Automated and Simplified IMS and DB2 Disaster Recovery

Session Agenda

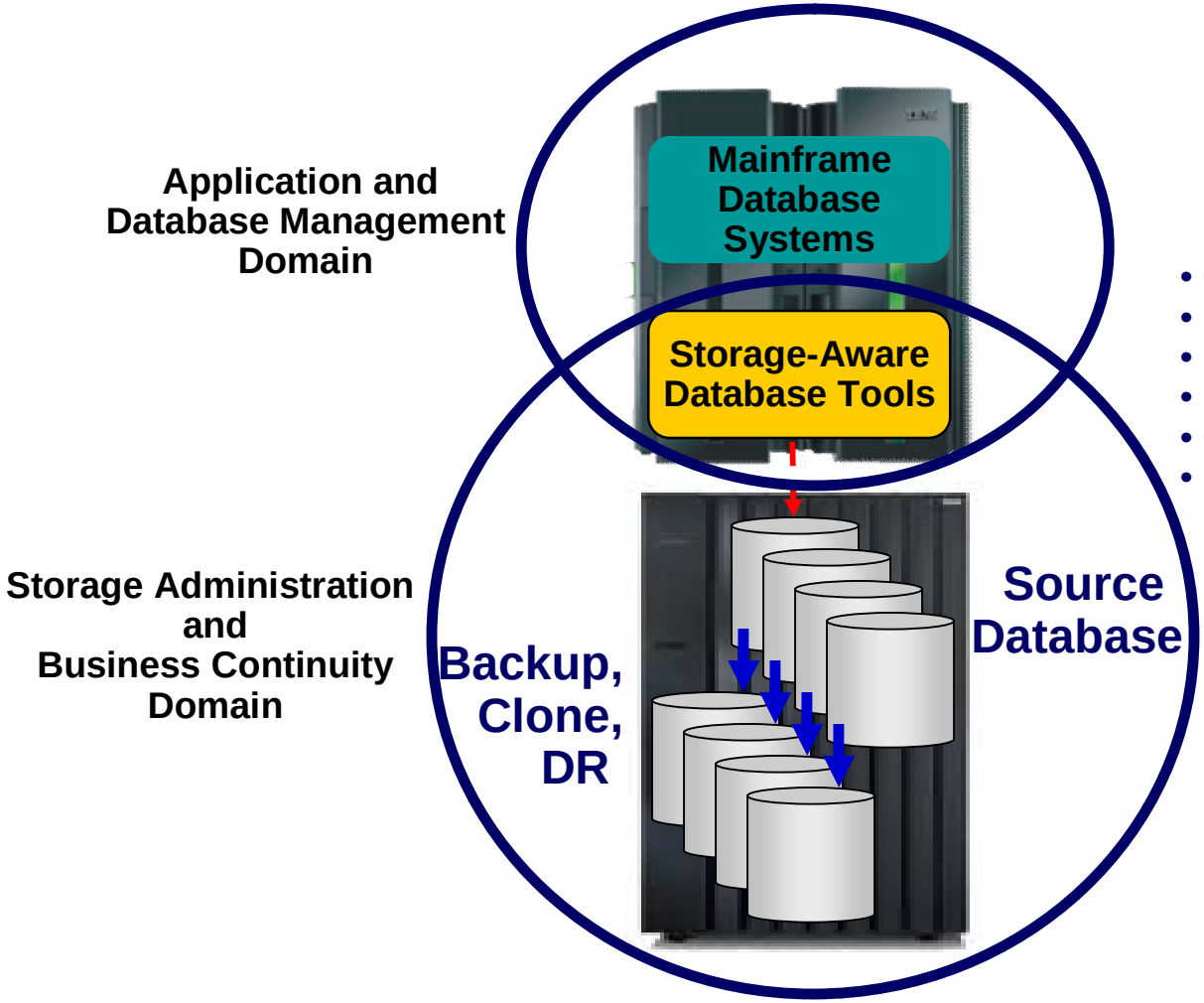
- **Storage-Aware Tools**
  - Database and Storage Integration
- **System Level Backup (SLB) Methodologies**
- **System Level Backup for Disaster Restart**
  - Using SLBs with Pickup Truck Access Method (PTAM)
  - Using SLBs with Virtual tape
  - Using SLBs for a Tertiary DR Site
- **Intelligent Disaster Recovery Manager**
  - Local site component
  - Remote site component
- **Session Summarization**

Database and Storage Integration

- Trends and Directions

- **Large Database systems require high availability**
  - Fast and non-intrusive backup and cloning facilities are required
  - Fast recovery capabilities are required to minimize downtime and promote high availability
  - Most backup, recovery and cloning solutions do not leverage storage-based fast-replication facilities
- **Storage-based fast-replication facilities are under-utilized**
  - Tend to be used by storage organizations
  - Tend not to be used by database administrators (DBAs)
- **Storage aware database products allow DBAs to use fast-replication in a safe and transparent manner**
  - Provides fast and non-intrusive backup and cloning operations
  - Simplifies recovery operations and reduces recovery time
  - Simplifies disaster recovery procedures

Database and Storage Integration



- Organizational Integration
- New Backup Methods
- New Recovery Strategies
- Business Recovery Monitoring
- Cloning Automation
- Disaster Restart Solutions

Database and Storage Integration
- Operational Advantages

- **Reduce backup, recovery, and cloning administration costs**
- **Reduce host CPU and I/O resource utilization**
- **Perform backups and create clone copies instantly**
- **Fast restore and parallel recovery reduces recovery time**
- **Simplify disaster recovery operations and procedures**
- **DBMS and storage-based fast-replication integration**
  - Leverage storage processors and fast-replication investments
    - IBM, EMC, HDS, STK
  - Expose fast-replication capabilities to the DBAs ***safely and transparently*** using "***storage-aware***" database utilities
- **Provide a sophisticated infrastructure and metadata to manage the DBMS and storage processor coordination**

