



Advanced Technical Skills (ATS) North America

IMS Tools Teleconference Coordinated IMS and DB2 Disaster Recovery

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IBM Advanced Technical Skills (ATS)



IBM Disaster Recovery Solutions

■ **IMS *Recovery* Solutions**

- IMS databases are recovered using image copies and/or logs
 - IMS Full Database recovery or IMS Timestamp recovery

■ **IMS *Restart* Solutions**

- IMS system and databases are mirrored to remote site
 - IMS Recovery Expert product: System Level Backup
 - GDPS and Storage Mirroring

■ **IMS *Restart & Recovery* Solution**

- IMS system and databases are mirrored to remote site
- Additional transmitted data allows for forward recovery

■ ***Coordinated* IMS and DB2 *Restart* Solution**

- Approach 1: SLB contains both IMS and DB2 volumes
- Approach 2: Separate SLBs for IMS and DB2 and PITR log recovery

RTO vs. RPO

- **Recovery Time Objective (RTO)**
 - Time allowed to recover the applications
 - All critical operations are up and running again
 - Considerations include:
 - Recovery of databases and network
- **Recovery Point Objective (RPO)**
 - Amount of data lost in the disaster
 - Last point-in-time when all data was consistent
 - Considerations include:
 - Frequency of creating recovery points
 - Frequency of transfer of data to remote site

RTO/RPO of Coordinated IMS/DB2 DR Solutions

- ***Coordinated* IMS and DB2 *Recovery & Restart* Solutions**
 - RTO is low based on:
 - Performance of Storage-Based Fast Replication
 - Volumes are restored from the SLB at the remote site
 - Databases are recovered in parallel in one pass of logs
 - RPO is medium based on:
 - Frequency of SLB creation and Log transmission
 - Method of data transmission (ex. Virtual Tape)
 - Operational complexity is low
 - Automation provided by IBM Tools

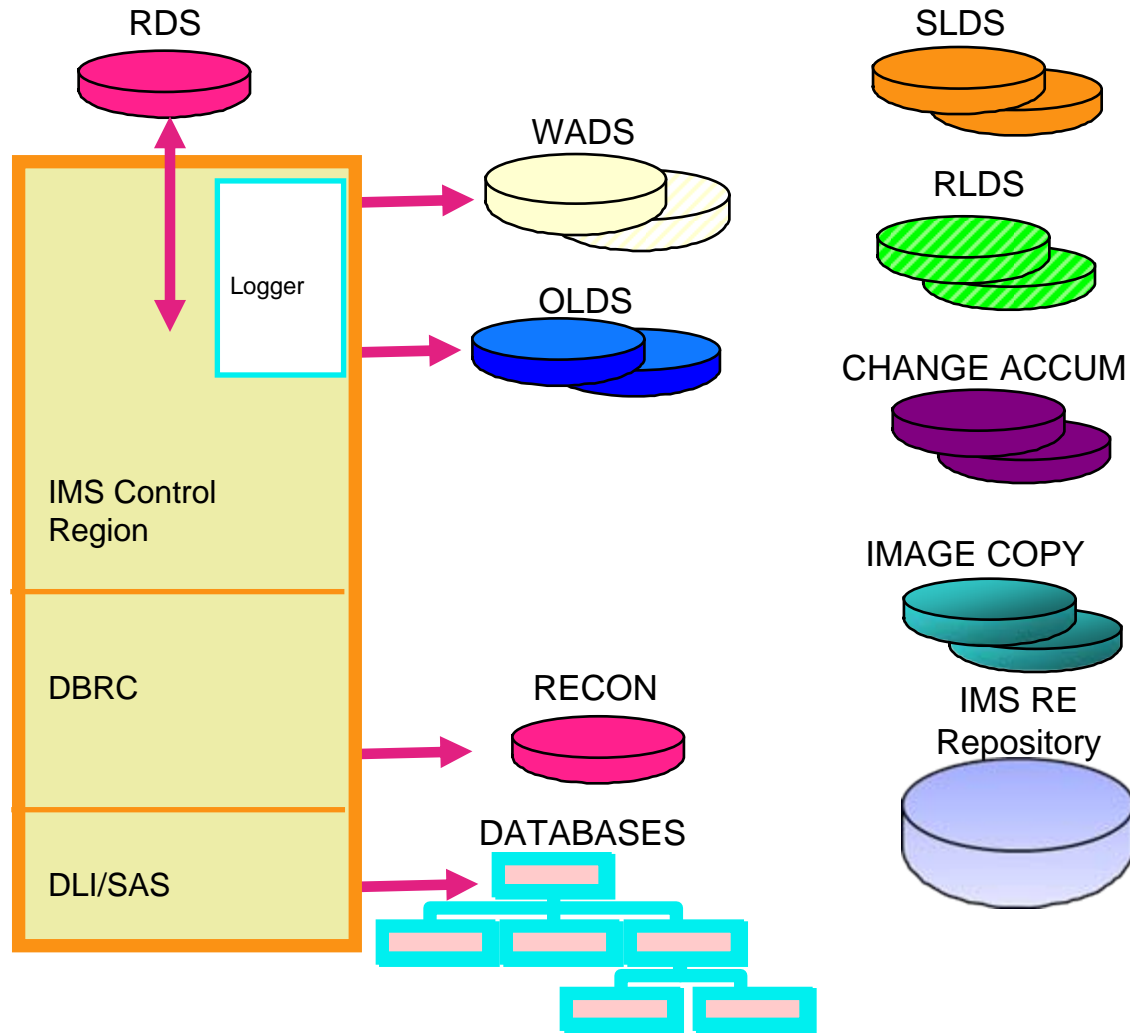
Coordinated IMS and DB2 DR Solutions

■ **Coordinated IMS and DB2 Restart Solution**

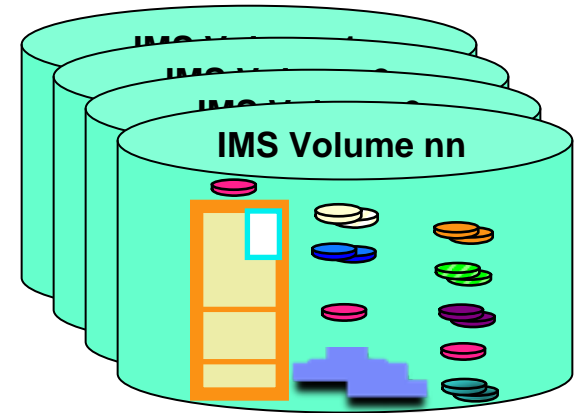
- Combined SLB created from IMS and DB2 volumes
 - Separate analysis is performed on IMS and DB2
 - Volumes combined under one Recovery Expert product
 - At Primary site, one SLB is created
 - One Flashcopy for all volumes (IMS & DB2)
 - At Remote site, after SLB is restored
 - IMS and DB2 are restarted individually
 - Restart with Dynamic Backout and Undo/Redo processing occur

