveries on databases
  - Using database recovery tools of choice
- Perform backout operations
  - Identified by IMS RS
- Backup databases
- Back in business!



Process - Time Stamp Recovery

- Create backup copy of production RECON
- Execute IMS RS using backup RECON
- Perform full recoveries on databases using backup RECON
  - Using database recovery tools of choice
- Perform backout operations using backup RECON
  - Identified by IMS RS
- Inform production RECON that recovery operations have been performed and backup the databases
- Back in business!

Process - IMS - DB2 Coordinated Recovery

- Recover DB2 tables to any known time stamp allowed by DB2
- Use IMS RS to recover the IMS databases to the same time stamp

Executing IMS RS

- Runs as a standard MVS job
  - No CSA usage
  - Minimal private area usage below 16M line
- All log data sets and work files dynamically allocated
- Log data streams processed in parallel (MVS tasks)

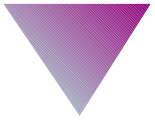
```
//SAMPLE   JOB  ...
//STEP     EXEC  PGM=IDPMAIN
//STEPLIB  DD    DSN=KEENE.IMSRS.RESLIB,DISP=SHR
//SYSPRINT DD    SYSOUT=*
//SYSUDUMP DD    SYSOUT=*
//RECON    DD    DSN=KEENE.RECON1,DISP=OLD
//DEFAULTS DD    DSN=KEENE.IMSRS.DEFAULTS,DISP=SHR
//SYSIN    DD    *
```

Control Statements

- GMTOFFSET
- LINECNT
- CUTOFF
- CATIN | NOCATIN, INUNIT
- PRIIN | SECIN
- CATOUT | NOCATOUT
- OUTUNIT, OUTSPACE, OUTHLQ
- BATCHTOL
- DELSSYS | NODELSSYS
- WRKUNIT, WRKSPACE, WRKHLQ
- DEFREL
- SUBSYS
- VERIFYONLY | NOVERIFYONLY
- MARKIC | NOMARKIC
- DELOLDS | NODELOLDS
- MARKLOGS | NOMARKLOGS
- ABEND | NOABEND

Sample Output

```
01/12/1998                  IMS/ESA RECOVERY SAVER FOR MVS/ESA                  Page 001

 12:17:11 IDP0001I PROCESSING CONTROL STATEMENTS FROM FILE DEFAULTS

           DEFREL 5.1
           ABEND
           WRKSPACE 200
           WRKHLQ KEENE.IMSRS
           OUTUNIT TAPE
           OUTHLQ KEENE.OUTLOG

 12:17:11 IDP0001I PROCESSING CONTROL STATEMENTS FROM FILE SYSIN

           ABEND
```

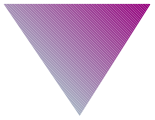


Sample Output ...

```
12:17:11 IDP0002I THE FOLLOWING OPTIONS ARE IN EFFECT:

                  GMTOFFSET -05:00
                  LINECNT 60
                  CUTOFF ** NONE **
                  CATIN
                  SECIN
                  CATOUT
                  INUNIT  **NONE **
                  OUTUNIT TAPE
                  OUTSPACE ** NONE **
                  OUTHLQ KEENE.OUTLOG
                  WRKUNIT SYSDA
                  WRKSPACE 200
                  WRKHLQ KEENE.IMSRS
                  DEFREL 5.1
                  NOVERIFYONLY
                  MARKIC
                  DELSSYS
                  DELOLDS
                  MARKLOGS
                  BATCHTOL 24
                  ABEND
```

Sample Output ...

```
12:17:11 IDP0003I SCANNING RECON FOR OPEN BATCH LOGS, ARCHIVING GAPS, AND BATCH
                  BACKOUT LOGS

12:17:11 IDP0004I BUILDING LOG STREAM CONTROL BLOCKS

12:17:11 IDP0005I CUTOFF TIME ADJUSTED TO 1998.012 09:33:41.800000 GMT BASED ON
                  RECON CONTENT

12:17:11 IDP0006I THE FOLLOWING LOG DATA SETS WILL BE INITIALLY SELECTED BASED ON
                  RECON CONTENT:

      SSID = IMS1      SS START = 1998.010 14:19:40.900000 GMT
      DS START = 1998.012 09:30:46.800000 GMT  DS END = 1998.012 09:34:47.500000 GMT
      UNIT TYPE = 3390      FILE SEQUENCE NUMBER = 0001  DATA SET TYPE = SECSLDS
      DSN = KEENE.DBDC51.IMS1.D98012.T0930468
      VOLSERS = T00001

      SSID = IMS2      SS START = 1998.010 14:19:44.400000 GMT
      DS START = 1998.012 09:30:06.200000 GMT  DS END = 1998.012 09:33:41.800000 GMT
      UNIT TYPE = 3390      FILE SEQUENCE NUMBER = 0001  DATA SET TYPE = SECSLDS
      DSN = KEENE.DBDC51.IMS2.D98012.T0930062
      VOLSERS = T00002
```