Storage-aware Database Products

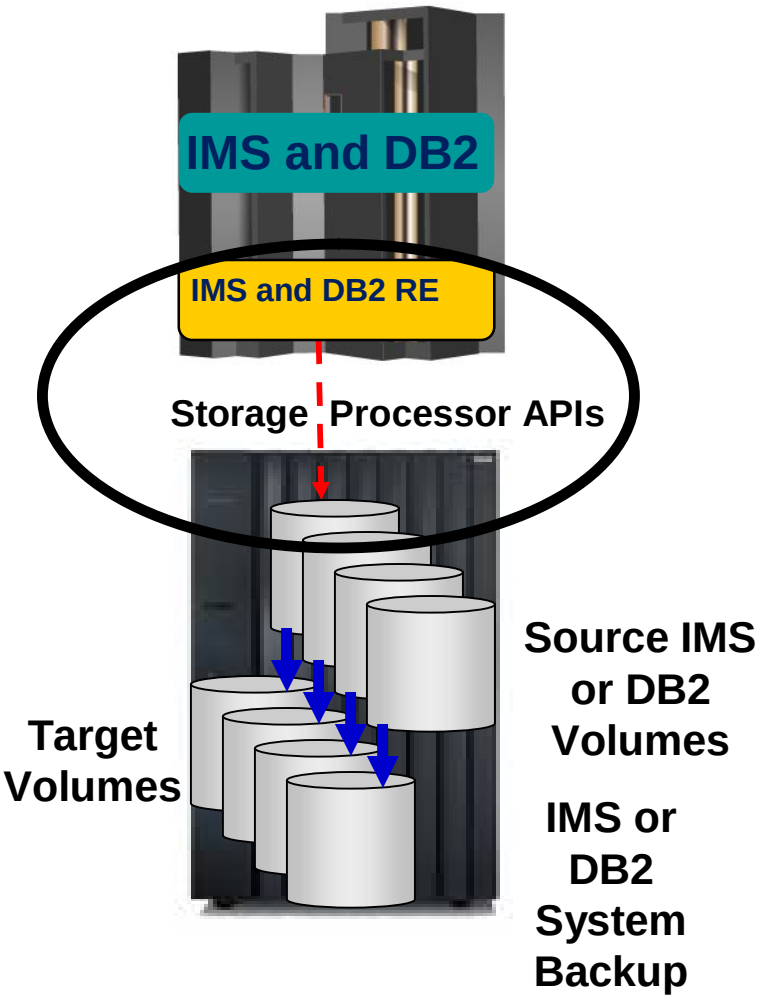
- **IMS Recovery Expert for z/OS**
- **DB2 Recovery Expert for z/OS**
- **IMS Cloning Tool**
- **DB2 Cloning Tool**

System Level Backup Methodologies

- **Backup complete database systems (IMS or DB2) as a unit without affecting running applications**
  - Backup components can include:
    - Active and archive logs
    - Recovery metadata (IMS RECONs, DB2 BSDS)
    - All database data sets
    - Appropriate libraries, and system data sets
    - IMS system data sets including ACBLIBs, DBDLIBs, PGMLIBs, etc.
    - All associated ICF User catalogs
  - Backups are performed instantly using storage-based fast replication
  - Does not require DB2 BACKUP SYSTEM or DFSMShsm
- **System-level backups (SLBs) are the foundation for federated backup and recovery solutions (IMS and DB2 together)**

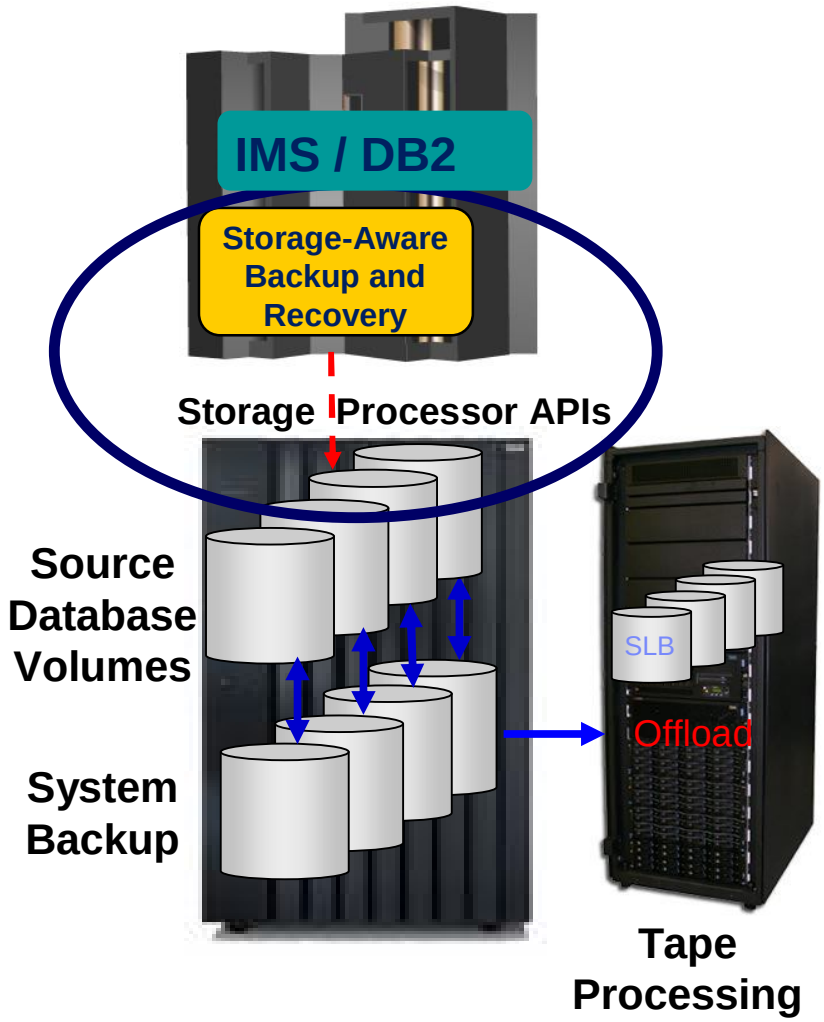
IMS and DB2 Recovery Expert
- System Level Backup Overview

