

IMS Disaster Recovery

Part 1 – Understanding the Issues

February 5, 2008

Author

Bill Keene has almost four decades of IMS experience and is recognized world wide as an expert in IMS recovery and availability. Prior to retiring from IBM, Bill was the technical leader of the IMS unit within the Dallas Systems Center, part of IBM's Advanced Technical Support organization. In that capacity, Bill presented at numerous IBM and user technical conferences and was the technical focal point within IBM's marketing division for product introduction programs dealing with XRF, RRDF, and RSR, all IMS functions dealing with local system or disaster recovery.

Bill retired from IBM in 1998 and is currently utilizing his IMS database recovery knowledge and expertise as the product architect of iRecover and iChange, the primary components in the IMS database recovery solutions provided by NEON Enterprise



Agenda

Disaster Recovery Basics

Hardware Solutions

- **GDPS (Geographically Dispersed Parallel Sysplex)**
- **DASD remote copy (Metro Mirror / z/OS Global Mirror)**
- **Remote tape**

Software Solutions

- **IMS RSR**
- **E-Net RRDF**

Manual

- **PTAM (Pickup Truck Access Method)**

Database recovery considerations

Disaster Recovery Basics



Objective:

- **Restore IMS service at a remote location when the local (normal) computing facility is no longer available**

- **Remoteness is in the eye of the beholder**
 - In general, the further away, the better

