Coordinated DR for IMS and DB2

Session Number 1378

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IBM Software
Information On Demand 2011

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

Recovery vs. Restart: Comparison

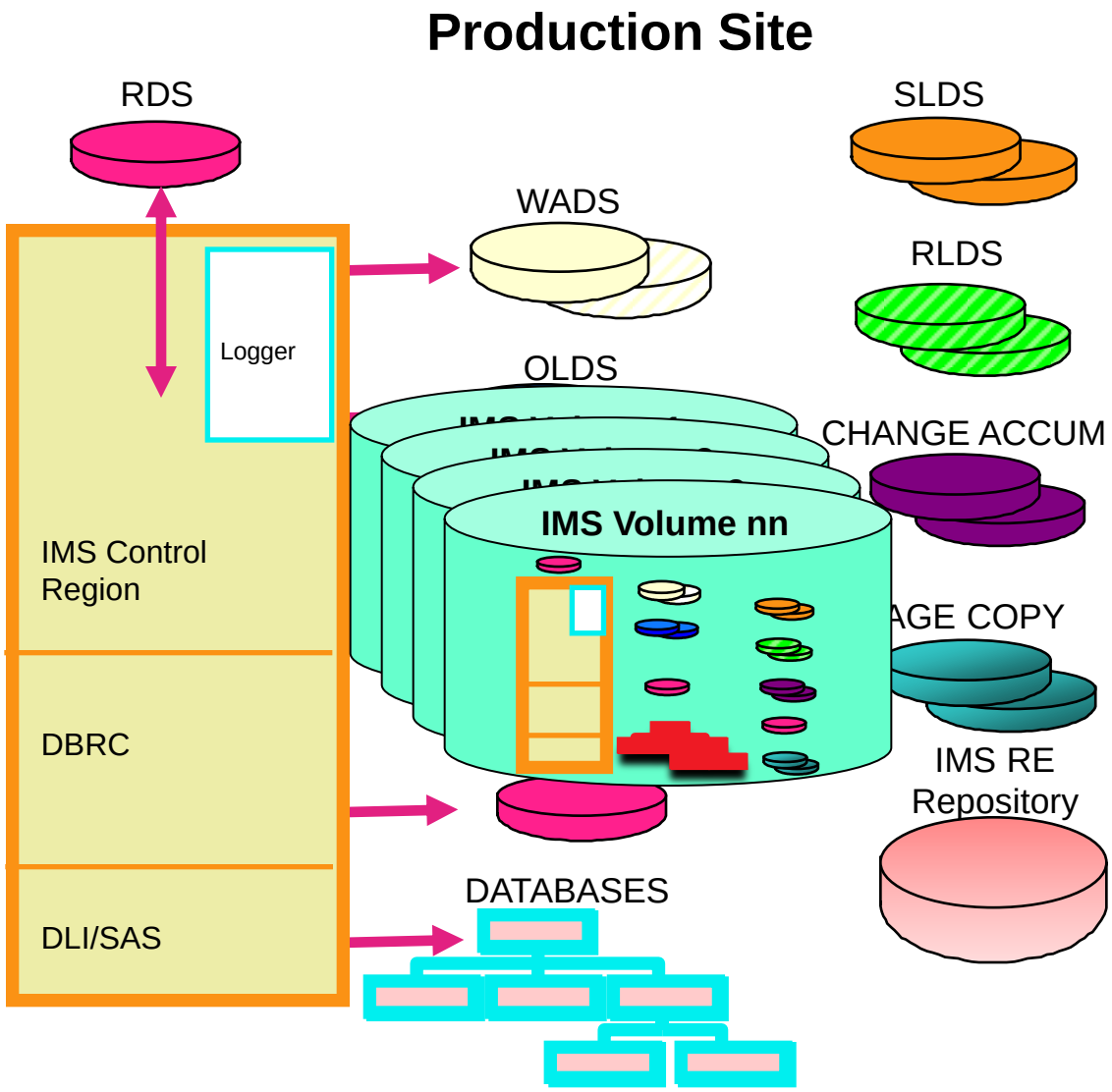
- *Coordinated* IMS and DB2 *DR* Solutions
  - RTO is low based on:
    - Performance of Storage-Based Fast Replication
    - Volumes are restored from the SLB at the remote site
    - Databases are recovered in parallel in one pass of logs
  - RPO is medium based on:
    - Frequency of SLB creation 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