IMS Recovery Expert

Production Site

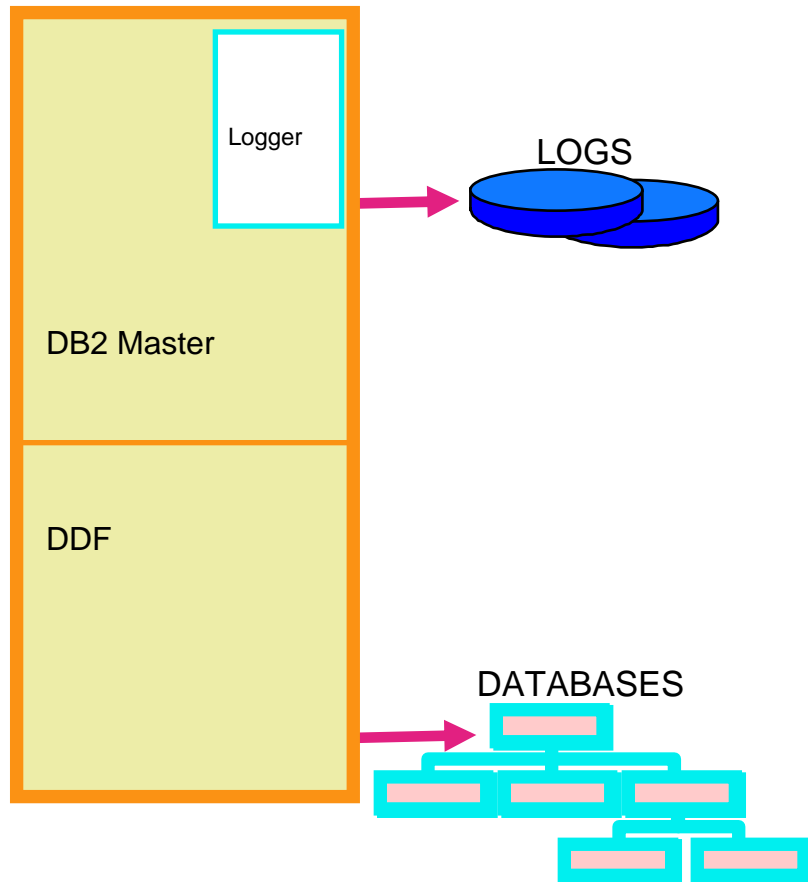


IMS System Analysis

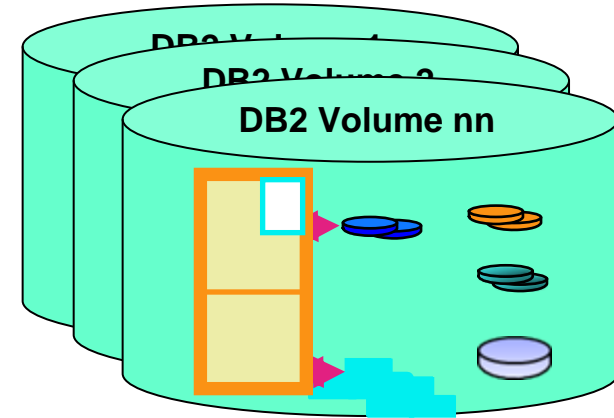
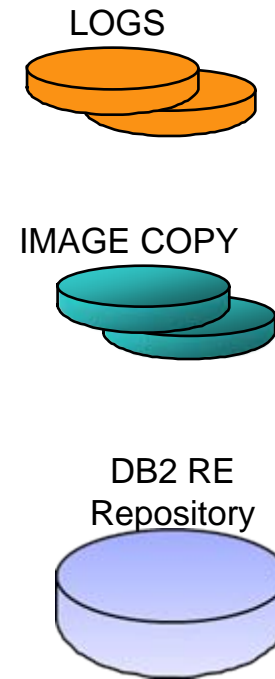


DB2 Recovery Expert

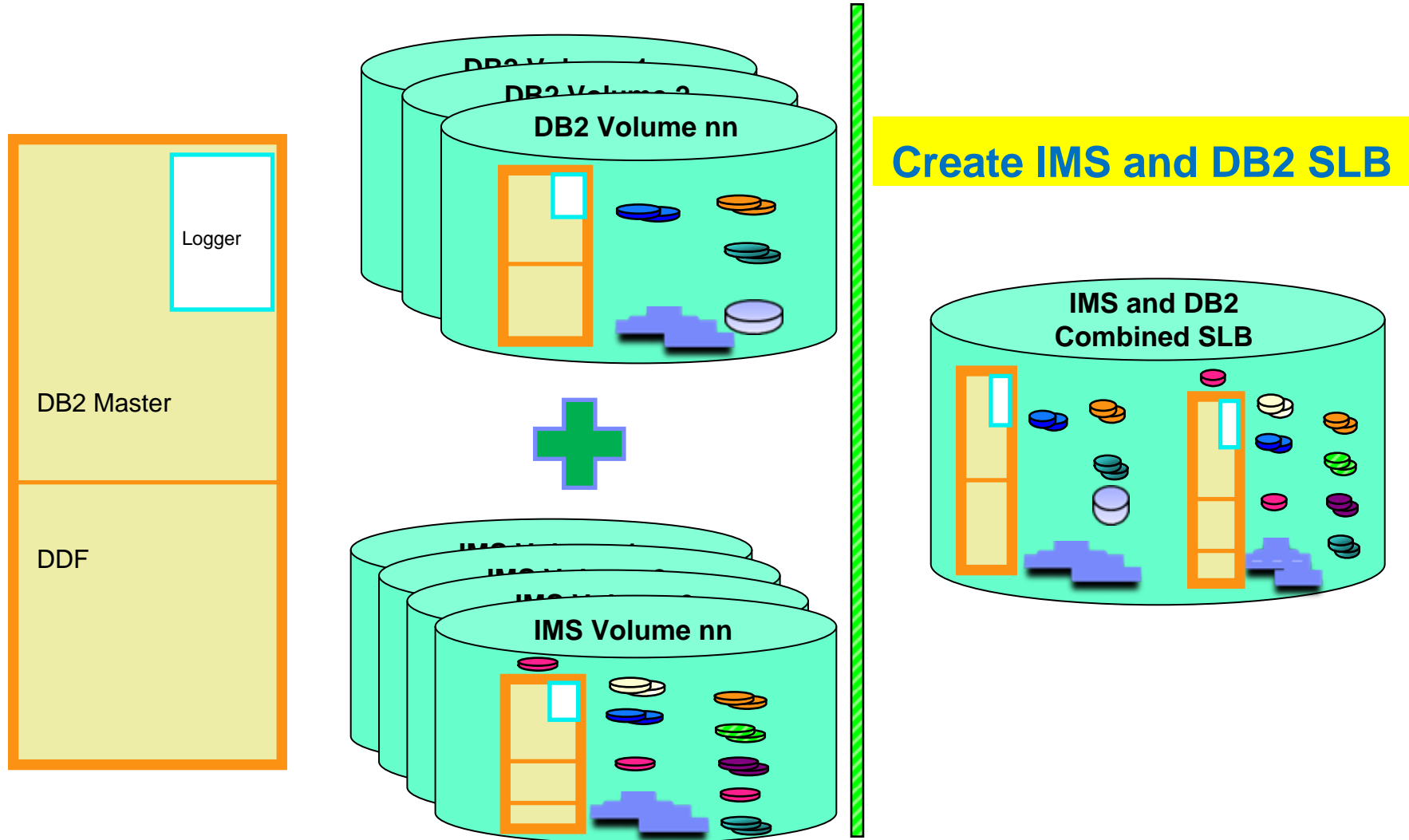
Production Site



DB2 System Analysis



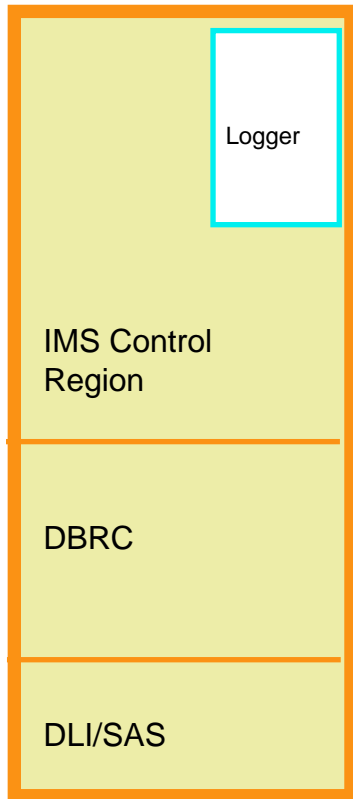
DB2 Recovery Expert or IMS Recovery Expert