- **Ensure the survival of the business!**

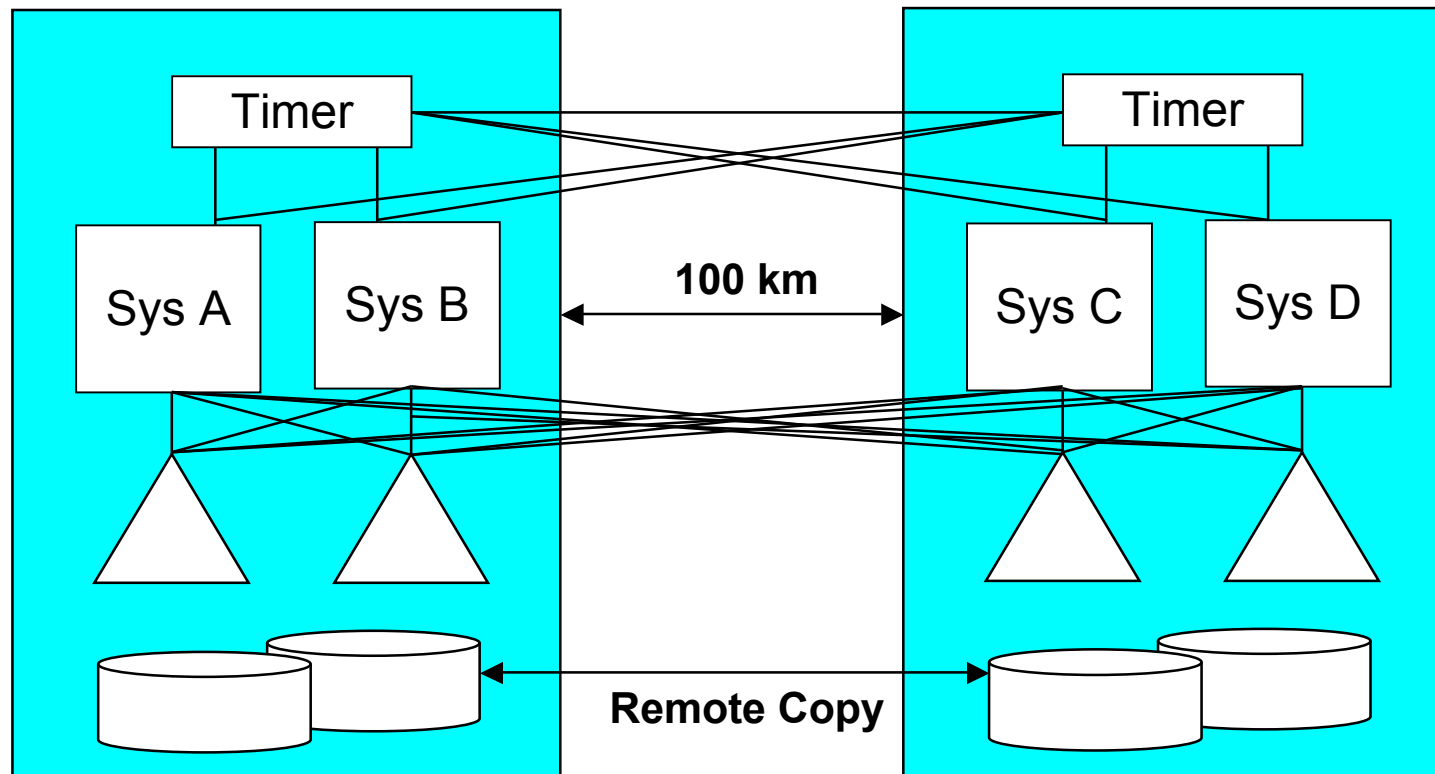


Disaster Recovery Methodology

- **Determined by business needs**
 - How remote is remote (type of disaster)
 - How much data can business lose?
 - How long can business go without service?
 - What can business afford?
 - Is DR methodology allowed to impact local availability?

- **Cost goes up as data loss and service unavailability go down**
 - Not linear

Availability solution based on automation and Metro Mirror / z/OS Global Mirror



Advantages

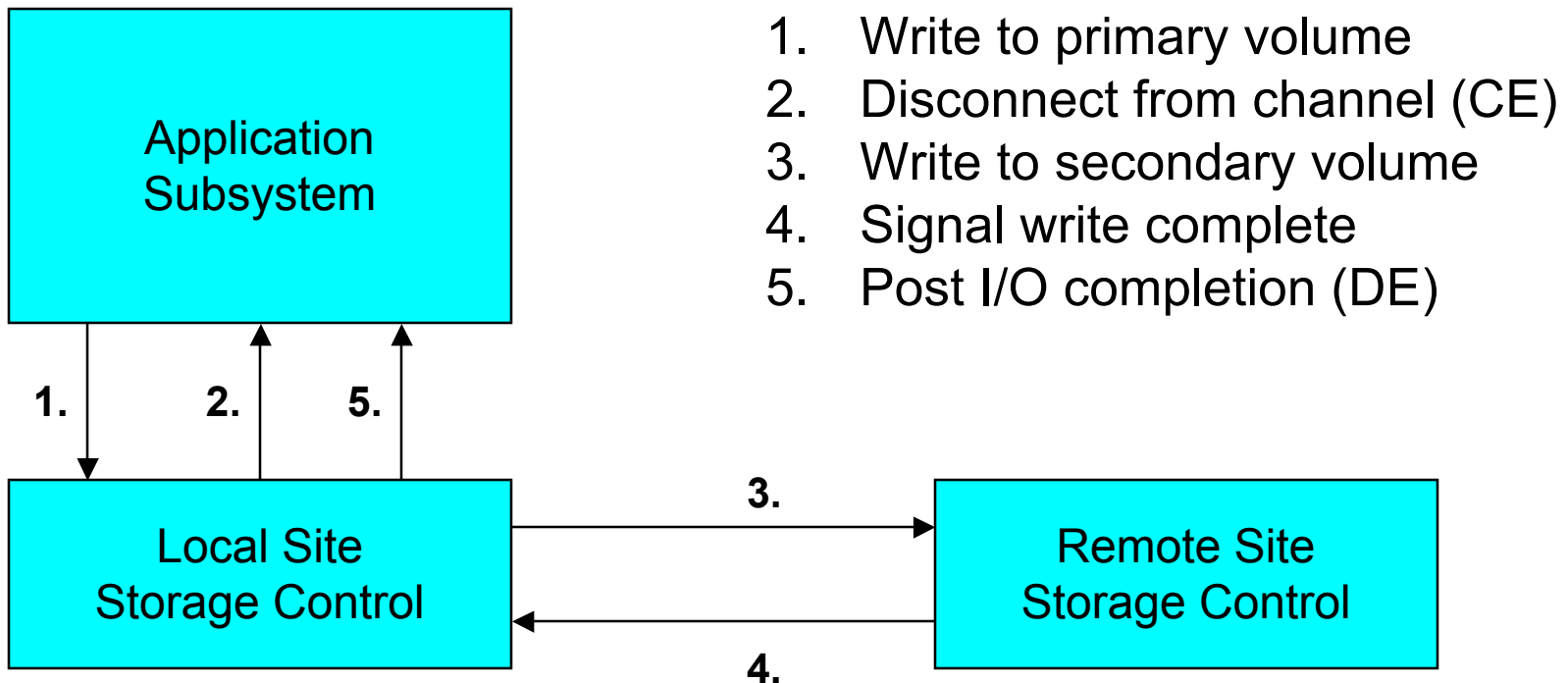
- **Transparent to application software (IMS, DB2, VSAM)**
- **No data loss (Metro Mirror)**
 - **Assumes no connectivity or write failures**
- **No impact on local operations**
 - **Assumes no connectivity or write failures**
- **No database recovery operations required**
 - **Assumes no connectivity or write failures**
- **Consistent recovery procedures**
- **Quick workload transfer**
- **No subsystem coordination problems**