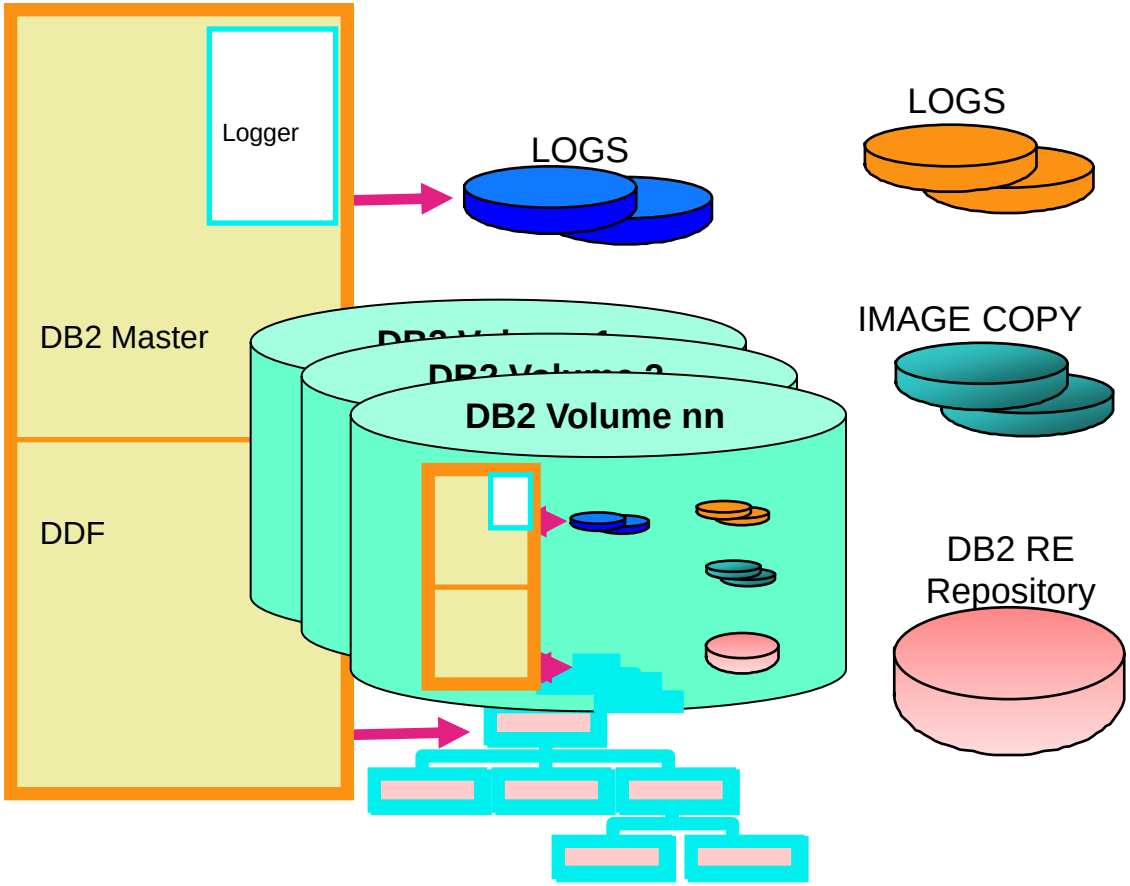
IMS System Analysis



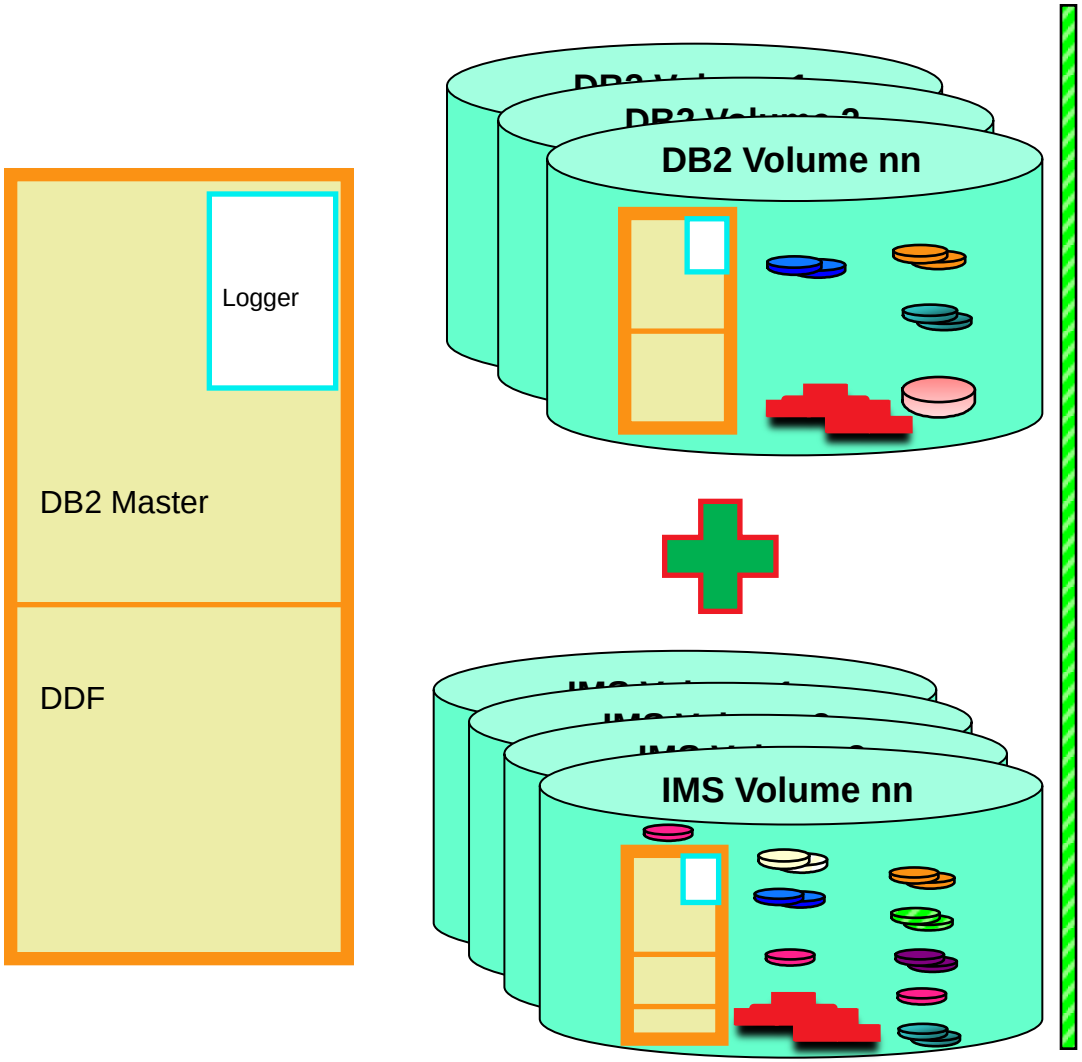
DB2 Recovery Expert

Production Site

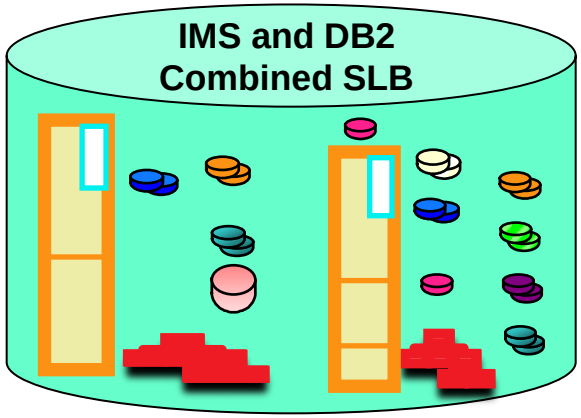
DB2 System Analysis



DB2 Recovery Expert or IMS Recovery Expert



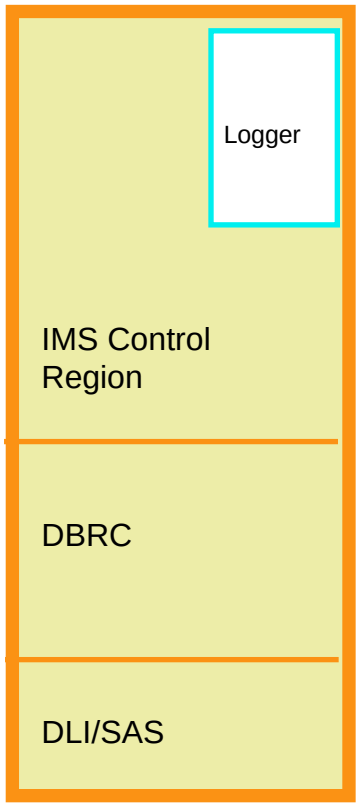
Create IMS and DB2 SLB



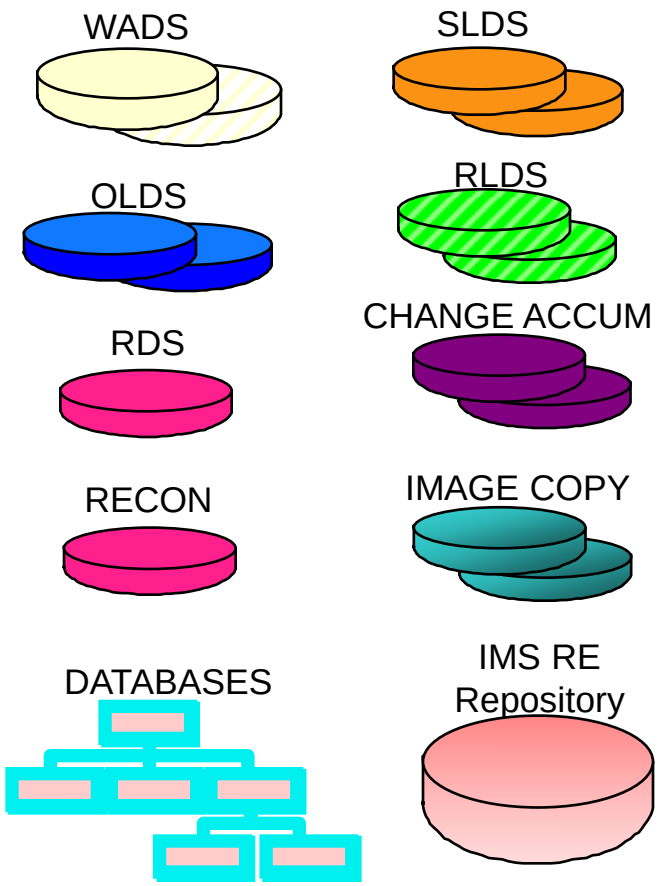