- **A System Level Backup is a backup of the entire IMS or DB2 environment at a point in time**
  - Recorded in Recovery Expert ‘s metadata repository
- **Leverages fast replication from all vendors to drive the volume backup**
  - Instantaneous backup
  - Offloading data copy process to the storage processor saves CPU and I/O resources
  - Faster than data set copies
- **Backup IMS or DB2 without affecting applications**
  - Backup windows reduced by replacing image copies where desired
  - Extends processing windows
- **Data consistency ensures data is dependent-write consistent**
  - IMS Log Suspend / DB2 Log Suspend
  - Storage-based consistency functions
  - Equivalent to a power failure



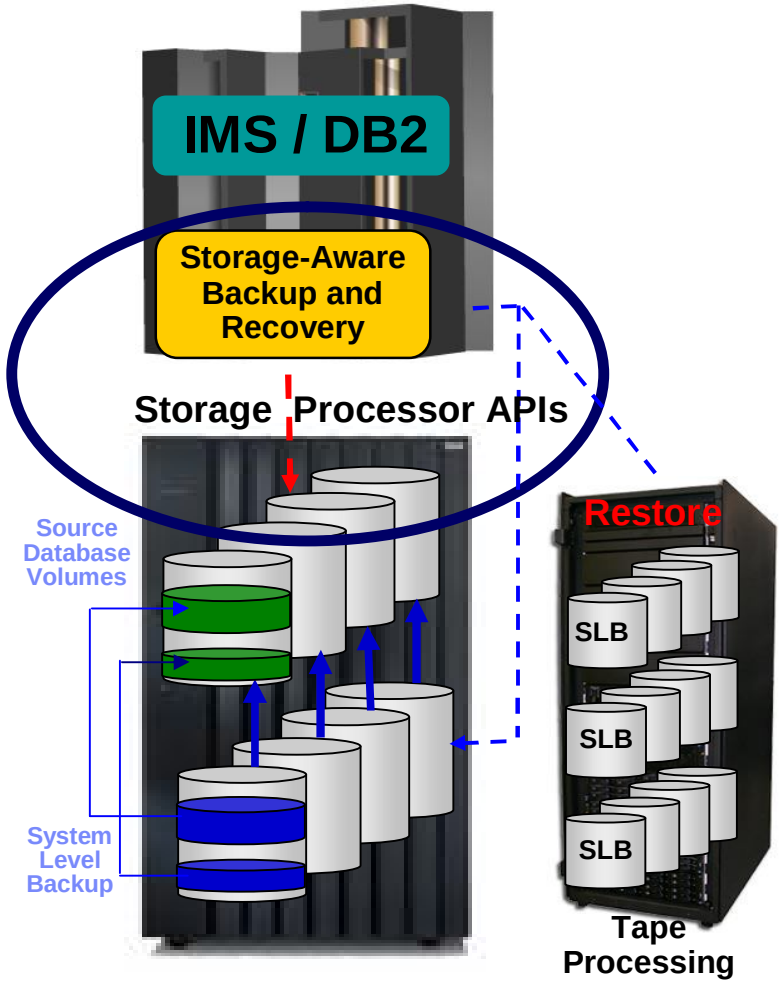
IMS and DB2 Recovery Expert
- System Level Backup Overview

- **Guaranteed Recoverability**
  - Insurance that a backup is available
  - Validates that entire IMS or DB2 was backed up
  - Validates storage layout
  - Checks that objects are in “OK” state to copy
- **Automated backup offload (archive/recall)**
  - Copies system backup from fast replication disk to tape for use at either local or disaster site (or both)
  - Tape can be local or remote
  - Encryption
- **Backup used for multiple purposes**
  - System, data only, application, IMS database, DB2 table space recovery
- **Can be used in combination with other backups (image copies)**
  - *(For DB2 RE only)* Image Copies can be taken from SLB and registered in SYSCOPY



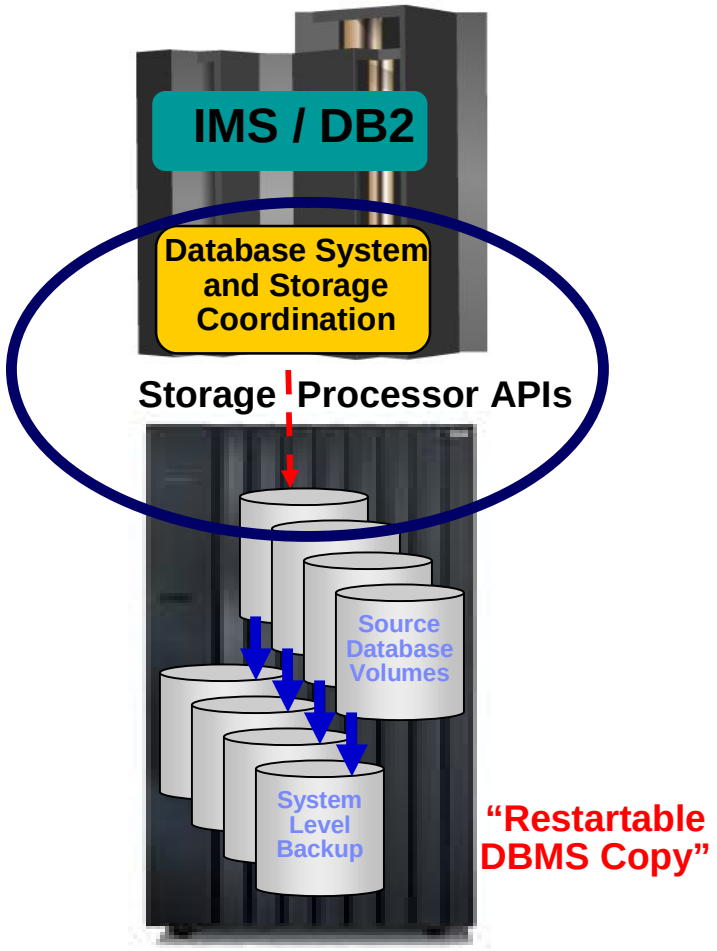
IMS and DB2 Recovery Expert
- System and Application Recovery Overview