Sample Output ...

```
12:17:11 IDP0007I ALLOCATING WORK FILES

12:17:11 IDP0008I WORK FILE WITH DD NAME = WORK001 ALLOCATED FOR SUBSYSTEM IMS1
                  DSN = KEENE.IMSRS.IDPWORK.IMS1
12:17:11 IDP0008I WORK FILE WITH DD NAME = WORK002 ALLOCATED FOR SUBSYSTEM IMS2
                  DSN = KEENE.IMSRS.IDPWORK.IMS2

12:17:11 IDP0009I PROCESSING INPUT LOGS FOR SUBSYSTEM IMS1
12:17:11 IDP0009I PROCESSING INPUT LOGS FOR SUBSYSTEM IMS2
12:17:12 IDP0050I IMS1     ALLOCATED DSN KEENE.DBDC51.IMS1.D98012.T0930468
12:17:12 IDP0050I IMS2     ALLOCATED DSN KEENE.DBDC51.IMS2.D98012.T0930062
12:17:12 IDP0051I IMS2     DEALLOCATED DSN KEENE.DBDC51.IMS2.D98012.T0930062
12:17:12 IDP0051I IMS1     DEALLOCATED DSN KEENE.DBDC51.IMS1.D98012.T0930468
```

Sample Output ...

```
12:17:12 IDP0010I CUTOFF TIME ADJUSTED TO 1998.012 09:33:41.800000 GMT BASED ON LOG
         CONTENT

12:17:12 IDP0011I THE FOLLOWING LOG DATA SETS WILL BE PROCESSED BASED ON LOG
         CONTENT:

      SSID = IMS1      SS START = 1998.010 14:19:40.900000 GMT
      DS START = 1998.012 09:30:46.800000 GMT  DS END = 1998.012 09:34:47.500000 GMT
      UNIT TYPE = 3390      FILE SEQUENCE NUMBER = 0001  DATA SET TYPE = SECSLDS
      DSN = KEENE.DBDC51.IMS1.D98012.T0930468
      VOLSERS = T00001

      SSID = IMS2      SS START = 1998.010 14:19:44.400000 GMT
      DS START = 1998.012 09:30:06.200000 GMT  DS END = 1998.012 09:33:41.800000 GMT
      UNIT TYPE = 3390      FILE SEQUENCE NUMBER = 0001  DATA SET TYPE = SECSLDS
      DSN = KEENE.DBDC51.IMS2.D98012.T0930062
      VOLSERS = T00002
```

Sample Output ...

```
12:17:12 IDP0012I CREATING OUTPUT LOG FOR SUBSYSTEM IMS1
12:17:12 IDP0012I CREATING OUTPUT LOG FOR SUBSYSTEM IMS2
12:17:13 IDP0050I IMS1     ALLOCATED DSN = KEENE.OUTLOG.IMS1.D1998012.T0930468
12:17:13 IDP0050I IMS2     ALLOCATED DSN = KEENE.OUTLOG.IMS2.D1998012.T0930062
12:17:13 IDP0051I IMS2     DEALLOCATED DSN = KEENE.OUTLOG.IMS2.D1998012.T0930062
12:17:14 IDP0051I IMS1     DEALLOCATED DSN = KEENE.OUTLOG.IMS1.D1998012.T0930468

12:17:14 IDP0013I THE FOLLOWING OUTPUT LOG DATA SETS HAVE BEEN CREATED:

      SSID = IMS1      SS START = 1998.010 14:19:40.900000 GMT
      DS START = 1998.012 09:30:46.800000 GMT  DS END = 1998.012 09:33:41.800000 GMT
      ALLOCATED UNIT TYPE = SYSDA     DBRC UNIT TYPE = 3390
      DSN = KEENE.OUTLOG.IMS1.D1998012.T0930468
      VOLSERS = T00011

      SSID = IMS2      SS START = 1998.010 14:19:44.400000 GMT
      DS START = 1998.012 09:30:06.200000 GMT  DS END = 1998.012 09:33:41.800000 GMT
      ALLOCATED UNIT TYPE = SYSDA     DBRC UNIT TYPE = 3390
      DSN = KEENE.OUTLOG.IMS2.D1998012.T0930062
      VOLSERS = T00012
```

Sample Output ...

```
12:17:14 IDP0014I THE FOLLOWING PSBS REQUIRE BACKOUTS FOR IMS1

                  PSB = PROG02A  UOR TOKEN = C9D4E2F140404040000002D100000000
                  STATUS = INFLIGHT
                  DBD = CUSTOMRA

12:17:14 IDP0014I THE FOLLOWING PSBS REQUIRE BACKOUTS FOR IMS2

                  NO BACKOUTS REQUIRED

12:17:14 IDP0065I WORK FILE WITH DD NAME = WORK001 DEALLOCATED
12:17:14 IDP0065I WORK FILE WITH DD NAME = WORK002 DEALLOCATED

12:17:14 IDP0015I RECON CLEANUP OPERATIONS IN PROGRESS

12:17:15 IDP0016I PROGRAM COMPLETED NORMALLY
```

IMS RS Miscellaneous

- Announcement date: 03/17/98
- Availability date: 03/27/98
- Product number: 5655-A68
- Supports
  - IMS/ESA Version 5 and Version 6 RECONs
  - Mixture of IMS/ESA Version 5 and Version 6 logs
- Provides RECON backup/restore utility that can process RECON data sets with records greater than 32,760 bytes in length

IMS RS Benefits

- Improved IMS data availability by eliminating need to establish IMS recovery points for disaster recovery or potential time stamp recovery purposes
- Ability to recover IMS databases to any time without requiring the existence of a recovery point
- Reduction in disaster recovery service restoration times by automatically performing all necessary RECON maintenance operations
- Ability to continue to use the incremental recovery point disaster recovery methodology with data sharing

IMS RS Benefits ...

- **Ability to perform coordinated disaster recovery between IMS databases and DB2 objects without requiring that both IMS and DB2 be quiesced**
- **Ability to backup RECON data sets that contain records greater than 32,760 bytes in size in a single step**
- **Reductions in planned outages by providing complete support for RECON data sets with records greater than 32,760 bytes in size**