IMS Recovery Expert

Remote Site

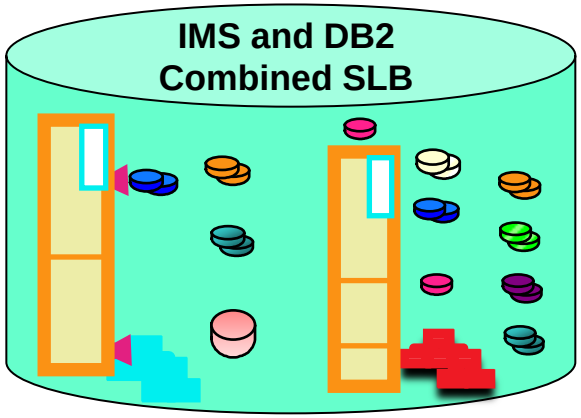
Restart IMS



Restore SLB



Transmitted



DB2 Recovery Expert

Remote Site

Start DB2

Logger

DB2 Master

DDF

Restore SLB

LOGS

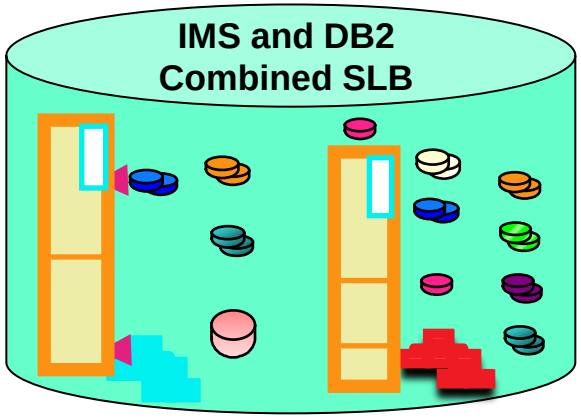
LOGS

IMAGE COPY

DB2 RE Repository

DATABASES

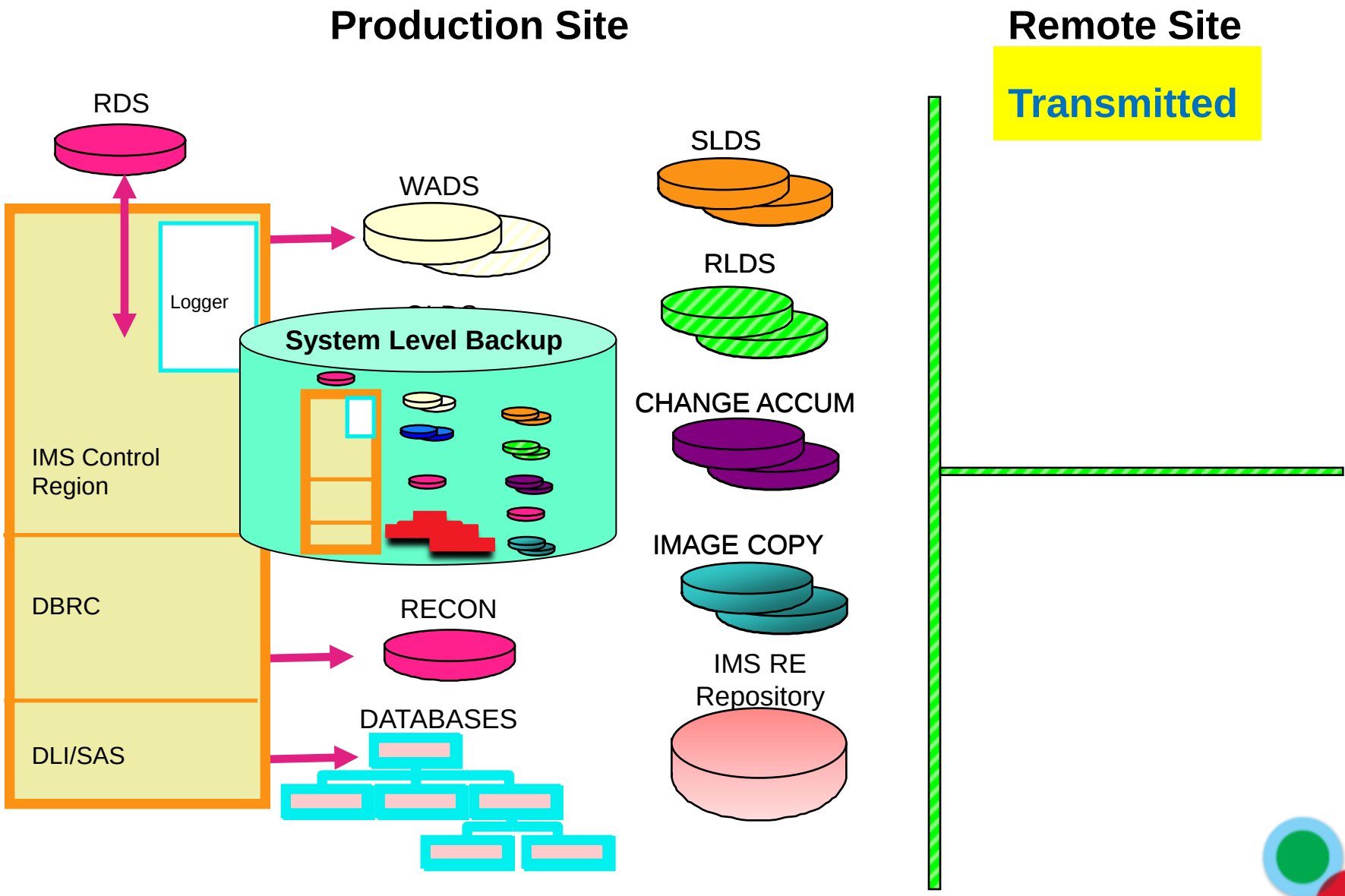