Disadvantages

- Limited distance (100 km – 40 km between Sysplex Timers)
- Duplicate DASD
 - RECONs, OLDS, WADS, and databases **must** participate
- Impacts IMS throughput and response times
 - PPRC elongates DASD write response times (10 microsec/km)
- High bandwidth requirements
- Backup site must always be available
- Logs archived to tape are a challenge
 - IMS 3494 Magstar VTS duplexing function might help
- Other techniques still desirable for backup

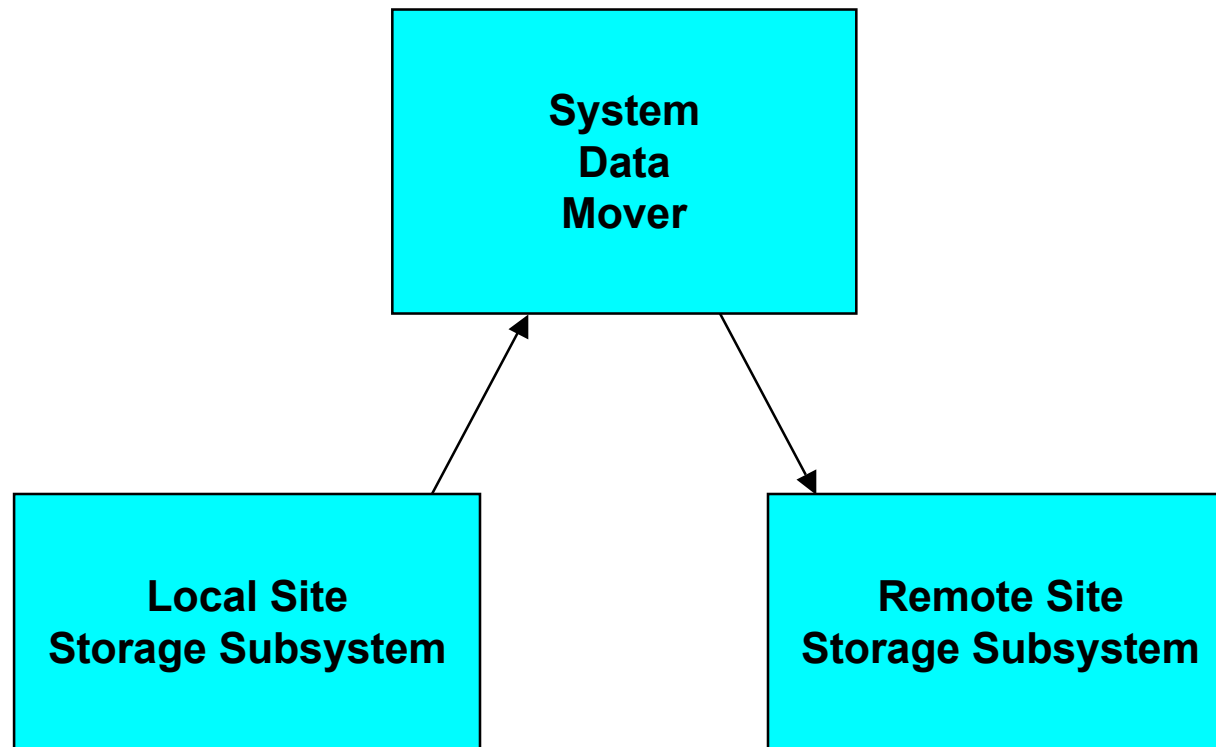
DASD Synchronous Remote Copy (Metro Mirror)