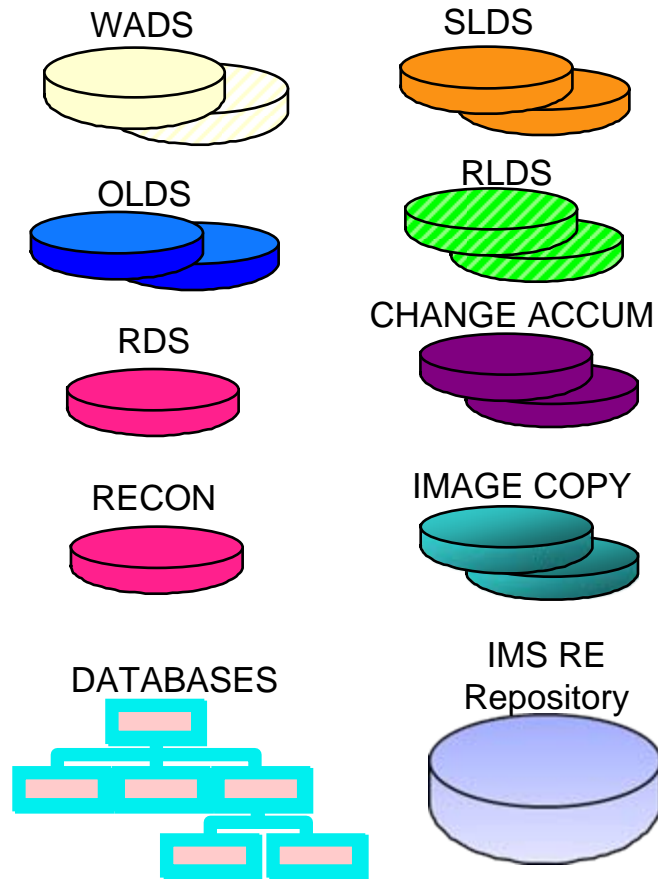
IMS Recovery Expert

Remote Site

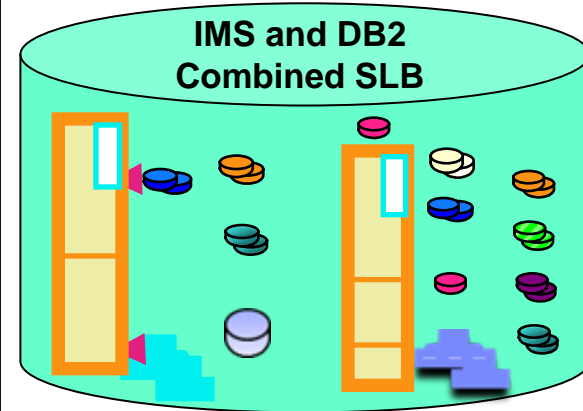
Restart IMS



Restore SLB

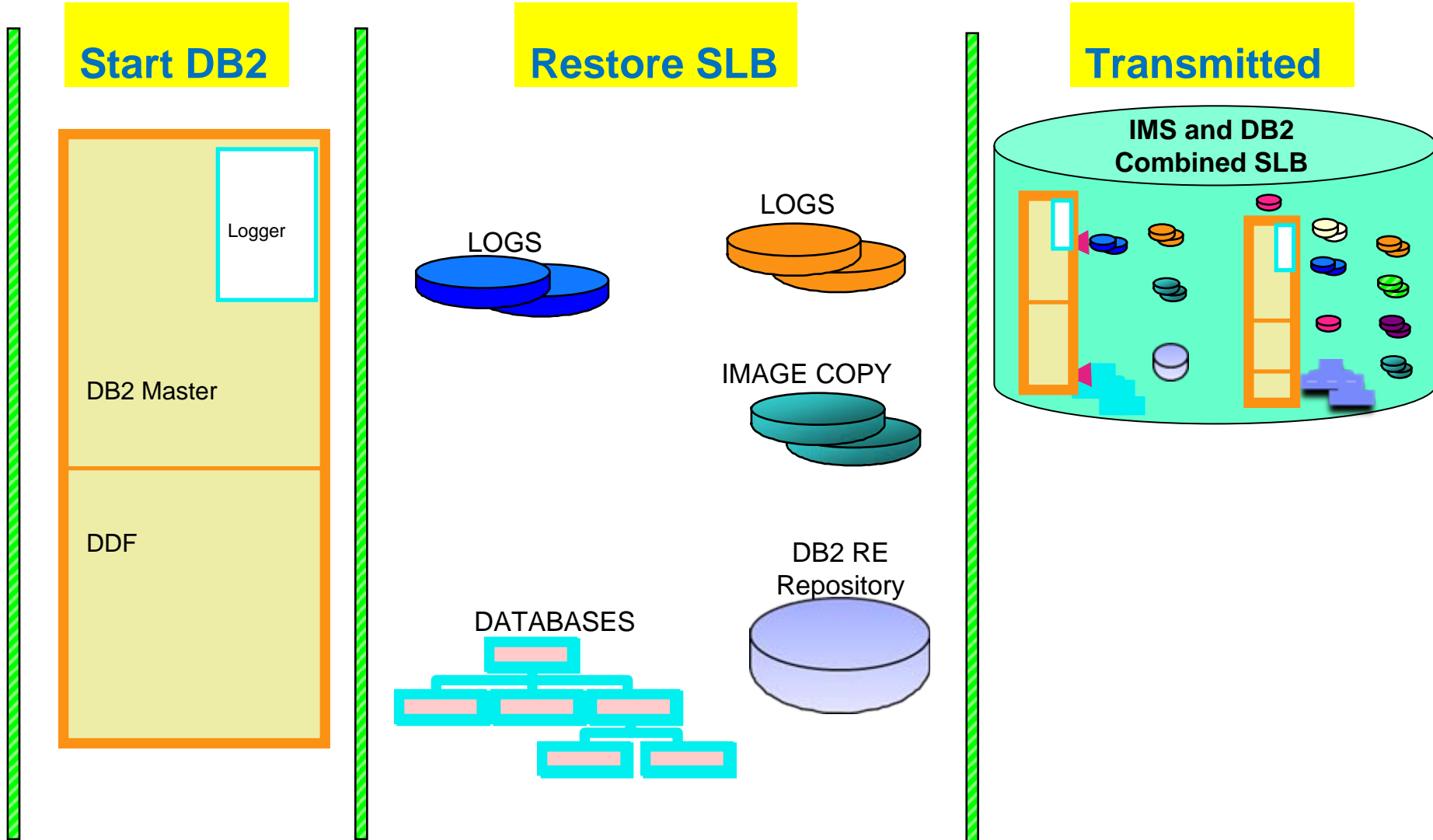


Transmitted



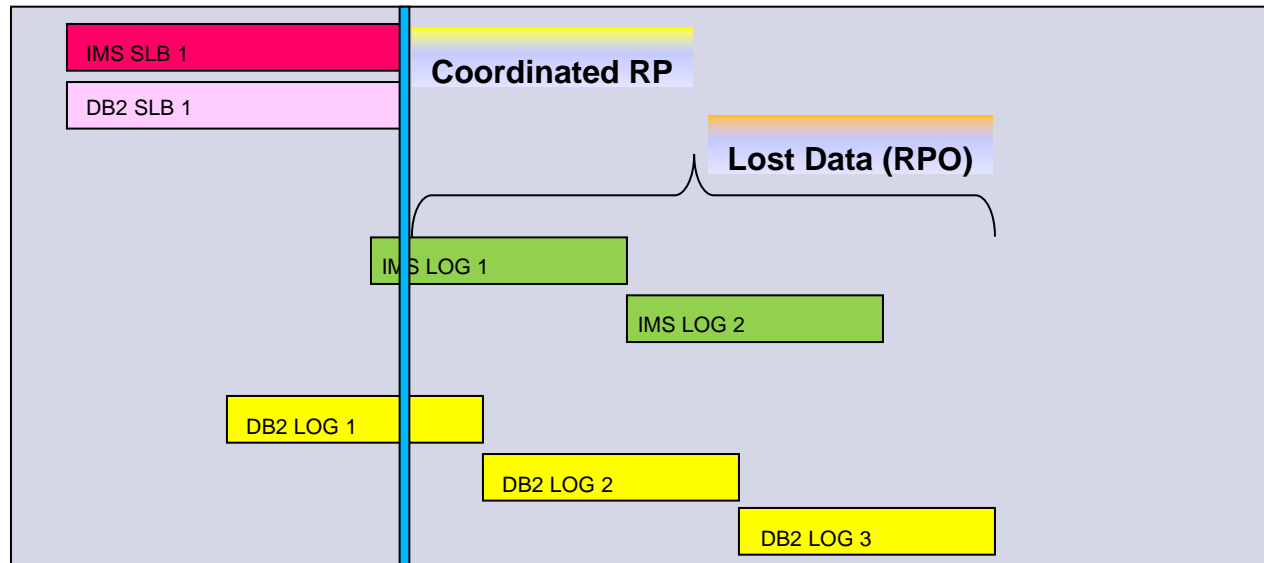
DB2 Recovery Expert

Remote Site



Coordinated IMS and DB2 DR: Combined SLB

- **Coordinated Recovery Point (RP)**
 - RPO = Changes Past the Last SLB



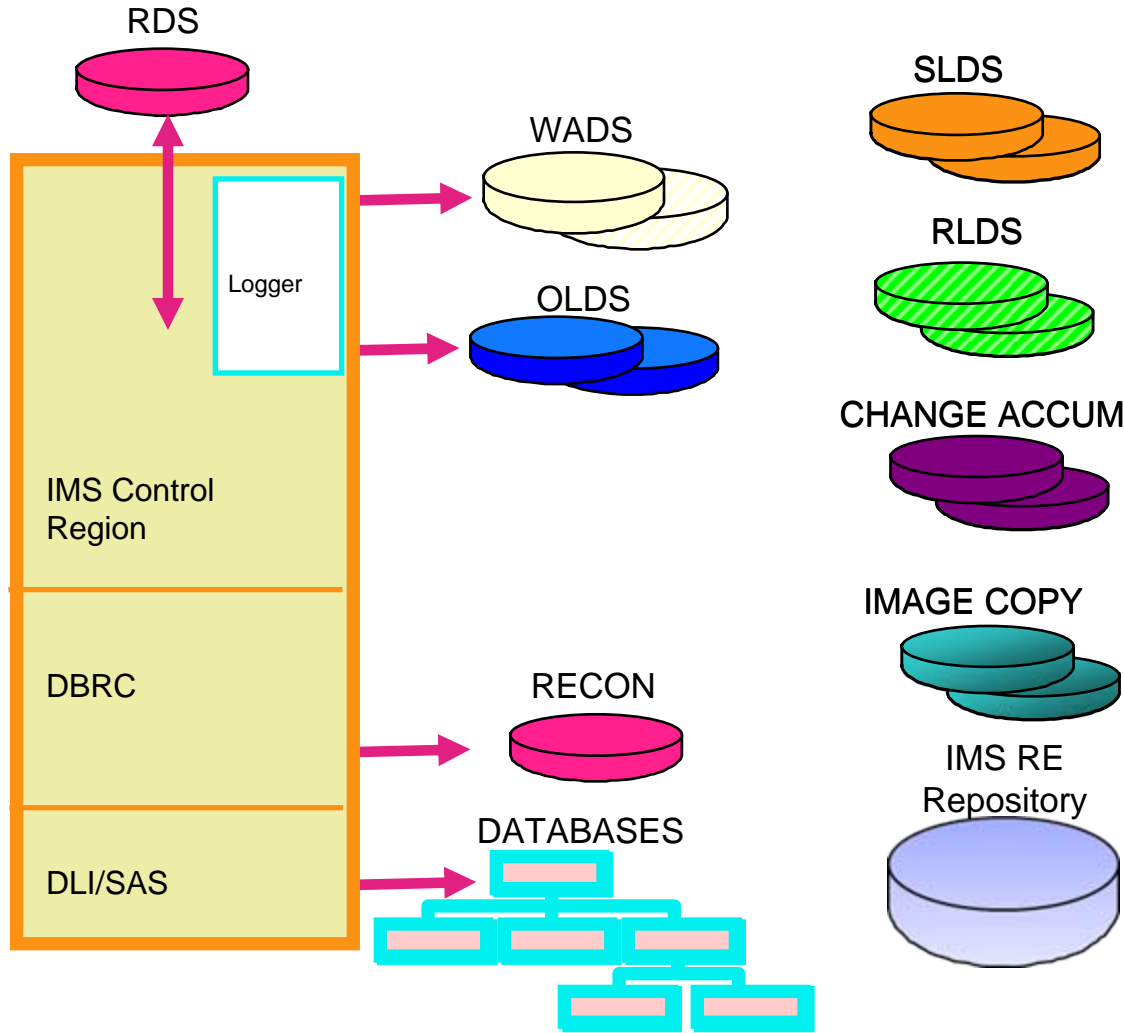
Coordinated IMS and DB2 DR Solutions

■ **Coordinated IMS and DB2 Recovery & Restart Solution**

- Separate SLBs created for IMS and DB2 volumes
 - Separate analysis is performed on IMS and DB2
 - At Primary site:
 - Separate SLB is created for IMS and for DB2