Transmitted



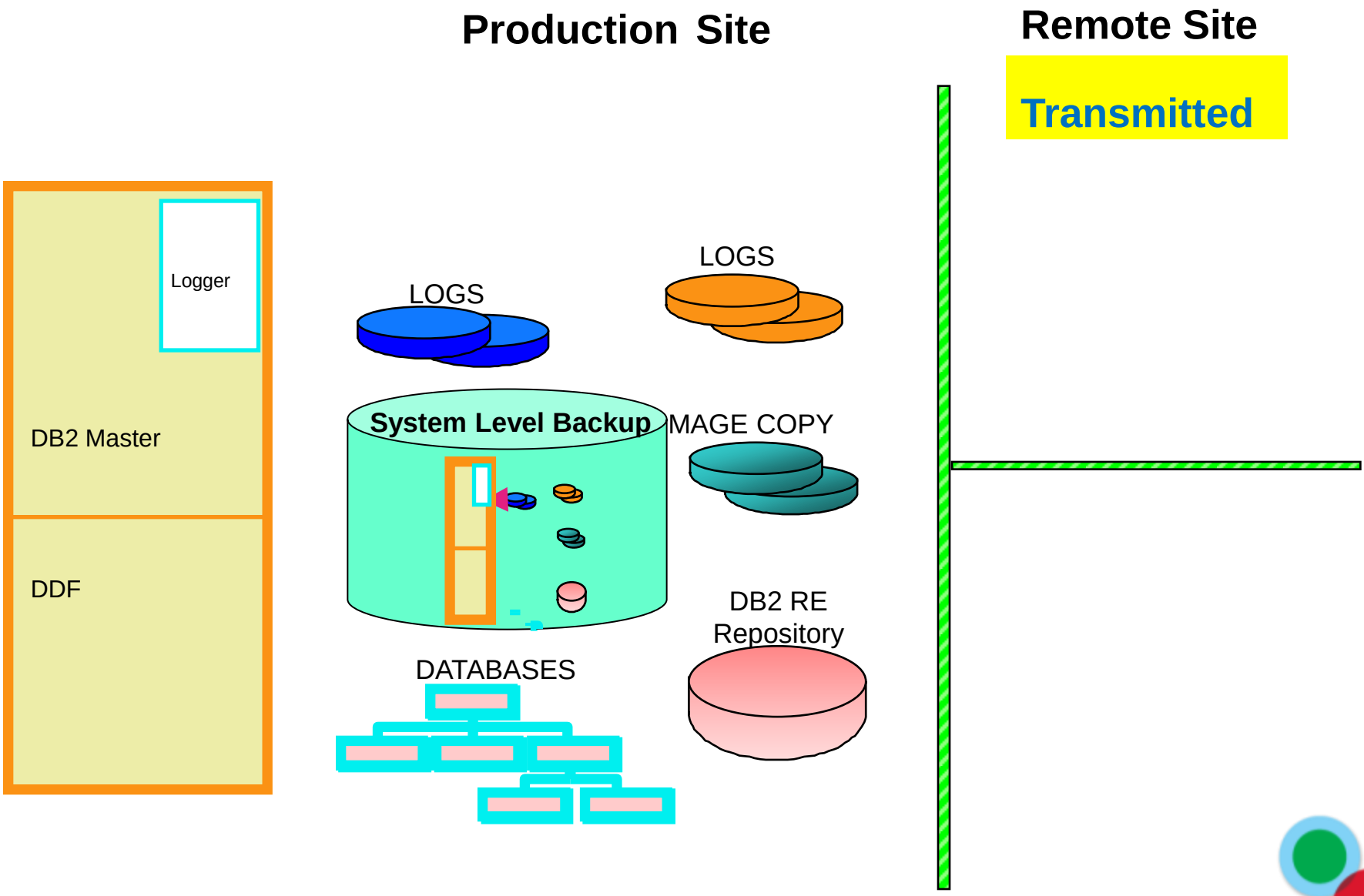
Coordinated IMS and DB2 DR Solutions

- *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

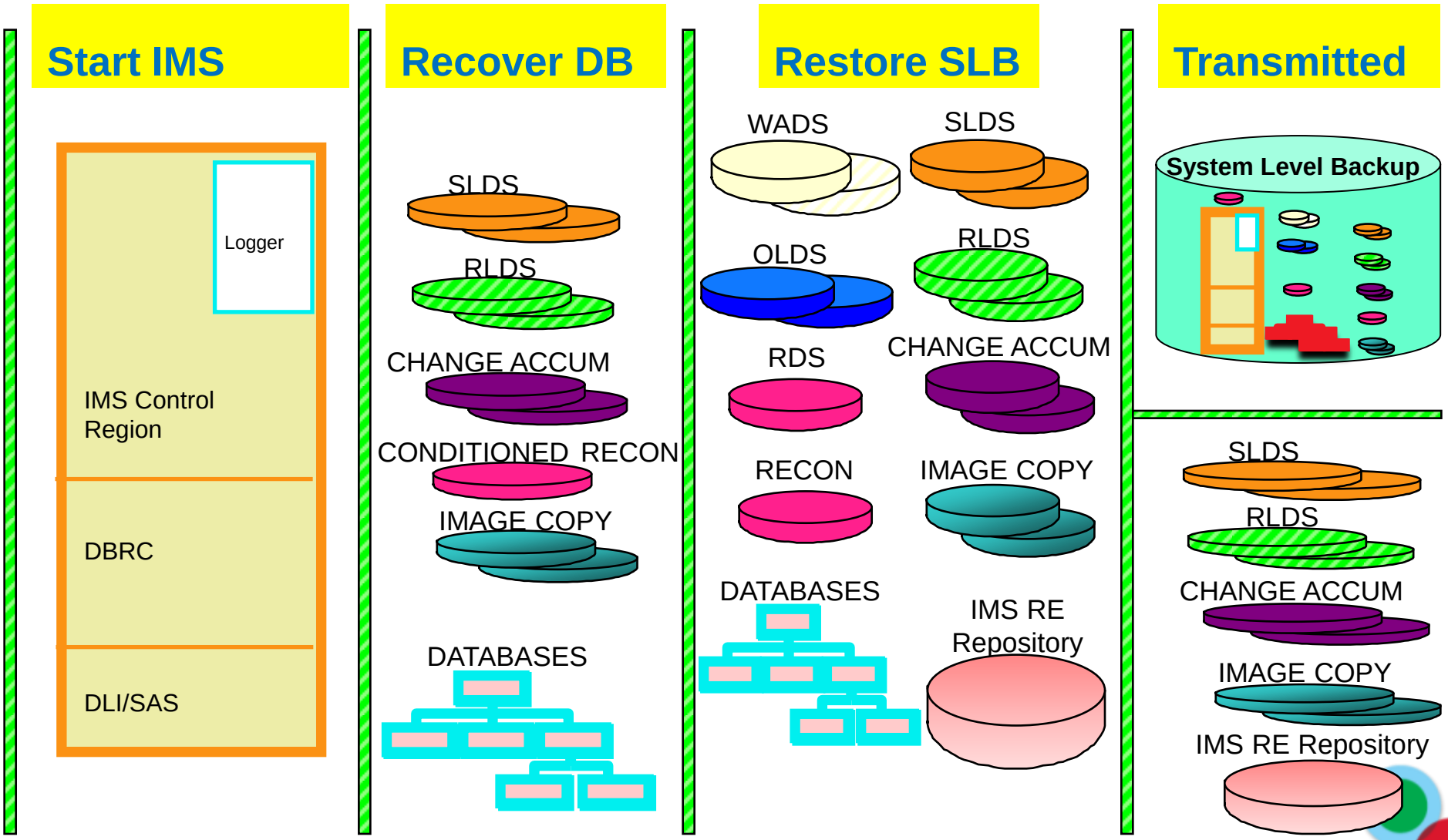


DB2 Recovery Expert

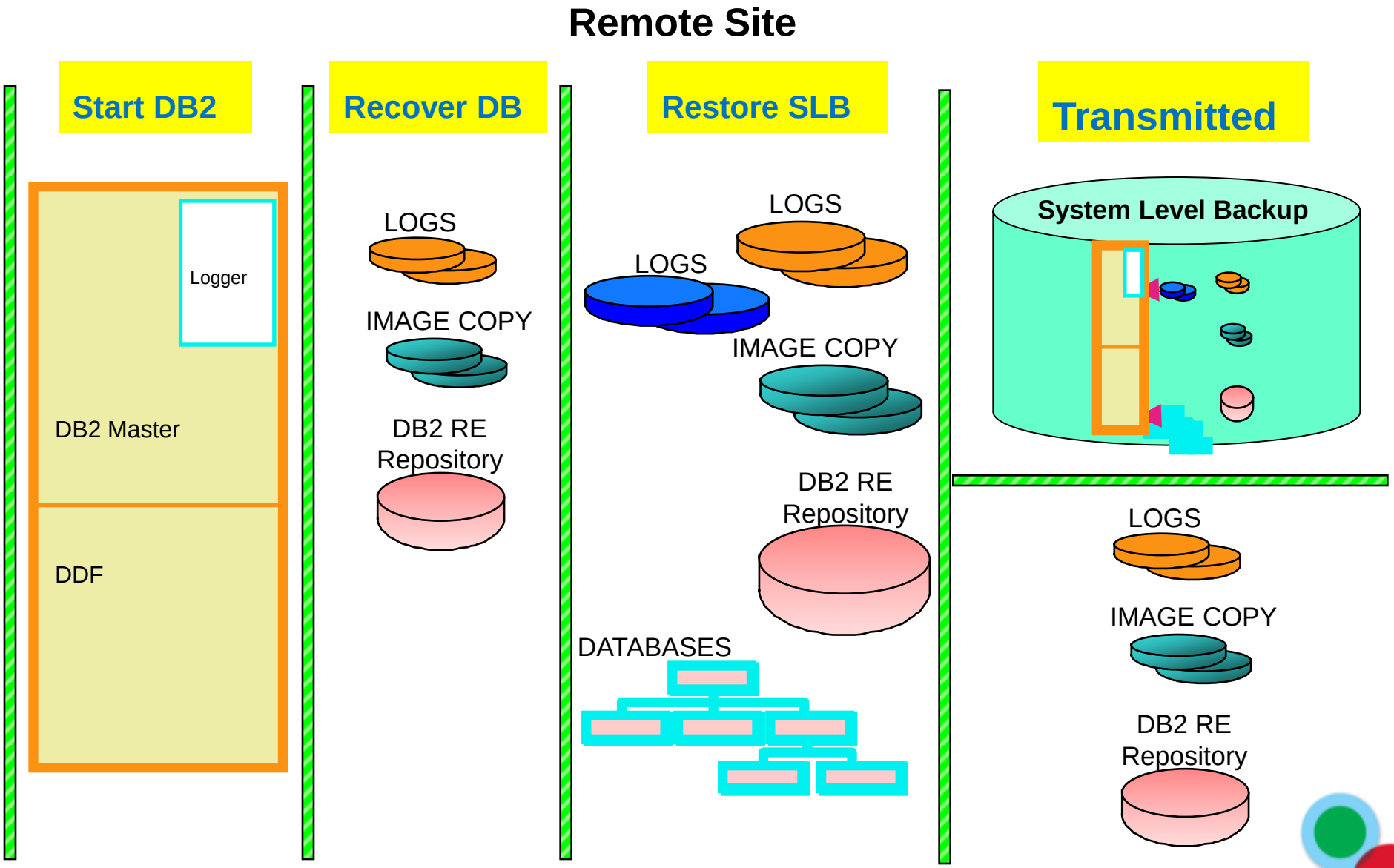


IMS Recovery Expert

Remote Site



DB2 Recovery Expert