DASD subsystem function



DASD Asynchronous Remote Copy (z/OS Global Mirror)

DASD subsystem / DFSMS function



DASD Remote Copy

What to copy?

■ Databases?

- No data loss (Metro Mirror) / minimal loss (z/OS Global Mirror)
- RECONS, OLDS, and WADS must also be copied
- No database recoveries needed
- In-flight updates must be backed out
- SLDS / RLDS and image copies assumed to be at remote site

■ OLDS / WADS?

- No data loss (Metro Mirror) / minimal data loss (z/OS Global Mirror)
- RECONS must also be copied
- Database recoveries needed
- SLDS / RLDS and image copies assumed to be at remote site

DASD Remote Copy ...

What to copy?

■ SLDS / RLDS

- Updates after last SLDS / RLDS lost
- RECONs must also be copied
- Database recoveries needed
- Image copy data assumed to be at remote site
- Questionable

■ RECONs?

- SLDS / RLDS and image copy data assumed to be at remote site
- Updates after last SLDS / RLDS at remote site lost
- Database recoveries needed
- Doesn't make sense

DASD Remote Copy ...



Advantages

- **Transparent to application software (IMS, DB2, VSAM)**
 - Depends on what is copied
- **No (Metro Mirror) / minimal (z/OS Global Mirror) data loss if OLDS / WADS copied**
 - Assumes no connectivity or write failures
- **No impact on local operations**
 - Assumes no connectivity or write failures
- **No database recovery operations required**
 - Assumes databases copied
 - Assumes no connectivity or write failures

DASD Remote Copy ...

Advantages

- **Consistent recovery procedures**
 - Depends on what is copied
- **Quick workload transfer**
 - Depends on what is copied
- **No subsystem coordination problems**
 - Depends on what is copied

DASD Remote Copy ...

Disadvantages

- **Metro Mirror has distance limitations (300 km)**
- **Duplicate DASD**
 - Depends on what is copied
- **Metro Mirror impacts IMS throughput and response times**
 - DASD write response time elongated (10 microsec / km)
 - Depends on what is copied
- **High bandwidth requirements**
 - Depends on what is copied
- **Image copies might be required following takeover**
 - Depends on log and image copy availability

DASD Remote Copy ...



Disadvantages

- **Logs archived to tape are a challenge**
 - IBM TotalStorage 3494 Magstar VTS duplexing function might help
- **Other techniques still desirable for backup**
- **Not as simple as it sounds**
 - IBM System Storage DS8000: Copy Services with IBM System z (800+ pages)
 - IBM TotalStorage Peer-to-Peer Virtual Tape Server: Planning and Implementation Guide (450+ pages)

Remote Tape

What is it?

- **Tape subsystem at remote location connected to local system via channel extender technology**
- **Appears to be a local device**

Used for

- **Secondary image copy data sets**
- **Secondary archived log data sets**
- **RECON backup data sets**
 - **Can use NEON iRecover or NEON iChange to create pre-conditioned “Load and Go” RECON backup data sets**

Remote Tape ...

Advantages

- **Low tech / low cost**
 - Easy to implement and maintain
- **Image copy and archived log data off-site when created**
- **RECON backups off-site when created**
- **No impact on IMS throughput and response times**
- **No duplicate DASD**
- **Subsystem coordination possible with the right software**
 - NEON iRecover and NEON iChange
- **Can be used with other techniques**

Remote Tape ...