- **Recover IMS / DB2 systems or application objects from disk or tape automatically**
- **Intelligent Recovery Manager (IMS / DB2) invoked to optimize recovery plans**
- **Faster recovery**
  - Instantaneous system-restore process
  - Coordinated and parallel restore and DBMS recovery operations minimize system downtime
- **System backup can be used for database (IMS) object (DB2), or application recovery**
  - Data sets snapped to restore data
  - Parallel log apply reduces recovery time
- **One system backup used for system, application, and disaster restart**



IMS and DB2 Recovery Expert
- System Level Backup for Disaster Restart

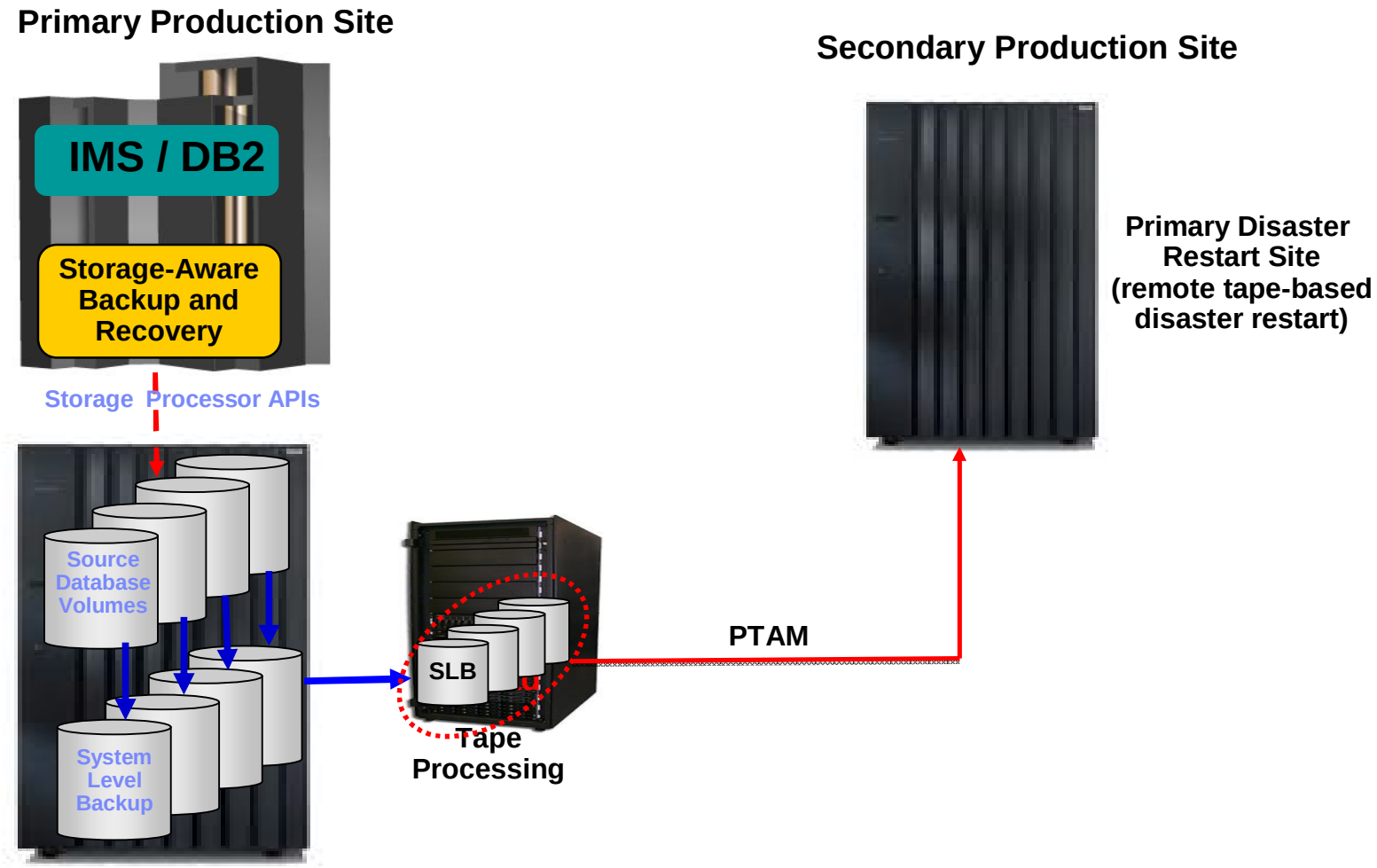
- **Simplifies disaster recovery operations**
  - System level backup for restart
  - System level backup and roll forward
- **System level backup is "restartable"**
  - Restore volumes containing the last SLB
  - Performs recovery during normal DB2 database initialization process or during IMS emergency restart procedures
  - Disaster recovery is as simple as restarting from a power failure
- **Intelligent Disaster Recovery Manager (IMS/DB2)**
  - Prepares local recovery assets and manages remote restore, restart, and recovery operations
- **Reduced recovery time at a DR site**
- **Transform disaster recovery procedures into a tape-based disaster restart process**
  - Similar benefits as storage-based remote replication solutions
- **Basis for IMS and DB2 coordinated recovery**