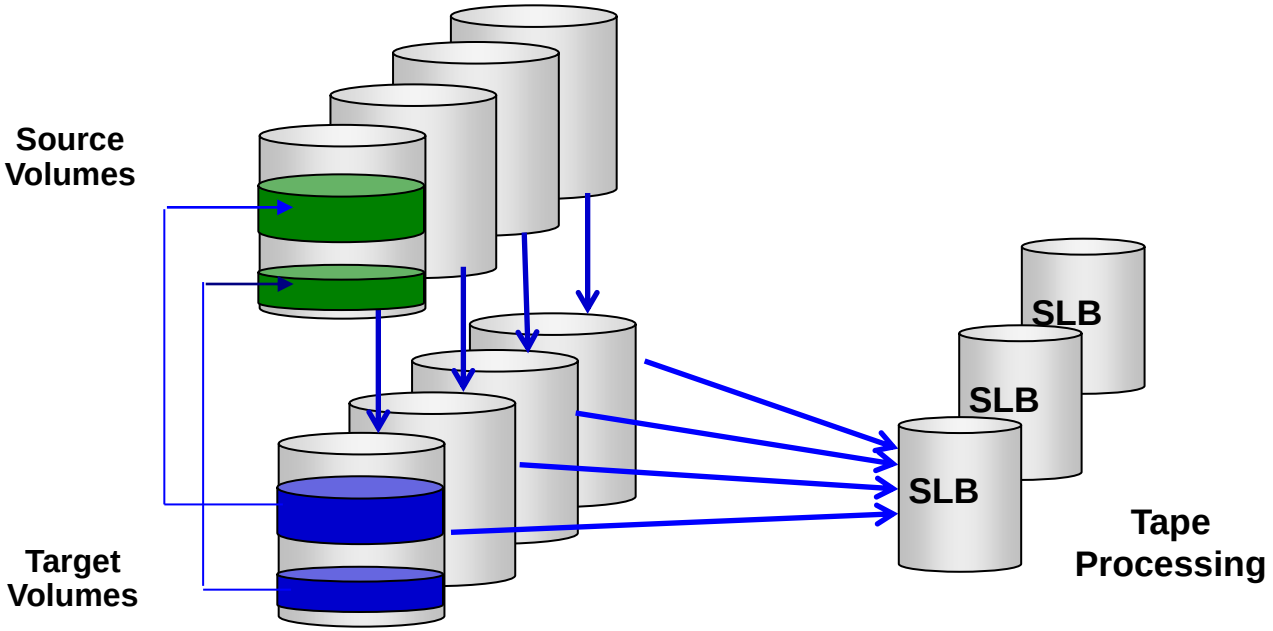


IMS and DB2 Recovery Expert: SLB

- 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

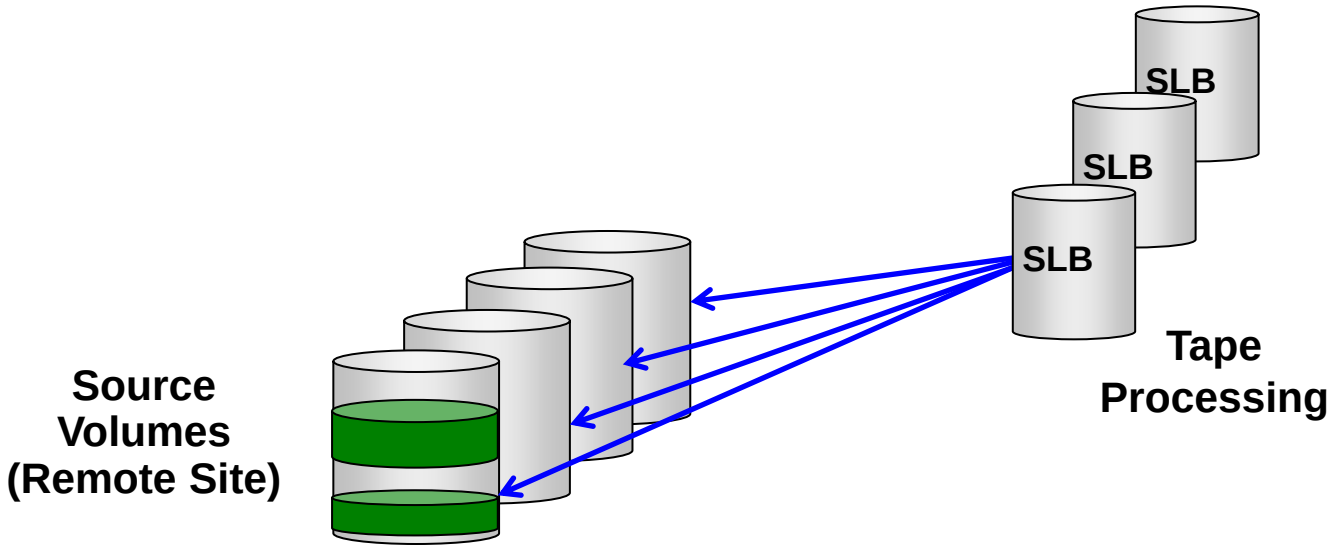
IMS and DB2 Recovery Expert: SLB

- 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



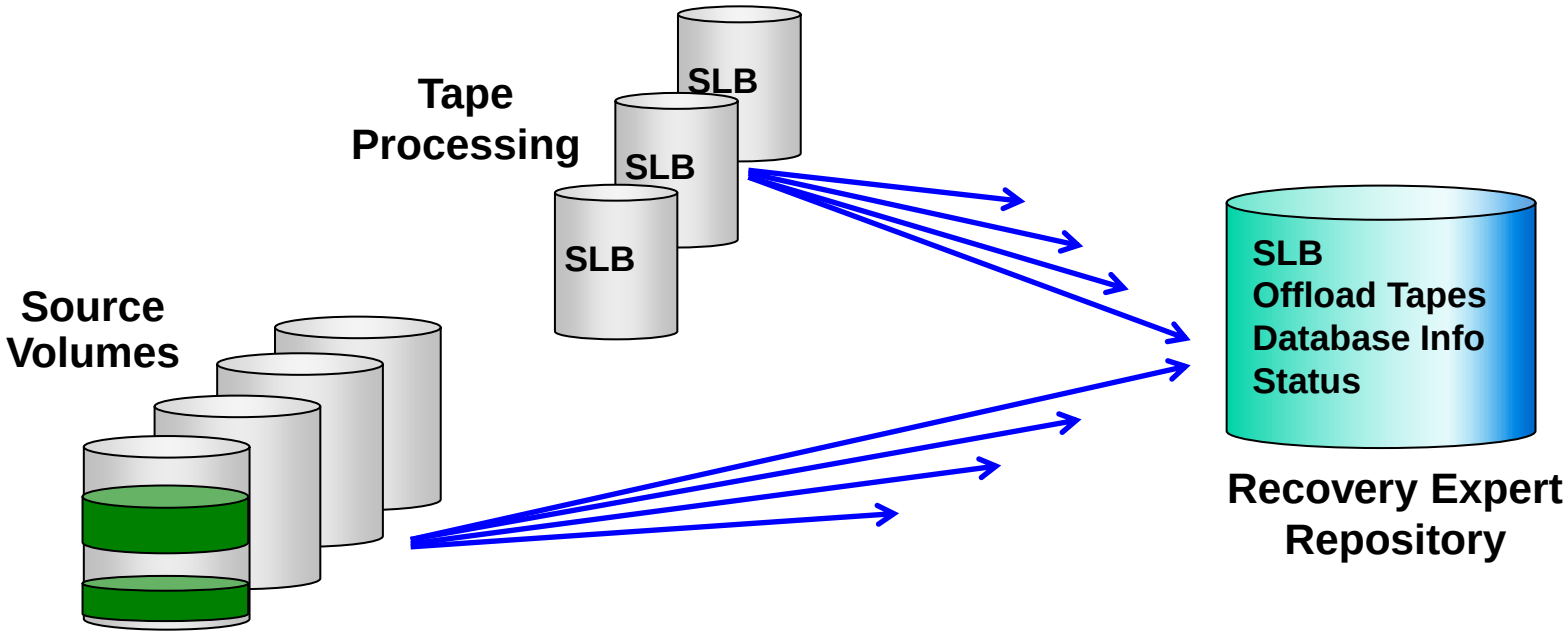
IMS and DB2 Recovery Expert: SLB Restore