Disadvantages

- **Medium data loss**
 - Data since last archived log unavailable
- **Database recovery operations required**
- **Image copy times could be elongated**
- **Log archive times could be elongated**
- **Procedures needed to “catalog” remote tape files at remote location**

IMS Remote Site Recovery (RSR)



IMS feature

- Recovery log tracking (RLT)
- Database log tracking (DLT)

Electronic log vaulting (DLT and RLT)

- Log blocks transmitted to “special purpose” IMS system at remote location prior to writing to OLDS (on-line) / RLDS (batch)
- IMS log records contain RECON update information

Shadow databases (DLT)

- Option to maintain shadow databases
 - Continuous forward recovery
 - Selectable by database

IMS RSR ...

Advantages

- **Minimal data loss**
 - Updates since last OLDS write
 - Updates in transmission “pipeline”
- **Minimal bandwidth**
- **No impact on IMS throughput and response times**
- **No distance limitations**
- **No database recovery operations required when shadow databases are maintained**
- **Some subsystem coordination support provided**

IMS RSR ...

Disadvantages

- Only supports IMS data
- IMS system (CPU cycles) required at remote location
 - Requires about 5% of active site CPU usage for RLT
 - Requires about 10 – 15% of active site CPU usage for DLT
- Does not address image copy data set transport



E-Net RRDF

Electronic log vaulting

- Log blocks transmitted to “RRDF Receive” system at remote location after written to OLDS (on-line) / RLDS (batch)
- RECON updates transmitted to “RRDF Receive” system at remote location

Works quite differently from IMS RSR!

Advantages

- **Minimal data loss**
 - Updates since last OLDS write
 - Can force OLDS write during low logging periods
 - Updates in transmission “pipeline”
- **Minimal bandwidth**
- **No distance limitations**
- **Support for IMS, DB2, and CICS**
 - Common electronic log vaulting solution

E-Net RRDF ...

Disadvantages

- **“RRDF Receive” system required at remote location**
- **IMS database recovery operations required**
- **Does not address image copy data set transport**

PTAM (Pickup Truck Access Method)



What is it?

- **Copies of recovery media periodically shipped off-site**
 - Secondary image copies
 - Secondary logs
 - Change accums?
 - RECON backups
 - Can use NEON iRecover or NEON iChange to create pre-conditioned “Load and Go” RECON backup data sets
 - Frequency of shipments depends on amount of acceptable data loss
 - Data not really available until the truck arrives at the remote location!

Advantages

- **Low tech / low cost**
 - Easy to implement and maintain
- **Minimal resources at remote location**
- **No impact on IMS throughput and response times**
- **No duplicate DASD**
- **Subsystem coordination possible with the right software**
 - NEON iRecover and NEON iChange
- **Can be used with other techniques**

Disadvantages

- **Maximum data loss**
 - Data not “hardened” until truck leaves local site
 - Data not “available” until truck arrives at remote site
- **Error prone**
 - Manual procedures to collect data at local site
 - Manual procedures to receive data at remote site
 - Need software that can create a “pick list” of required data sets
 - NEON iRecover
 - NEON iChange

Disaster Recovery Requirements



Local system data availability should not be impacted by disaster recovery methodology

RECON conditioning / cleanup operations should be automatic

Database recovery speed

- **One pass, parallel recovery operations are a necessity**
- **Image copy, index rebuild, and hashed pointer checking operations need to be performed as part of the recovery process**

User needs complete control over the time to which databases are recovered

Coordinated recovery with DB2 is mandatory

Recovery Considerations



IMS and DB2 log data available at remote site

- **Any time stamp is possible with NEON iRecover**
- **Process**
 - **Restore conditioned RECON backup created by NEON iRecover**
 - **Recover IMS databases to ANY desired time stamp using NEON iRecover**
 - **Single step operation**
 - **IC, PC, and index rebuild performed while recovering**
 - **Recoveries performed with transactional consistency**
 - **Perform DB2 conditional restart to same time stamp (DB2 facility)**
 - **Use “in-doubt’ DB2 UOR status report from NEON iRecover to resolve DB2 in-doubt UORs from IMS UORs**



NEON iRecover DR Support



Steps to accomplish disaster recovery

■ Restore latest DR RECON backup

```
//DR1      JOB      . . .
//STEP1    EXEC     PGM=NSRRCNRS
//STEPLIB  DD       DSN= . . .
//BACKUP   DD       DSN= . . .
//RECON1   DD       DSN= . . .
```

■ Restore RECON duality

```
//DR2      JOB      . . .
//STEP1    EXEC     PGM=DSPURX00
//STEPLIB  DD       DSN= . . .
//SYSPRINT DD       SYSOUT=*
           LIST.RECON STATUS
/*
```



NEON iRecover DR Support ...