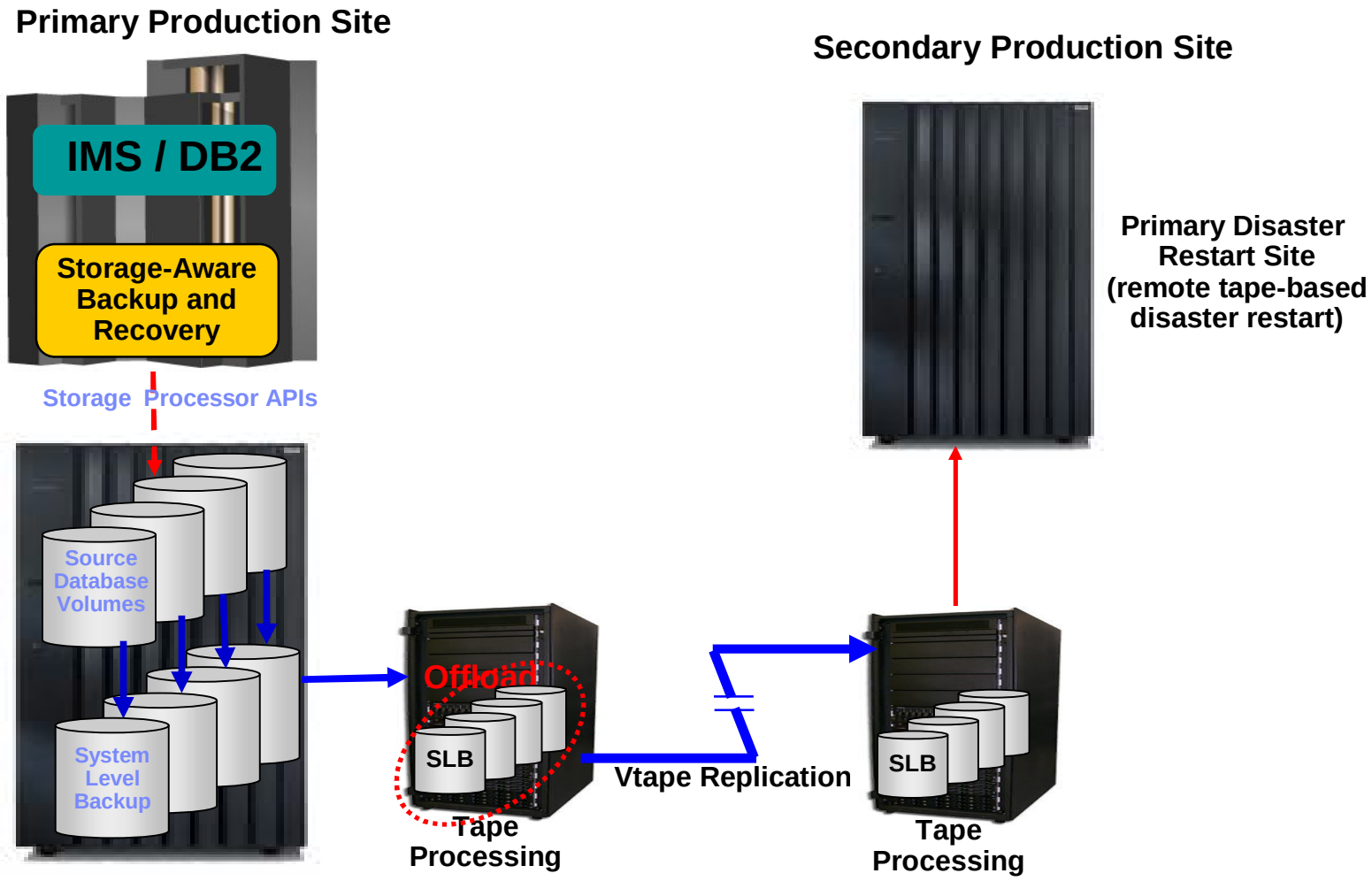
IMS and DB2 Recovery Expert
- Definitions

- **Traditional Disaster Recovery - The explicit application of database logs to a previous database copy**
  - Recovery order must be established and ensured
  - Consistency point must be established
  - Recovery process is time consuming and error prone
  - Integrity validation must be performed