- 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
  - SLB and Offloading Tape information
  - Needed at remote site for restart and recovery

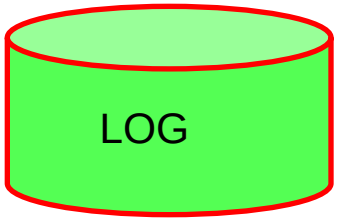


Storage-Based Consistency: Key to Coordinated SLB

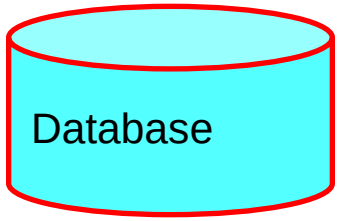
- DBMS System
  - Provides dependent writes for database updates
- Storage-Based Flashcopy for Consistency Group
  - Provides consistency for set of volumes
- Coordinated Disaster Recovery
  - Requires DBMS to order the log and database updates
  - Requires Storage processors to ensure volume consistency

IMS Dependent Writes

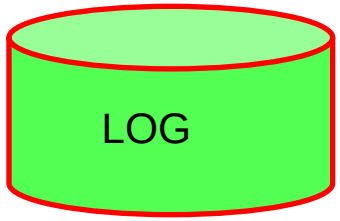
Full Function Commit and Backout Process



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



(2) Update Database

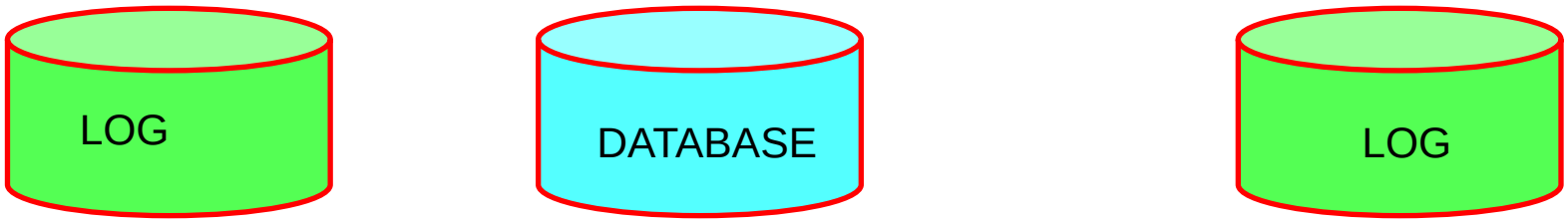


(3) Log ”Commit”

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”

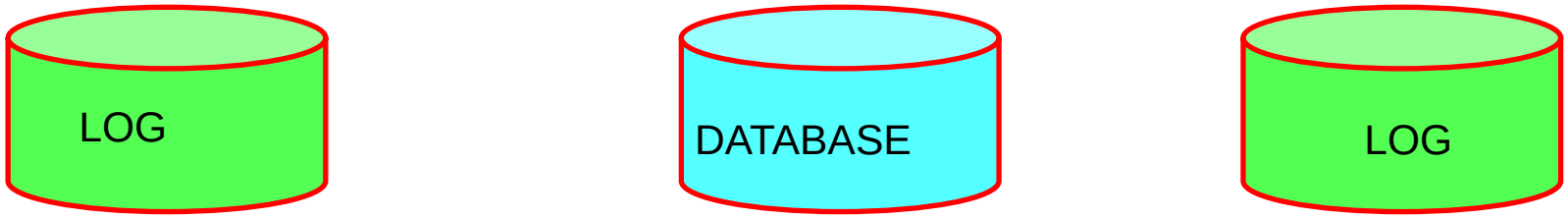
(3) Update Database using output thread processing

(4) Log ”Output Thread Completed”

Updates Completed	Fast Path REDO Required
Log (1)	No REDO, Update ***not*** 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 ***was*** Committed

DB2 Dependent Writes

DB2 Commit and UNDO/REDO Process



(1) Log “Change Information”
(2) Log “Commit” or ”Abort”

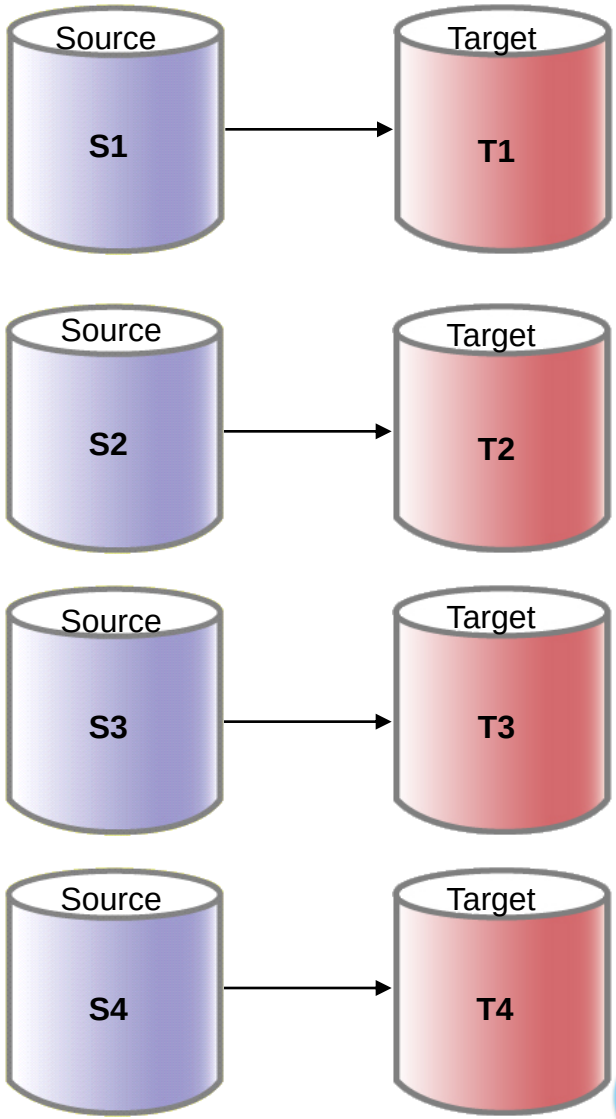
(3) Update Buffer Pool or Database

(4) Log ”Commit Completed”

