Simplify and Improve Database Administration by Leveraging Your Storage System

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Rocket Software

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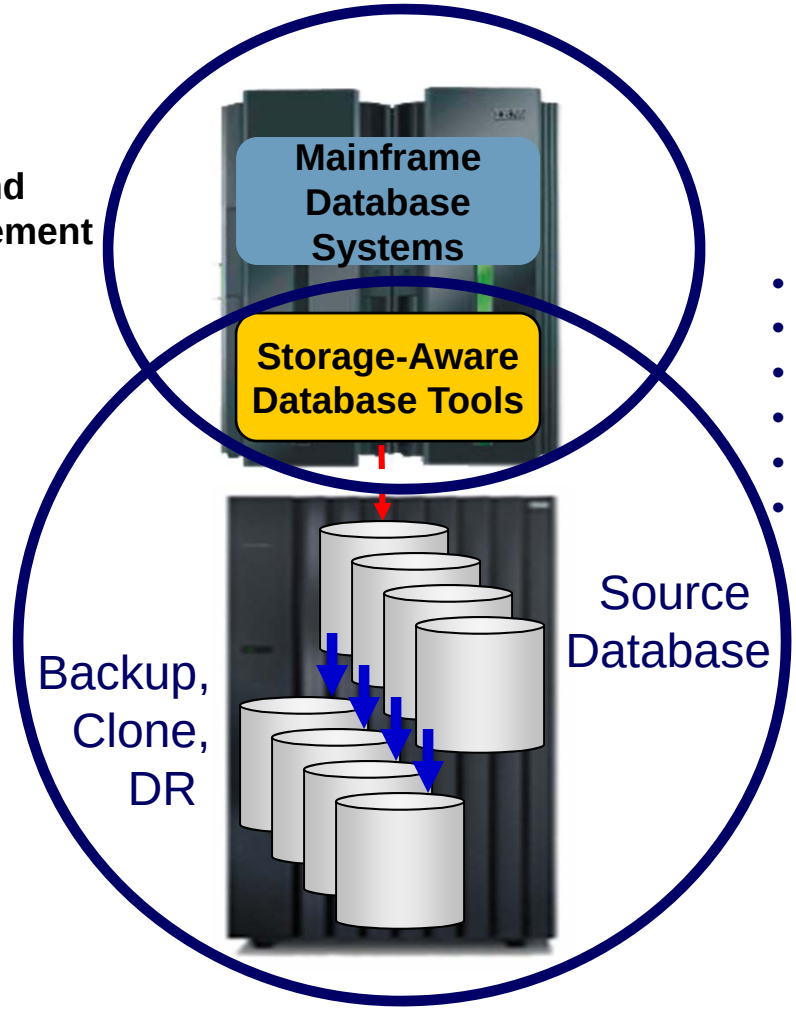
Session Agenda

- Database and Storage Integration Overview
- System-Level Backup Methodologies and Storage Integration
- Cloning Database Systems Using Storage-Based Fast Replication
- Refreshing DB2 Objects and IMS Databases by Leveraging Your Storage Facilities
- Implementation Planning Considerations
- Session Summarization

Database and Storage Administration
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

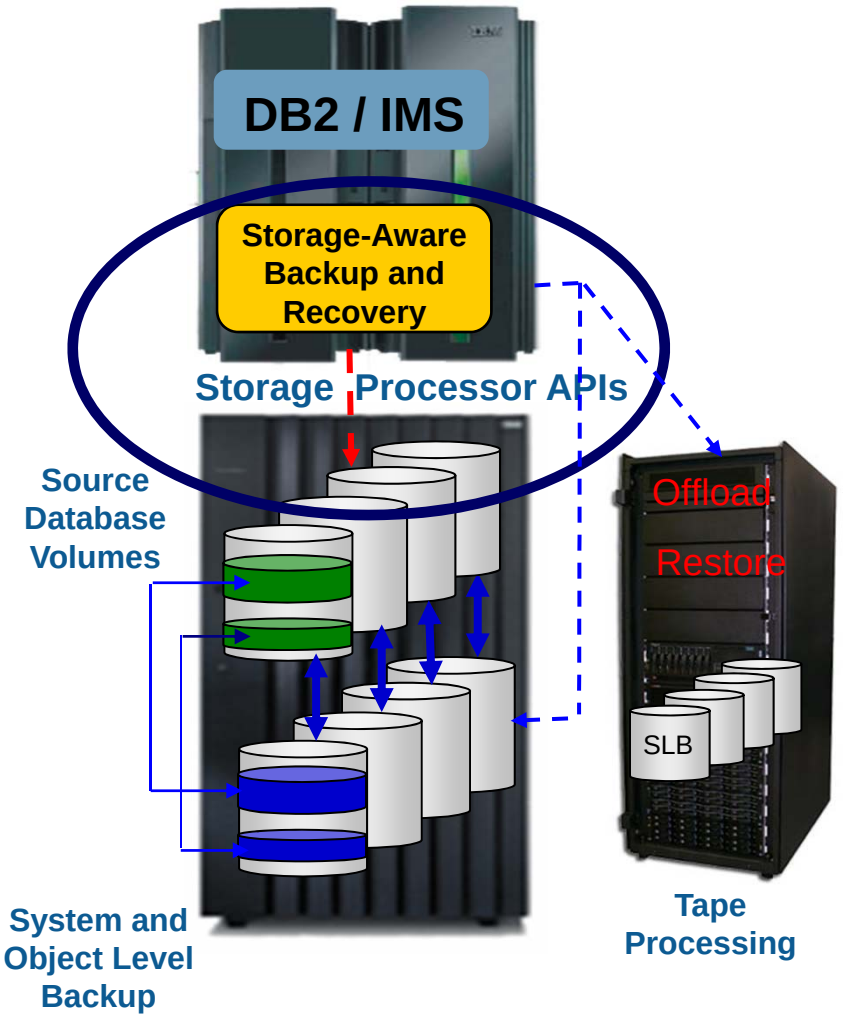
- Reduce backup, recovery, and cloning administration costs
- Reduce host CPU and I/O resource utilization
- Perform backups and create clone copies instantly
- Fast restore and parallel recovery reduces recovery time
- Simplify disaster recovery operations and procedures
- DBMS and storage-based fast-replication 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