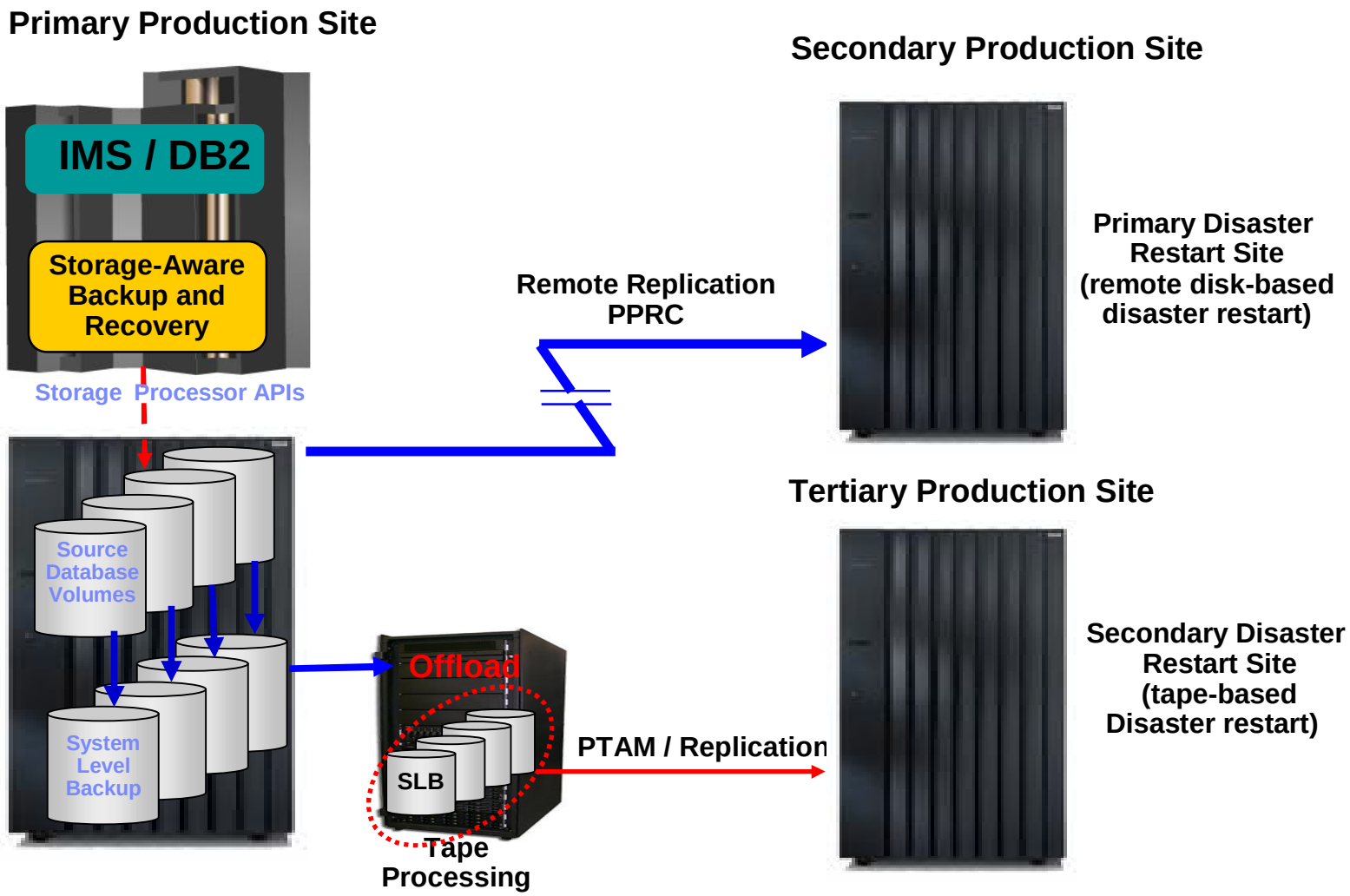
SLBs for Disaster Restart Using PTAM



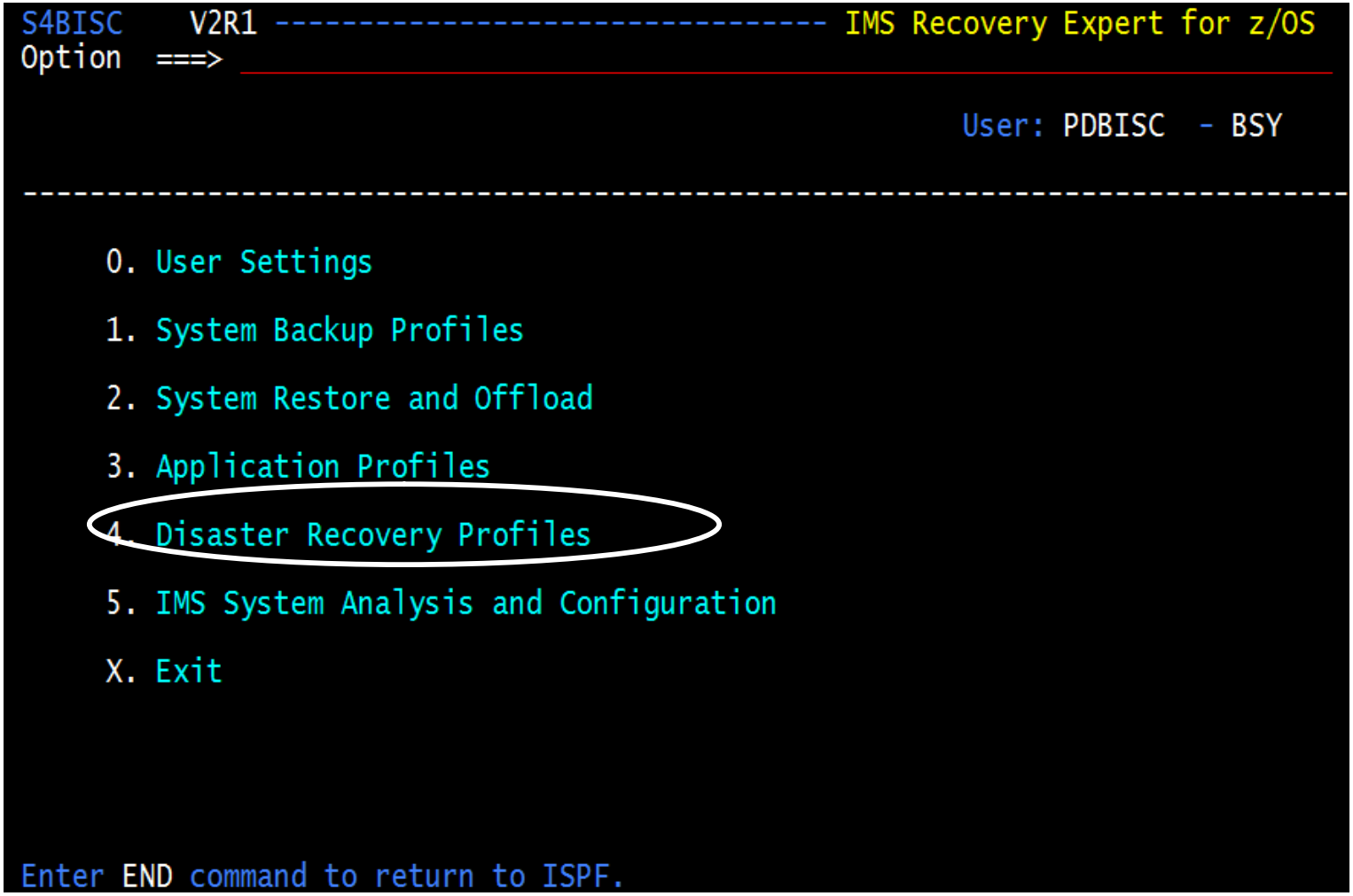
SLBs for Disaster Restart Using Virtual Tape



SLBs Used at a Tertiary DR Site



Recovery Expert – Setup and Usage Flow
- Main Menu



IMS or DB2 Intelligent *Disaster* Recovery Manager - Overview

- **Local and remote disaster recovery site components that automate the restart and recovery processes**
- **Local site component prepares recovery assets that are needed at the remote site**
  - Disaster Restart using system level backups and associated archive logs or Disaster Recovery using Image Copies and associated archive logs
  - It copies recovery assets, conditions the RECON, and builds the JCL needed to restore, restart and/or recover your IMS system
  - It copies recovery assets, conditions the BSDS, and builds the JCL needed to restore, restart, and/or recover your DB2 system
- **Remote site component performs intelligent remote site restore operations and performs appropriate IMS or DB2 recovery and restart procedures**