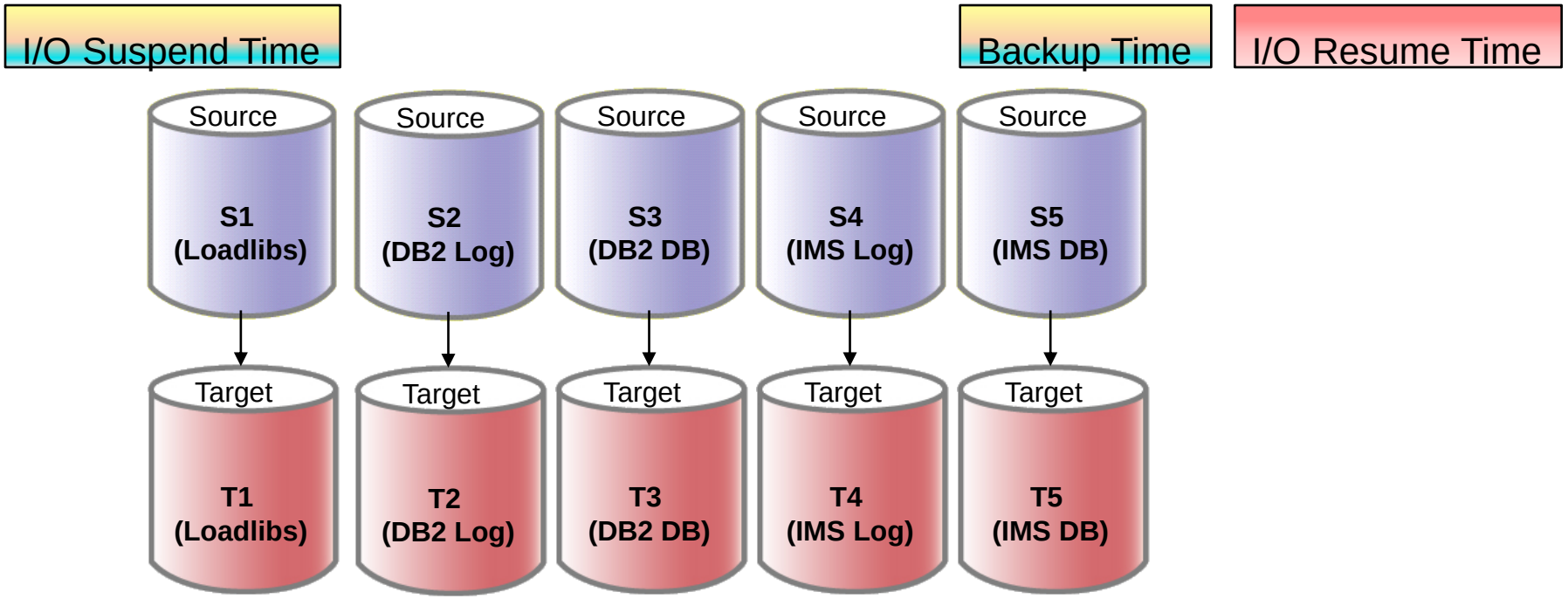
Updates Completed	DB2 UNDO/REDO Required
Log (1)	No UNDO or REDO, Update ***not*** Committed
Log (1) + Log (2)	Use “Change Information” with REDO or use “Change Information with UNDO
Log (1) + Log (2) + DB (3)	Use “Change Information” with REDO or use “Change Information with UNDO
Log (1) + Log (2) +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

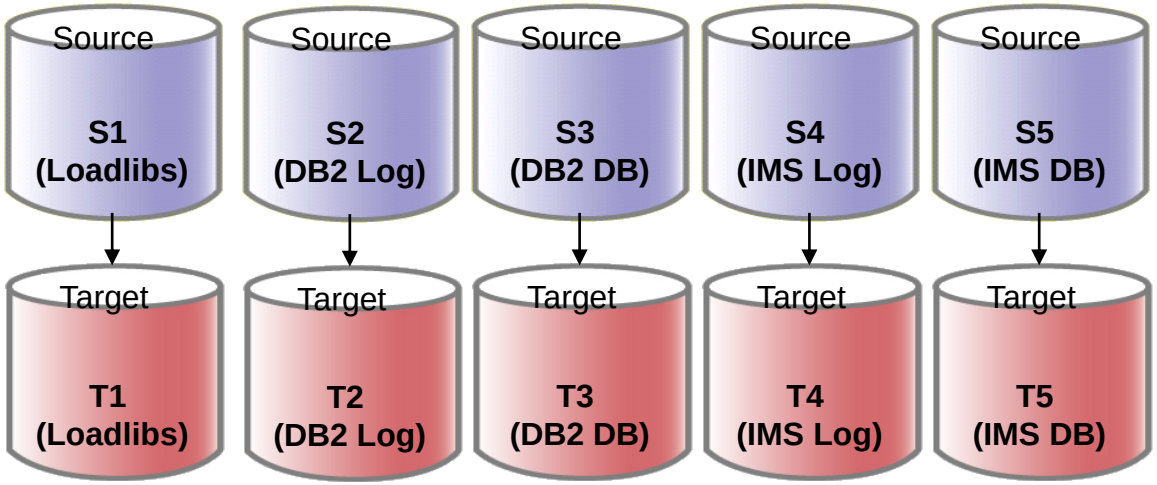


System Level Backup (SLB): Key Timestamps



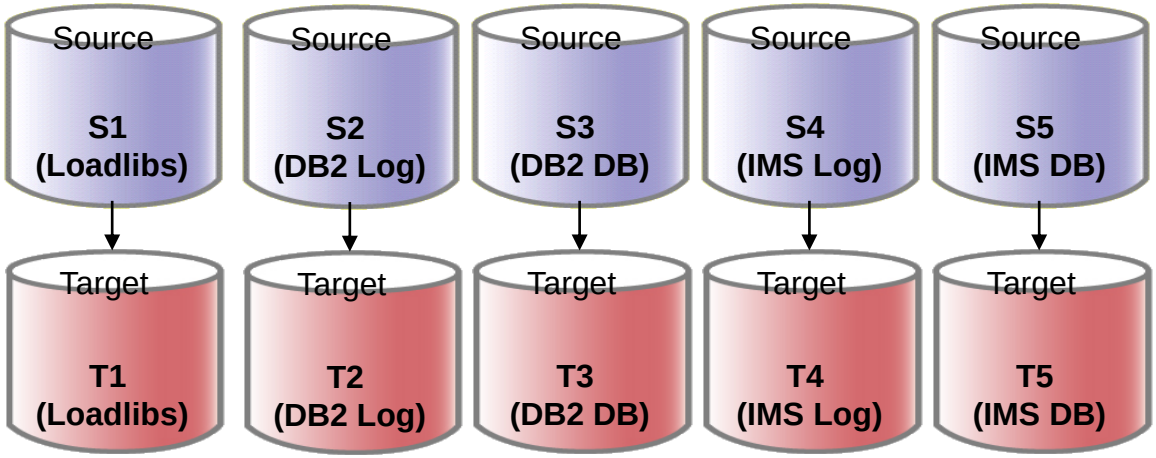
I/O Resume – I/O Suspend = Backup Elapsed Time (< 1 Sec)

Example: IMS and DB2 in Different UORs



FC	IMS FF Update	IMS FP Update	DB2 Update
S1 to T1	Log Before/After Image (S4)	Log After Image (S4)	Log Before/After Image (S2)
S2 to T2	Update Database (S5)	Log Commit (S4)	DB2 Log is Frozen (S2)
S3 to T3	Log Commit (S4)	Update Database (S5)	DB2 DB is Frozen (S3)
S4 to T4	IMS Log is Frozen (S4)	IMS Log is Frozen (S4)	
S5 to T5	IMS DB is Frozen (S5)	IMS DB is Frozen (S5)	
Result	**Update was Committed**	**No DB Commit, Need REDO**	**No Commit, No REDO**

Example: IMS and DB2 in Same UORs



FC	IMS FF Update	IMS FP Update	DB2 Update
S1 to T1	Log Before/After Image (S4)	Log After Image (S4)	Log Before/After Image (S2)
S2 to T2	Update Database (S5)	Can not Log Commit (S4) **(Waiting for DB2 Commit)**	**DB2 Log is Frozen (S2)**
S3 to T3	Can not Log Commit (S4) **(Waiting for DB2 Commit)**		**DB2 DB is Frozen (S3)**
S4 to T4	**IMS Log is Frozen (S4)**	**IMS Log is Frozen (S4)**	
S5 to T5	**IMS DB is Frozen (S5)**	**IMS DB is Frozen (S5)**	
Result	**Update is Backed Out**	**No Commit, No REDO**	**No Commit, No REDO**

IMS and DB2 Recovery Expert: IMS Onetime Setup

Primary Site

Step 1

IMS Recovery Expert
Register IMS
Include/Exclude Datasets

Step 2

IMS Recovery Expert
Analyze IMS Configuration

Step 3

DB2 Recovery Expert
Register DB2
Analyze DB2 Configuration

Step 4

IMS Recovery Expert
Create Backup Profile
Include DB2 Volumes
Update Target Pool
Update Offload Options