 - > Two Flashcopies for each set of volumes (IMS & DB2)
 - Archived logs are transmitted to remote site
 - > Log Timestamps are recorded in DR PDS
 - At Remote site:
 - IMS and DB2 SLBs are restored
 - Point In Time Recovery using timestamp in IMS and DB2 DR PDS
 - > Earlier of two timestamps in IMS and DB2 DR PDS
 - Start IMS and DB2 (No Backouts/Undos needed during restart)

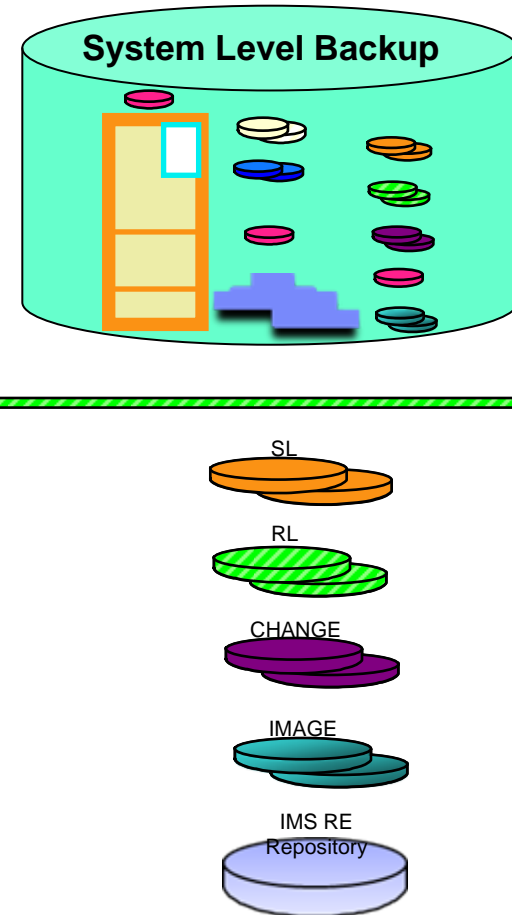
IMS Recovery Expert

Production Site



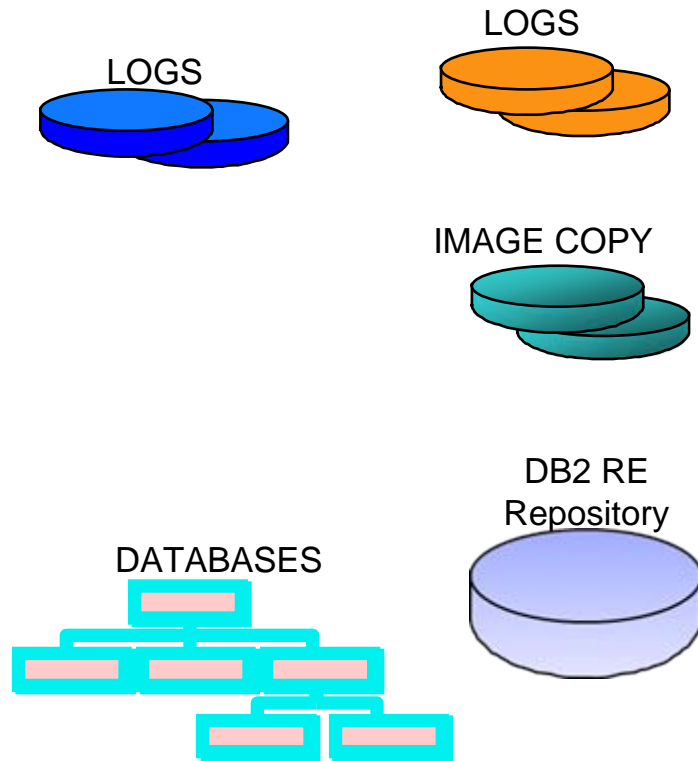
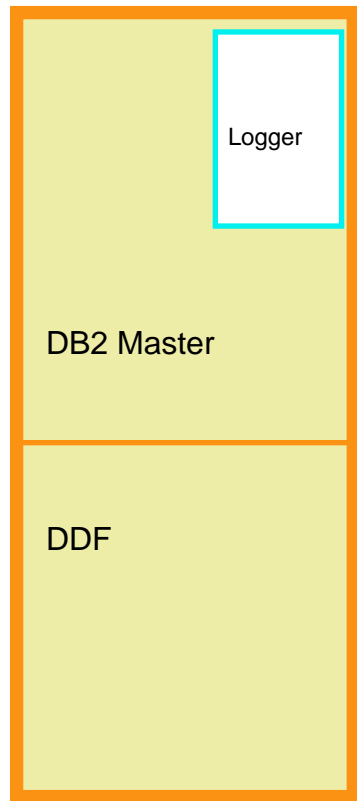
Remote Site

Transmitted



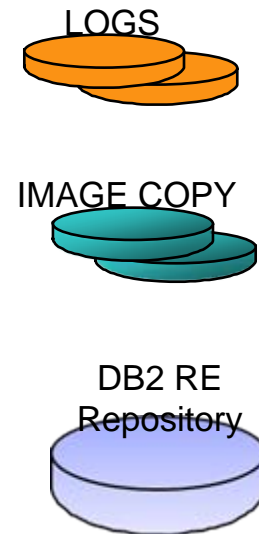
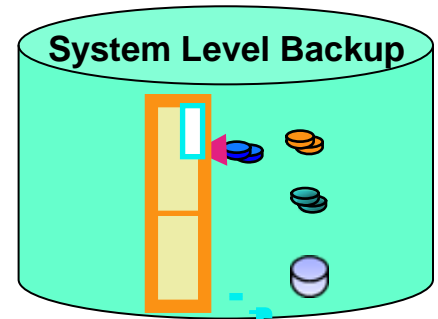
DB2 Recovery Expert