IMS or DB2 Intelligent *Disaster* Recovery Manager
- Local Site Component Overview

- **Creates jobs to restore an IMS system level backup and restart IMS**
  - Optionally creates jobs to restore a system level backup, restore conditioned RECONs, run recoveries to a point in time, and restart IMS
- **Create jobs to restore a DB2 system level backup and restart DB2**
  - Optionally creates jobs to restore a system level backup, condition BSDSs, restart DB2 and run recoveries to a point in time
- **User-defined profiles specify which restart and recovery operations to perform**
  - Specify recovery assets that will be shipped to the remote site
  - Determine desired recovery point objective (RPO)
  - The Intelligent Disaster Recovery Manager is run on a schedule to accommodate your recovery point objective

Defining Disaster Recovery Profile Options
- IMS Local Site Component

```
S4BISC   V2R1 ----- Update Disaster Recovery Profile ---- 2010/08/02  15:31:49
Option  ===>
--------------------------------------------------------------------------------
 Creator: PDBISC     Name: I9A2                              User: PDBISC
 Share Option: U  (Upd,View,No)    Description: I9A2 TO RS47
 IMS System/Group: I9A2
--------------------------------------------------------------------------------

DR Profile Options:
  DR Site Recovery point       ==> P  (Backup/Point in time)
  SLB Used for DR              ==> R  (Localsite/Recoverysite)

  Process Archive Logs for DR  ==> Y  (Yes/No/Update)
  Process Change Accums for DR ==> Y  (Yes/No/Update)
  Process Image Copies for DR  ==> Y  (Yes/No/Update)
  Customize RECON dataset name ==> N  (Yes/No)
  Run RECON Health Check       ==> Y  (Yes/No)

  Update DR Recovery Options   ==> N  (Yes/No)
```

Defining Remote Site Disaster Recovery Assets
- IMS Local Site Component

```
S4BISC   V2R1 --------- Edit DR Archive Options --------- 2010/08/02  15:33:13
Option  ===>
--------------------------------------------------------------------------------
 Creator: PDBISC     Name: I9A2                              User: PDBISC
 Share Option: U  (Upd,View,No)    Description: I9A2 TO RS47
 IMS System/Group: I9A2
--------------------------------------------------------------------------------

Archive Log Options:
  Use RLDS datasets at DR Site       ==>     (Yes/No)
  Archive Logs Used at DR Site       ==> C   (Copied/1/2)
  Copy local archive logs            ==> 1   (1/2/Both/Create 2 from 1)
  Number of archive copy tasks       ==> 04  (1-32)
  Force an archive log switch        ==> Y   (Yes/No)
  Force checkpoint before archiving  ==> Y   (Yes/No)
  Archive logs needed at DR site     ==> 010 (days)  000 (hours)
  Unit for Copying archive log       ==> SYSALLDA
     Edit Allocation parameters      ==> N   (Yes/No)
  Number of qualifiers to replace    ==> 2   (0-9)
  DR Archive Prefix 1                ==> SIRRTE.I9A2LOG1.DR
  DR Archive Prefix 2                ==> SIRRTE.I9A2LOG2.DR
  Copy archives to DASD at DR site   ==> Y   (Yes/No/Update)
```

IMS or DB2 Intelligent *Disaster* Recovery Manager
- Local Site Component

- **Recovery JCL is created each time Intelligent Disaster Recovery Manager is executed at local site**
  - Scheduled on a periodic basis at local site
- **Jobs are pre-built and placed in a PDS to be shipped to the remote site**
- **Produces an offsite tape list for the image copies, change accumulation, or archive logs to be used at the remote site**

IMS Intelligent *Disaster* Recovery Manager
- IMS Local Site Component

- **Scheduled on a periodic basis at local site**
- **IMS Disaster Restart**
  - Creates a System Level Backup
  - Creates a PDS to be shipped to remote site
    - JCL to restore System Level Backup
    - Copy of IMS Recovery Expert repository and corresponding recovery JCL
- **IMS Disaster Restart and roll forward to last log available**
  - Creates a System Level Backup
  - Copy image copies, change accumulations and archive logs if needed
  - Creates a conditioned RECON to reflect recovery assets being sent to the remote site (any logs, change accumulations and image copies) and allows IMS to be restarted
    - Removes the requirement to modify the RECON at the DR site
    - If logs and change accumulations aren't required, they are marked in error in the conditioned RECON so they won't be pulled in
  - Creates a PDS to be shipped to remote site
    - JCL to restore System Level Backup
    - JCL to recover all databases
    - Copy of conditioned RECON
    - Copy of IMS Recovery Expert Repository and corresponding restore JCL
  - Tape pick list

IMS Intelligent *Disaster* Recovery Manager
- IMS Remote Site Component

- **IMS Disaster Restart**
  - Restore the PDS created at the local site that contains any JCL needed to complete the remaining steps
  - Restore the IMS Recovery Expert repository. The repository contains information about the SLB
  - Restore the System Level Backup (all log and data volumes)
  - Emergency restart IMS
- **IMS Disaster Restart and roll forward to last log available**
  - Restore the PDS created at the local site that contains any JCL needed to complete the remaining steps
  - Restore the IMS Recovery Expert repository. The repository contains information about the SLB.
  - Restore System Level Backup
  - Delete and reallocate the IMS OLDS, WADS, and RECONs
- **Continued**
  - Delete and redefine GDG bases required for archive logs, image copies or change accumulation data sets
  - Issue IDCAMS RECATALOG commands to re-catalog archive logs on tape
  - Rebuild the RECON records from the recovery PDS
  - Uncatalog the tape archive logs. Copy the uncataloged tape archive logs to disk and catalog them
  - Optionally verify that the assets needed for recovery are at the remote site
  - Run forward recovery to recover all committed changes up to the end of the last archive log
  - Cold start IMS