Step 5

IMS Recovery Expert
Create Profile for DR Site
Build Restart JCL

IMS and DB2 Recovery Expert: DB2 Onetime Setup

Primary Site

Step 1

DB2 Recovery Expert
Register DB2

Step 2

DB2 Recovery Expert
Analyze DB2 Configuration

Step 3

IMS Recovery Expert
Register IMS
Analyze IMS Configuration

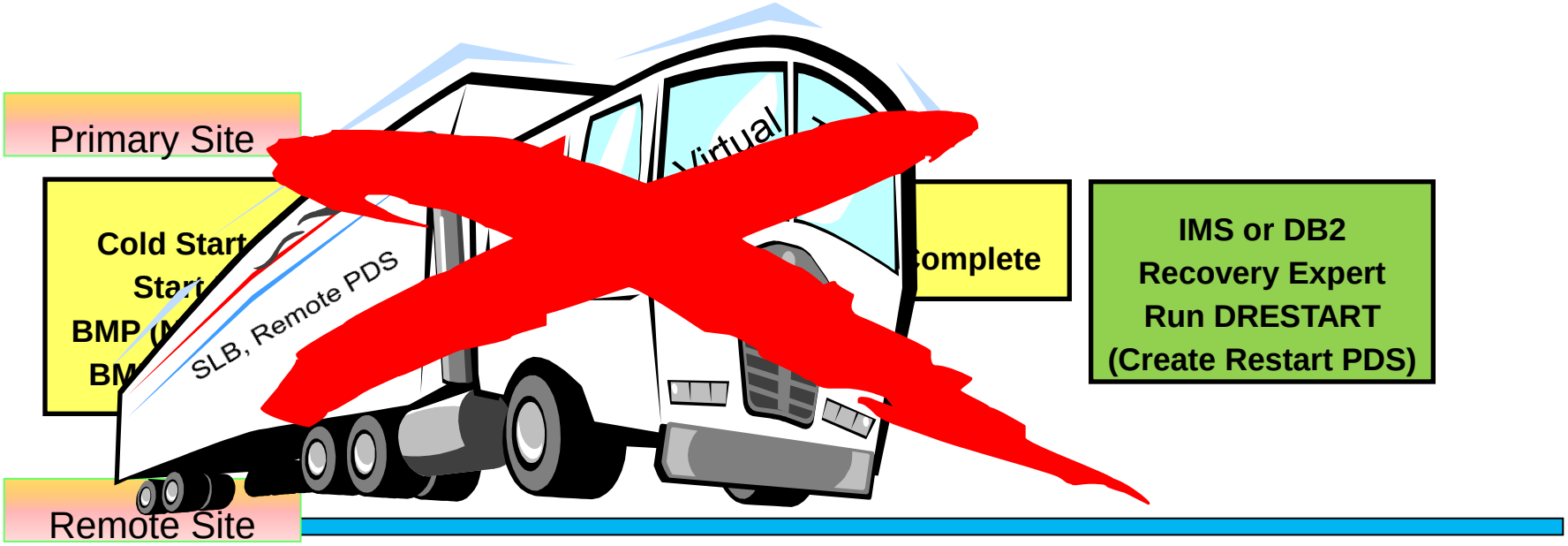
Step 4

DB2 Recovery Expert
Create Backup Profile
Include IMS Volumes
Update Target Pool
Update Offload Options

Step 5

DB2 Recovery Expert
Create Profile for DR Site
Build Restart JCL

IMS and DB2 Coordinated Restart DR (SLB Only)



IMS or DB2
Recovery Expert
Execute Restart JCL
(Restore SLB)

Emergency Restart IMS
Start DB2
(Show Dynamic Backout)

Show Updated Database

IMS Recovery Expert: Onetime Setup

Primary Site

Step 1

IMS Recovery Expert
Register IMS
Include/Exclude Datasets

Step 2

IMS Recovery Expert
Analyze IMS Configuration

Step 3

IMS Recovery Expert
Create Backup Profile
Update Target Pool
Update Offload Options

Step 4

IMS Recovery Expert
Create Profile for DR Site
Build Recovery JCL

DB2 Recovery Expert: Onetime Setup

Primary Site

Step 1

DB2 Recovery Expert
Register DB2

Step 2

DB2 Recovery Expert
Analyze DB2 Configuration

Step 3

DB2 Recovery Expert
Create Backup Profile
Update Target Pool
Update Offload Options

Step 4

DB2 Recovery Expert
Create Profile for DR Site
Build Recovery JCL

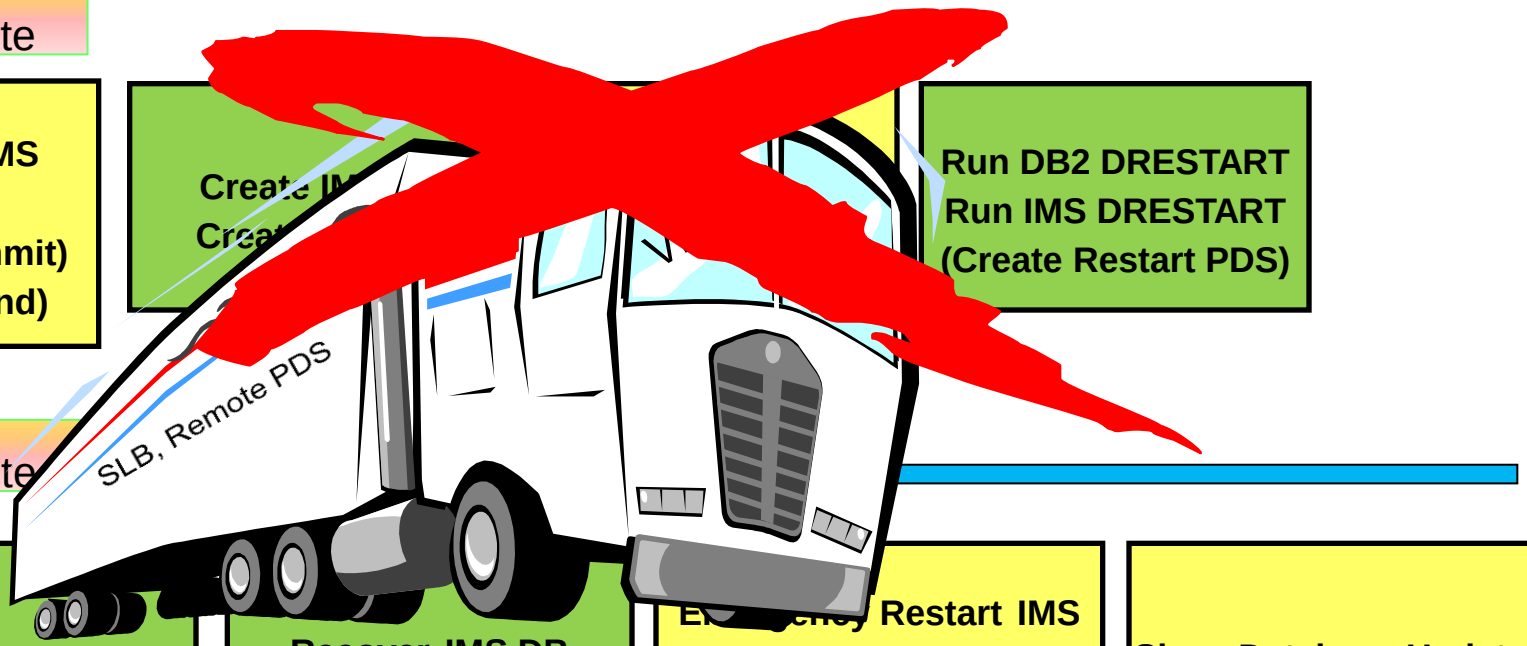
IMS and DB2 Coordinated Recovery & Restart DR

Primary Site

Cold Start IMS
Start DB2
BMP (No Commit)
BMP (Suspend)

Create IM
Creat

Run DB2 DRESTART
Run IMS DRESTART
(Create Restart PDS)



Remote Site

Execute IMS Restart JCL
Execute DB2 Restart JCL
(Restore SLB)

Recover IMS DB
Recover DB2 DB

Restart IMS
Start DB2
(Show Dynamic Backout)

Show Database Updates

Demo of IMS and DB2 Coordinated DR

(Onetime Setup)

(Coordinated IMS and DB2 Restart)

(Coordinated IMS and DB2 Recovery & Restart)

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