Production Site



Remote Site

Transmitted



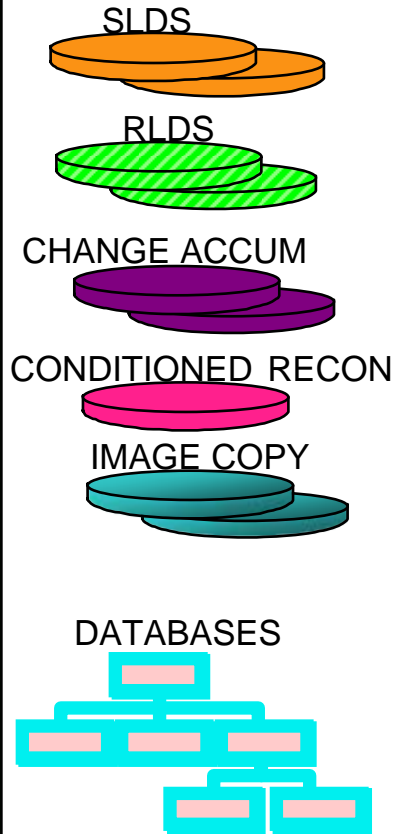
IMS Recovery Expert

Remote Site

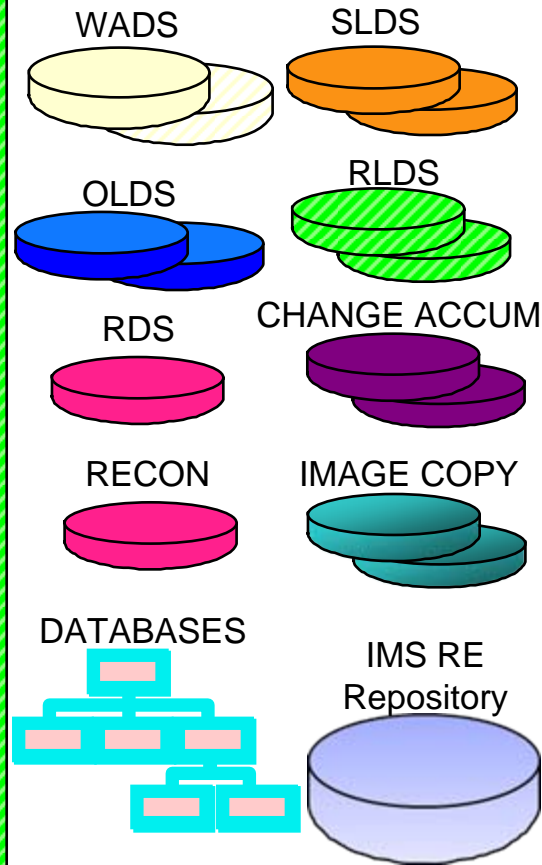
Start IMS



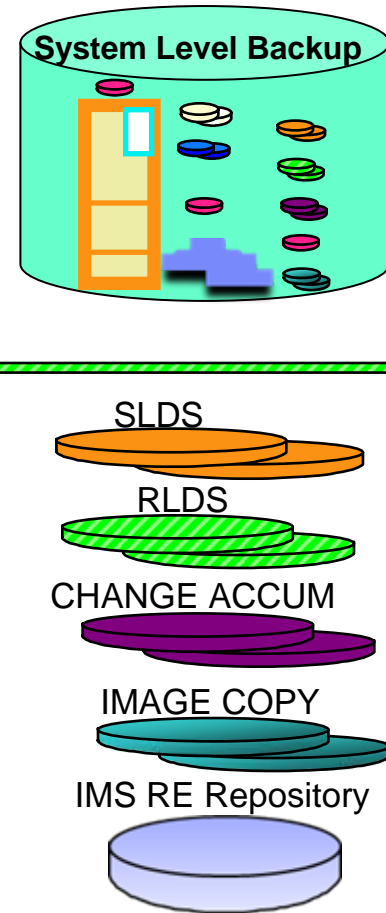
Recover DB



Restore SLB



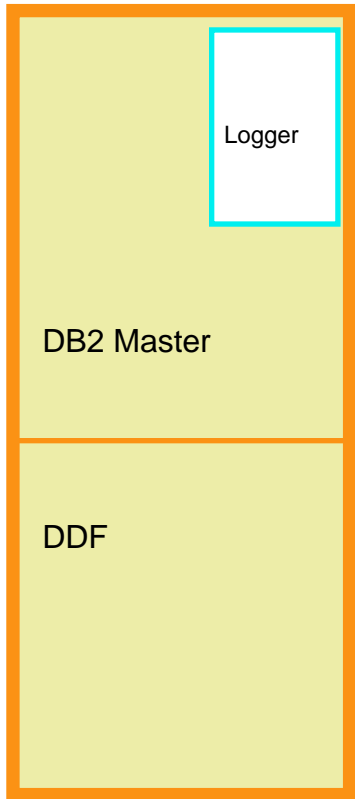
Transmitted



DB2 Recovery Expert

Remote Site

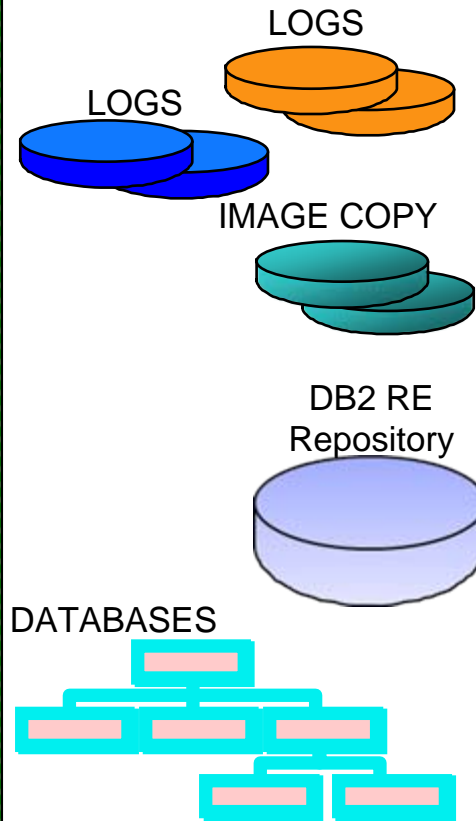
Start DB2



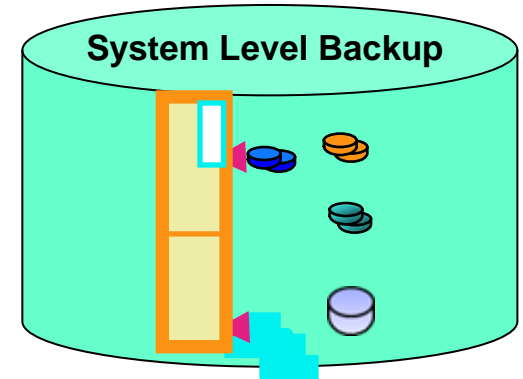
Recover DB



Restore SLB

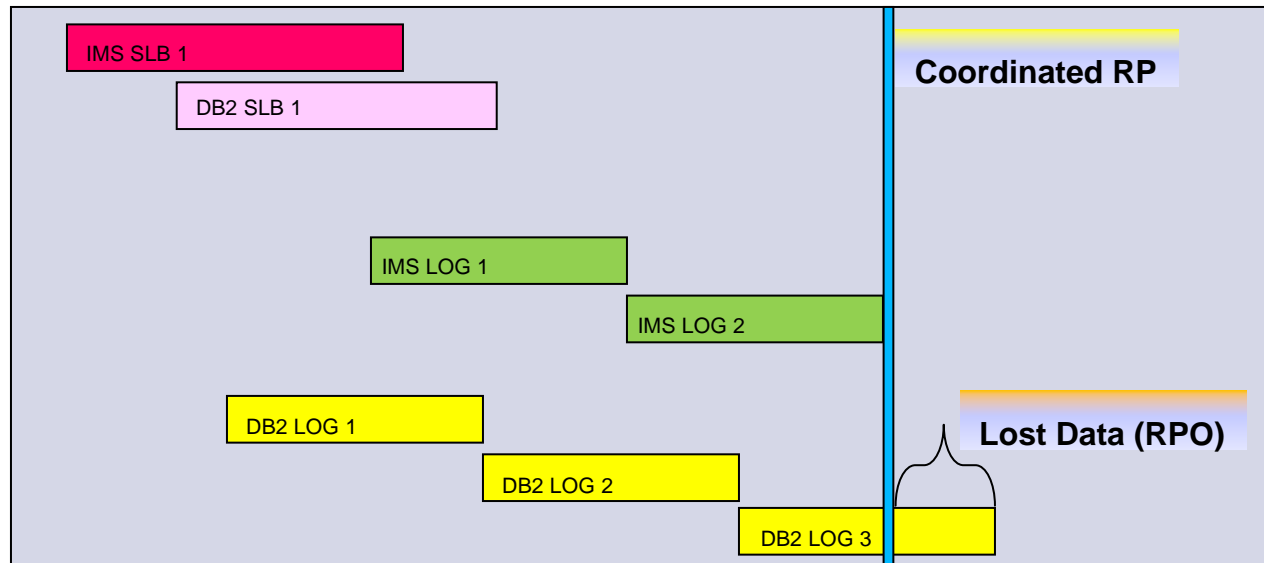


Transmitted



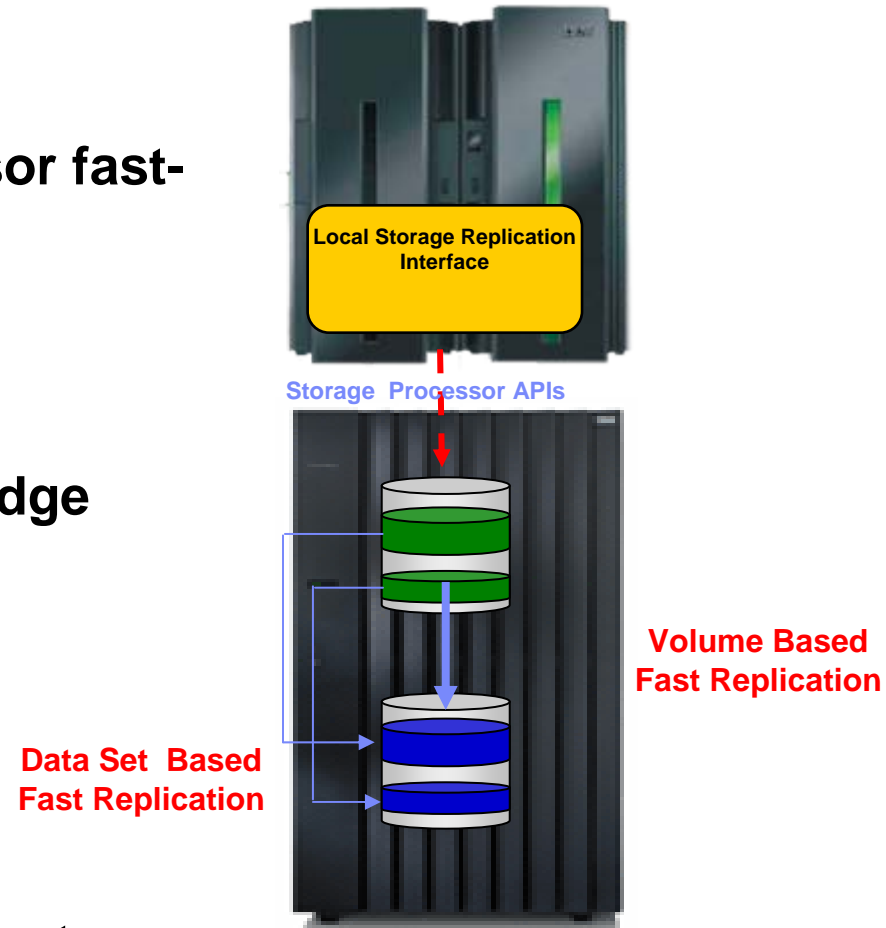
Coordinated IMS and DB2 DR: Separate SLB

- **Coordinated Recovery Point (RP)**
 - RPO = Changes Past the Coordinated RP
 - Requires application and business-cycle analysis
 - Determine how all data is interconnected and when batch jobs are run