DB2 Intelligent *Disaster* Recovery Manager
- DB2 Local Site Component

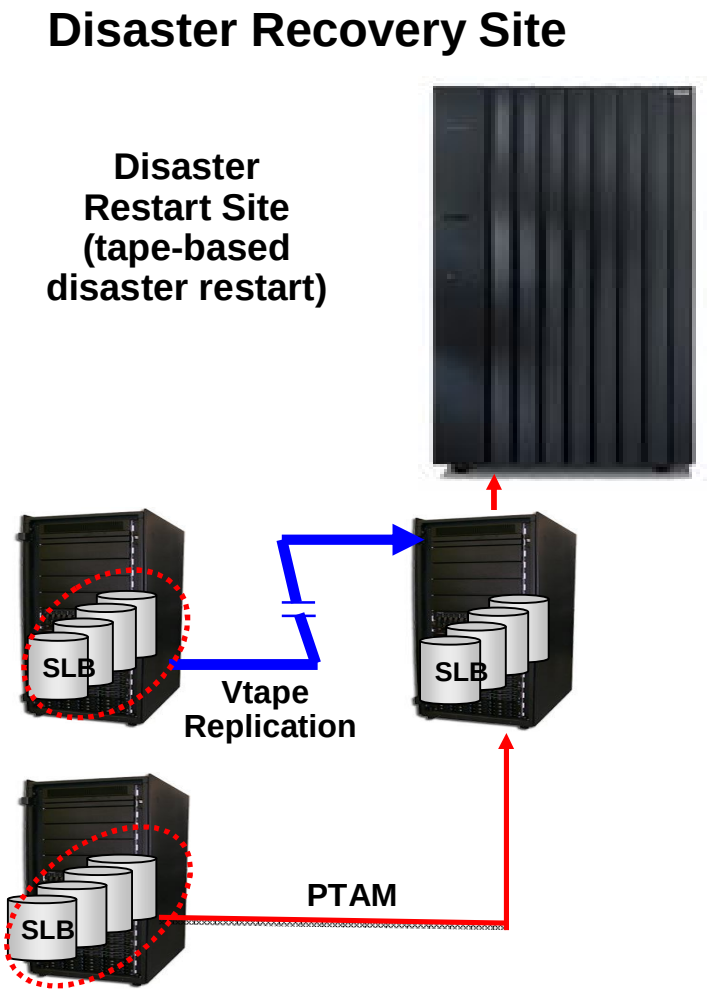
- **Scheduled on a periodic basis at local site**
- **DB2 Disaster Restart**
  - Creates a System Level Backup
  - Creates a PDS to be shipped to remote site
    - JCL to restore System Level Backup
    - Copy of DB2 Recovery Expert Repository and corresponding recovery JCL
- **DB2 Disaster Restart and roll forward to last log available**
  - Creates a System Level Backup
  - Copy archive logs
  - Option to force a checkpoint before archiving – DB2 Recovery Expert issues a SET LOG LOGLOAD(0) command
  - Option to force the active log to archive
  - Creates a conditioned BSDS to reflect logs sent to the remote
  - Creates a PDS to be shipped to remote site
    - JCL to restore System Level Backup
    - Copy of DB2 Recovery Expert repository and corresponding recovery JCL
  - Identifies DR image copies and builds IDCAMS statements to catalog them. Stores these statements in the PDS which will be shipped to the DR site
  - Builds all steps to perform disaster recovery

DB2 Intelligent *Disaster* Recovery Manager
- DB2 Remote Site Component

- **DB2 Disaster Restart**
  - Restore the PDS created at the local site that contains any JCL needed to complete the remaining steps
  - Restore the DB2 Recovery Expert repository. The repository contains information about the SLB
  - Restore System Level Backup (all log and data volumes)
  - Start DB2
- **DB2 Disaster Restart and roll forward to last log available**
  - Restore the PDS created at the local site that contains any JCL needed to complete the remaining steps
  - Restore the DB2 Recovery Expert repository. The repository contains information about the SLB
  - Restore System Level Backup (data volumes)
  - Delete existing DB2 log and BSDS data sets
  - Defines BSDS, Active Logs
  - Optionally catalogs all DR image copies
- **Continued**
  - Loads the conditioned BSDS (contains info about all archive logs available at DR site)
  - Creates a system point in time conditional restart record telling DB2 the RBA/LRSN of the last log available
  - Prints out a report with contents of the BSDS
  - Optionally copies archive log data from tape to disk
  - User step - Start DB2
  - User step - Respond to WTOR allowing DB2 conditional restart
  - Applies the log at the DR site to bring the entire DB2 to the point of the last log available - only one pass of the log needed.
    - Traditional DR jobs would require several passes of the log to restore the DB2 system to the last log available.
  - Finds DB2 objects in recover or rebuild pending and build JCL to restore those objects from image copies. This could be needed if a LOG NO event occurred for an object in the time span between the SLB and the last log at the DR site. (Think online reorg)

DB2 or IMS Intelligent *Disaster* Recovery Manager
- Disaster Restart Remote Site Summary

- **Restore disaster recovery PDS**
- **Restore IMS and DB2 Expert repositories**
- **Restore System Level Backup**
  - From tape or Vtape
- **Start DBMS**
  - IMS emergency restart
  - Start DB2
- **If recovering to a more current time:**
  - For IMS
    - Recoveries are performed
    - A cold start is performed instead of an emergency restart
  - For DB2
    - Recoveries are performed



Session Summary

- **Storage-aware database utilities provide storage integration to simplify database administration tasks**
- **System-level backups leverage fast-replication facilities and investments**
  - Fast and non-intrusive backup operations with less administration
  - Reduce host CPU, I/O and storage utilization
  - Backups can be used for system, application, and disaster restart
  - Parallel recovery reduces system and application recovery time
- **System-level backups**
  - Simplify and automate local and remote disaster restart and disaster recovery procedures
  - Reduce recovery time objectives (RTO)
  - Combined with PTAM or virtual tape replication can reduce recovery point objectives (RPO)
  - Provide a cost effective tertiary DR solution

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