Steps to accomplish disaster recovery ...

- Run Eclipse iRecover to desired time stamp

```
//DR3      JOB      . . .
//STEP1    EXEC    PGM=NSRMAIN
//STEPLIB DD      DSN= . . .
//NEONIN   DD      *
            RECOVERGRP DBD(*) RECOVERTO(...)
/*
```

- Go get coffee!



Alternatives to Log Data



Environment

- **User needs only a few DR points per day**
 - Recovering to prior 2 AM is good enough

- **User does not want to quiesce database update activity or data sharing level when establishing a DR point**

- **User wishes to send only image copy and change accum data sets off-site (no logs), along with a RECON backup**

- **User wishes to recover databases to a consistent state (prior 2 AM) at the disaster site**
 - Quickly, correctly, with minimum effort

NEON iChange DR Support



Special DR change accumulation data sets

- Normal change accumulation information
- Additional records, if needed, to restore consistency

“Load and Go” RECON backup

- Conditioned for disaster recovery
- All necessary “cleanup” operations already performed

“DR media” inventory report

- Lists data sets required for disaster recovery
- Can be used to ensure all required assets are off-site

“DR coverage” report

- Lists all recoverable data sets that are not in a DR CA

NEON iChange DR Support ...



Steps to establish a 2:00 AM DR point at the local site

- Automation issues /SWI OLDS immediately after 2:00 AM
- Automation submits Eclipse iChange job after archives complete

```
//DRCA      JOB      . . . .  
//STEP1     EXEC     PGM=NSAMAIN  
//STEPLIB   DD       DSN= . . . .  
//NEONIN    DD       *  
              ACCUMGRP GROUP(CAGRP1) ACCUMTO(* 02:00:00)  
              ACCUMGRP GROUP(CAGRP2) ACCUMTO(* 02:00:00)  
/*
```

- DR change accums and RECON backup sent off-site, along with any image copy data sets created since last DR point

Steps to accomplish disaster recovery

■ Restore latest DR RECON backup

```
//DRCA      JOB      . . .  
//STEP1     EXEC     PGM=NSARCNRS  
//STEPLIB   DD       DSN= . . .  
//BACKUP    DD       DSN= . . .  
//RECON1    DD       DSN= . . .
```

■ Restore RECON duality

```
//DR2        JOB      . . .  
//STEP1     EXEC     PGM=DSPURX00  
//STEPLIB   DD       DSN= . . .  
//SYSPRINT  DD       SYSOUT=*  
//SYSIN     DD       *  
LIST.RECON STATUS  
/*
```

Eclipse iChange ...

Steps to accomplish disaster recovery

■ Run Eclipse iRecover

```
//DRCA      JOB      . . .  
//STEP1     EXEC     PGM=NSRMAIN  
//STEPLIB   DD       DSN= . . .  
//NEONIN    DD       *  
             RECOVERGRP GROUP (CAGRP1)  
             RECOVERGRP GROUP (CAGRP2)  
/*
```

■ Go get coffee!

Summary

DR solution is a business decision

- **How much data loss is acceptable**
- **How long a data outage is acceptable**
- **How much expense is acceptable**

DR solution needs to accommodate both IMS and DB2

All solutions require recovery software that can

- **Recover thousands of objects in a single step and survive**
- **Recover objects to any point in time**
- **Support multiple recovery points in time if needed**

Recovery solution needs to be designed with disaster recovery in mind

Questions and Answer Period

Reminder!



**To find out more about iRecover and
iChange and all the magical things they can
do, tune in next meeting (April 8th)**