 - Potential to add additional Recovery Points in future



Storage-Based Fast Replication

- **First product availability - late nineties**
 - Used to streamline batch processing
 - Speed backup processing
- **Data copied using storage processor fast-replication facilities**
 - Volume based
 - Dataset based
- **No application or database knowledge**
- **Examples**
 - EMC TimeFinder
 - IBM FlashCopy
 - HDS Shadow Image
- **Typically used by storage administrators**



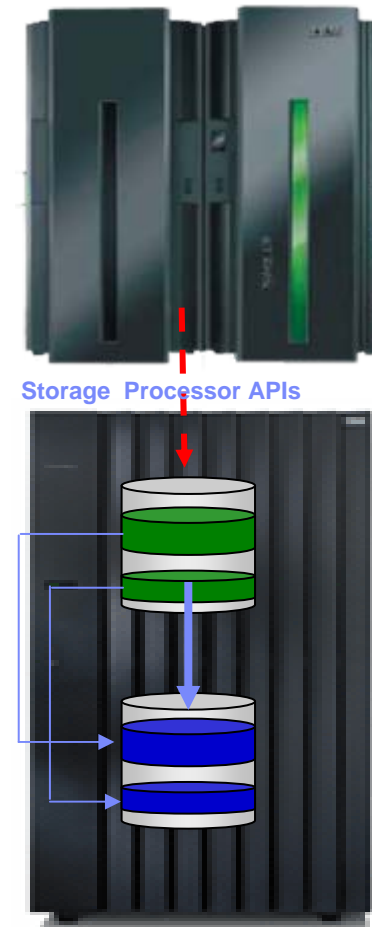
Fast Replication: Many Hardware Options

■ Volume Based Fast Replication

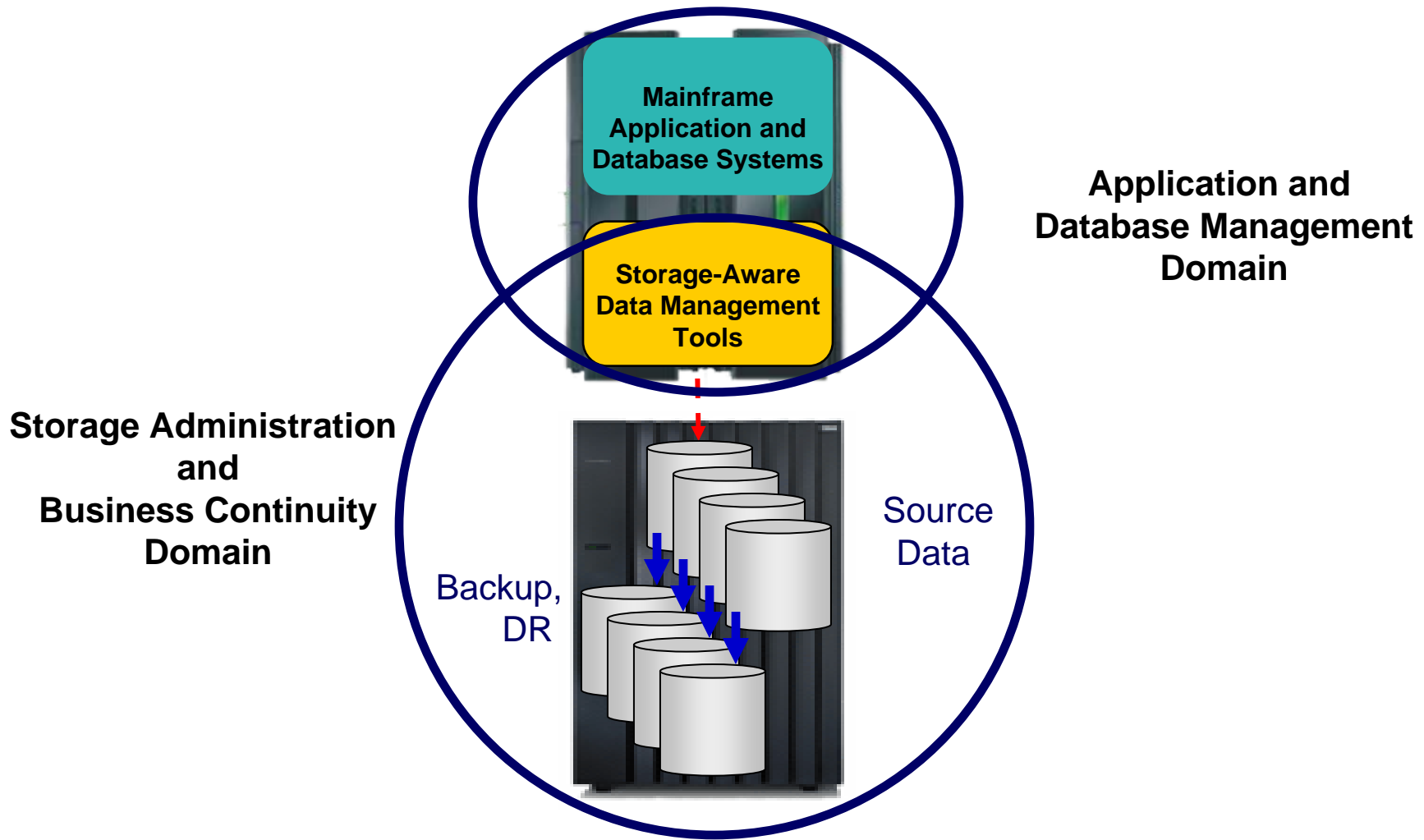
- FlashCopy (IBM,EMC,HDS)
- SnapShot (IBM,STK)
- TimeFinder/Clone Volume Snap (EMC)
- TimeFinder/Snap (EMC)
- Mirror processes
 - PPRC (IBM,EMC,HDS)
 - TimeFinder/Mirror, SRDF (EMC)
 - ShadowImage HUR (HDS)

■ Data Set Based Fast Replication

- Data Set FlashCopy (IBM,EMC,HDS)
- Data set SnapShot (IBM,STK)
- TimeFinder/Clone Data set Snap (EMC)



Application & Database Storage Integration



Storage-Based Consistency: Key to Coordinated SLB

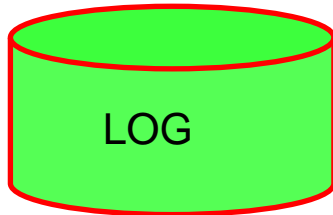
- **DBMS System**
 - Provides dependent writes for database updates

- **Storage-Based Flashcopy for Consistency Group**
 - Provides consistency for set of volumes

- **Coordinated Disaster Recovery**
 - Requires DBMS to order the log and database updates
 - Requires Storage processors to ensure volume consistency

IMS Dependent Writes

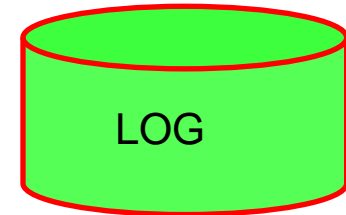
Full Function Commit and Backout Process



(1) Log "Before and After Image"
(Segment, Pointers, Freespace)



(2) Update Database

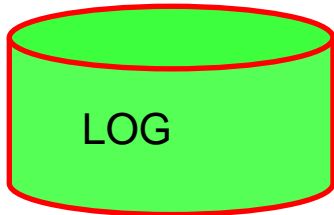


(3) Log "Commit"

Updates Completed	Dynamic Backout Required
Log (1)	Use "Before Image" from Log (1)
Log (1) + DB (2)	Use "Before Image" from Log (1)
Log (1) + DB (2) + Log (3)	No Backout, Update Committed

IMS Dependent Writes

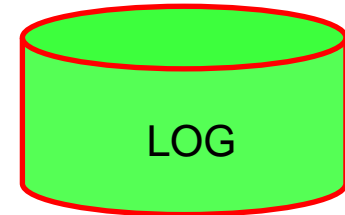
Fast Path Commit and REDO Process



(1) Log "After Image"
(2) Log "Commit"



(3) Update Database using
output thread processing

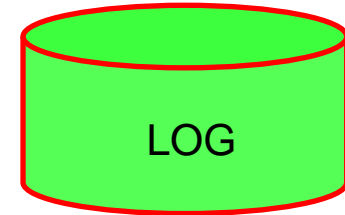
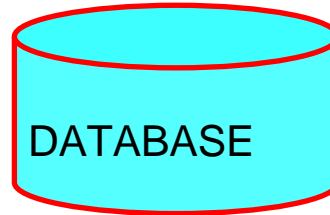
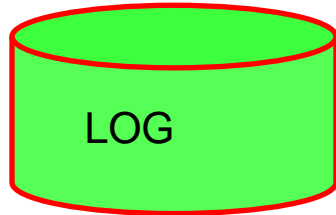


(4) Log "Output Thread Completed"

Updates Completed	Fast Path REDO Required
Log (1)	No REDO, Update <i>not</i> Committed
Log (1) + Log (2)	Use "After Image" to COMMIT (REDO)
Log (1) + Log (2) + DB (3)	Use "After Image" to COMMIT (REDO)
Log (1) + Log (2) + DB (3) + Log (4)	No REDO, Update <i>was</i> Committed

DB2 Dependent Writes

DB2 Commit and UNDO/REDO Process



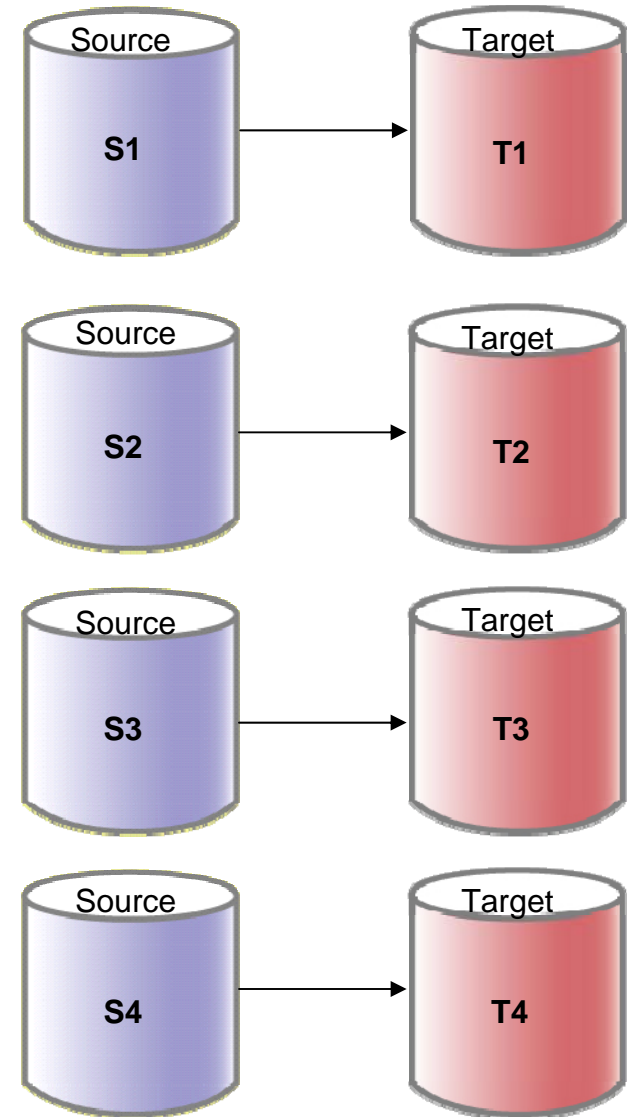
(1) Log "Change Information"
(2) Log "Commit" or "Abort"

(3) Update Buffer Pool or Database
(4) Log "Commit Completed"

Updates Completed	DB2 UNDO/REDO Required
Log (1)	No UNDO or REDO, Update not Committed
Log (1) + Log (2)	Use "Change Information" with REDO or use "Change Information with UNDO"
Log (1) + Log (2) + DB (3)	Use "Change Information" with REDO or use "Change Information with UNDO"
Log (1) + Log (2) + DB (3) + Log (4)	No UNDO or REDO, Update was Committed

Consistency Group FlashCopy

- **FlashCopy S1 to T1**
 - Writes can not proceed on S1
 - Any writes occurring on S2-S4 can not be dependent writes
- **FlashCopy S2 to T2**
 - Writes can not proceed on S1 or S2
 - Any writes occurring on S3-S4 can not be dependent writes
- **FlashCopy S3 to T3 and S4 to T4**
- **T1-T4 contain a consistent copy**
- **Unfreeze Flashcopy**
 - Writes may proceed on S1-S4



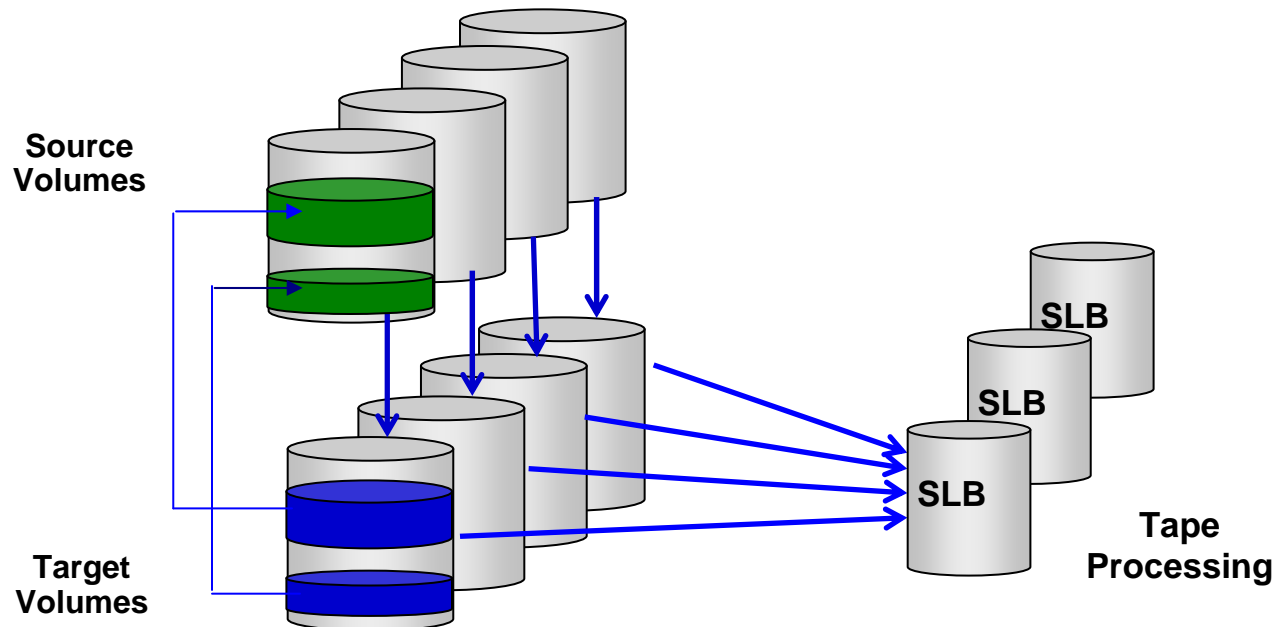
IMS and DB2 Recovery Expert: SLB

- **IMS and DB2 Recovery Expert features:**
 - Environment discovery and configuration management
 - IMS System Level Backup includes:
 - Active and archive logs
 - RECONs
 - All IMS database data sets
 - IMS system data sets (ex. ACBLIBs, DBDLIBs, PGMLIBs, etc.)
 - All associated ICF User catalogs
 - DB2 System Level Backup includes:
 - Active and archive logs
 - Bootstrap Data Set
 - All DB2 database data sets
 - DB2 system data sets (ex. Loadlib)
 - All associated ICF User catalogs
 - IMS and DB2 volumes need to be separate from each other

IMS and DB2 Recovery Expert: SLB

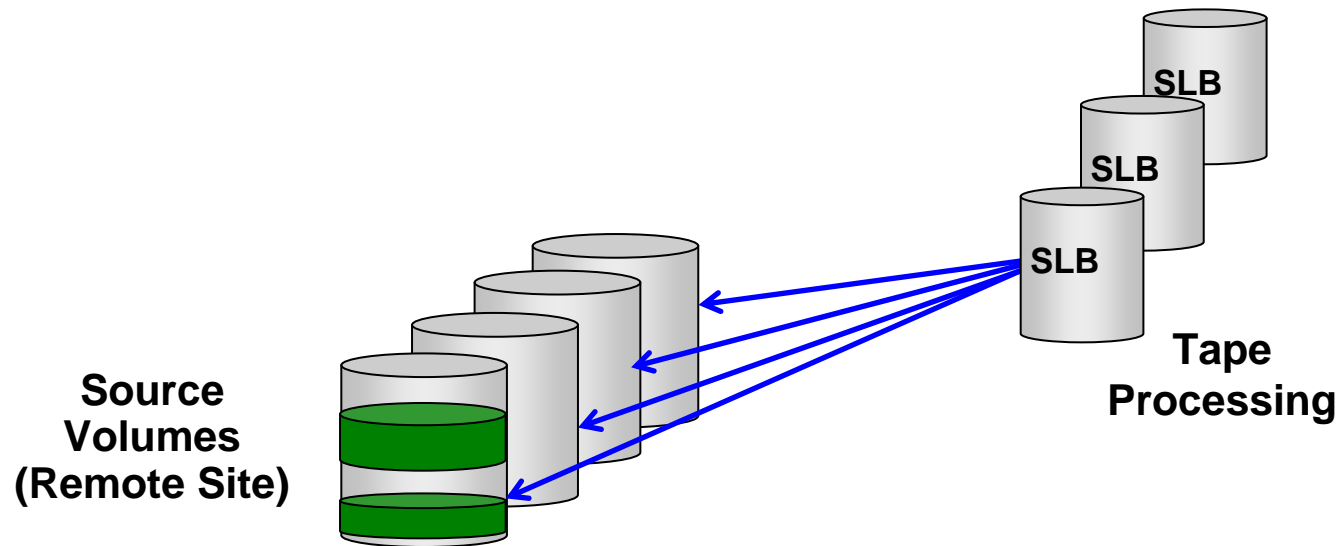
■ System Level Backup (SLB)

- Backs up entire DBMS production environment
 - Records SLB in IMS Recovery Expert Repository
- Leverages Storage-Based Volume Fast Replication
 - Uses FlashCopy for a Consistency Group
 - Data is dependent-write consistent
- Multiple SLBs can be offloaded to tape for remote site



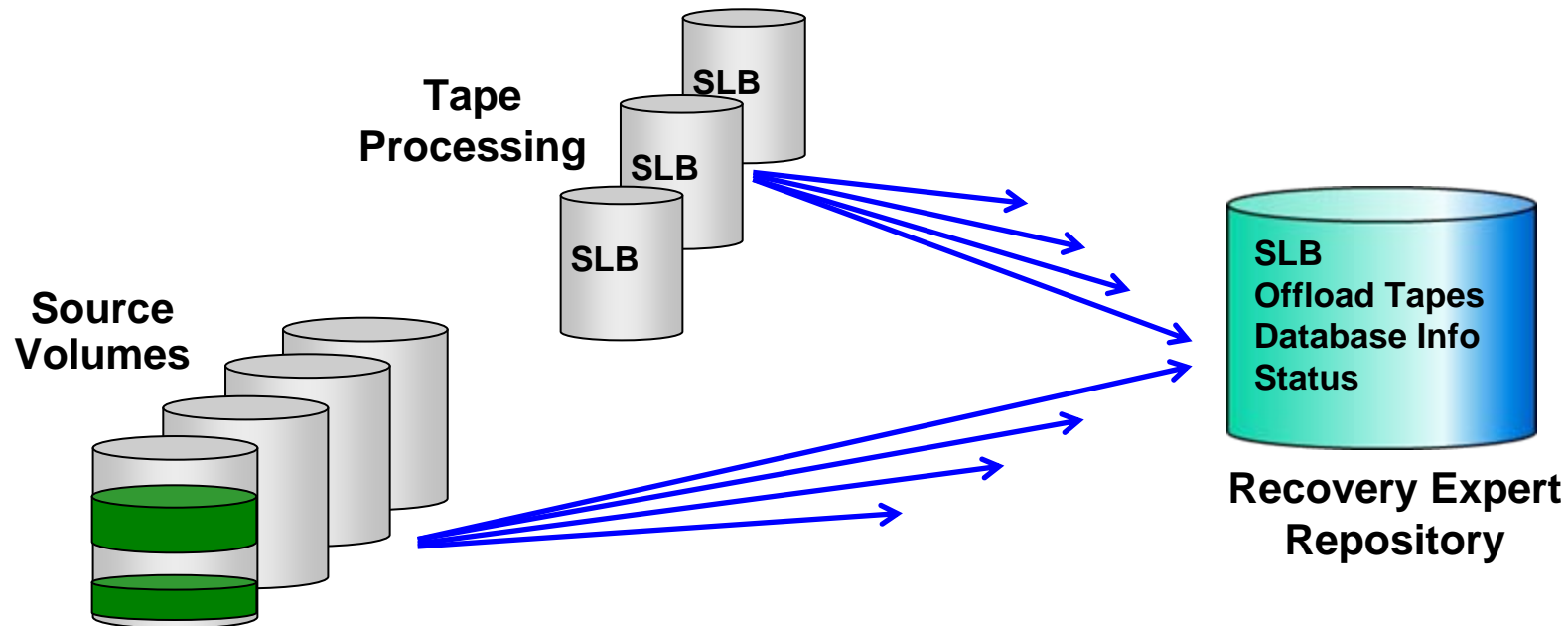
IMS and DB2 Recovery Expert: SLB Restore

- **Restoring the SLB**
 - System Level Backup is restored from disk or tape
 - Coordinated parallel restore operations
 - Restore is based on offload characteristics



IMS and DB2 Recovery Expert: Repository

- **IMS Recovery Expert and DB2 Recovery Expert have own Repository**
 - Store information on SLBs created
 - Track database characteristics and status
 - HALDB, Fast Path EEQEs, Volume, Recovery Needed Status, Tablespaces, etc.
 - SLB and Offloading Tape information
 - Needed at remote site for restart and recovery



Coordinated IMS and DB2 DR: Benefits

- **IMS Recovery Expert and DB2 Recovery Expert:**
 - Guaranteed Recoverability
 - New volumes discovered during SLB creation are automatically mapped
 - Validates recovery resources when IMS and DB2 systems are healthy
 - Procedures are consistent for both IMS and DB2
 - Less “human error” during disaster recovery event
 - Same jobs used for creating SLB for IMS and DB2
 - Same dataset used to transport recovery jobs to remote site
 - Same ISPF user interface for IMS and DB2 Recovery Expert

- **IMS Recovery Solution Pack:**
 - IMS Point-In-Time-Recovery to a Coordinated Timestamp with DB2
 - Parallel log apply with one pass of log data sets

IBM Disaster Recovery Solutions: Summary

■ **IMS *Recovery* Solutions**

- IMS databases are recovered using image copies and/or logs
 - IMS Full Database recovery or IMS Timestamp recovery

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- IMS system and databases are mirrored to remote site
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■ ***Coordinated* IMS and DB2 *Restart* Solution**

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