System Level Backup Methodologies

- Backup complete database systems as a unit without affecting running applications
  - Backup components include:
    - *Active and archive logs*
    - *Recovery metadata (DB2 BSDS, IMS RECONs)*
    - *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 performed instantly using storage-based fast replication
- System-level backups are the foundation for federated backup and recovery solutions
- System backup and cloning methodologies are difficult to implement without sophisticated automation
    - *"Split mirror" backup methodologies pioneered in late 1990s*
    - *Valuable concept - but hard to implement*

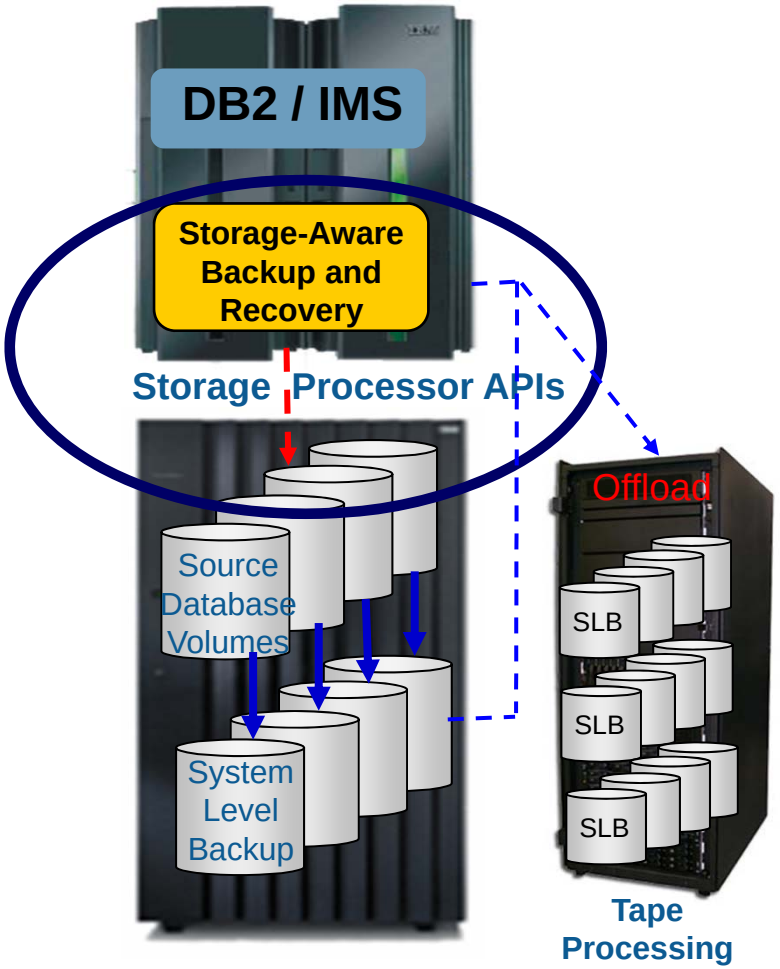
Storage-aware DB2 and IMS Backup
Functional Requirements

- Integrate DB2 and IMS backup, restore, and recovery process with storage-based fast replication
- Provide easy and fast backup and restore of DB2 and IMS systems and applications
- Support common storage systems
  - IBM – FlashCopy (FC)
  - EMC – TimeFinder/Mirror/Clone/Snap, FC
  - HDS – Shadow Image, FC
- Feature requirements include:
  - DB2 and IMS system discovery and configuration management
  - DB2 and IMS system backup and recovery operations
  - System backup validation
  - Application and object data set backup (DB2)
  - Image copy creation (DB2)
  - DB2 object and application recovery
  - IMS database and application recovery
  - Active metadata repository
  - Encrypted tape offload support
  - DR preparation and management



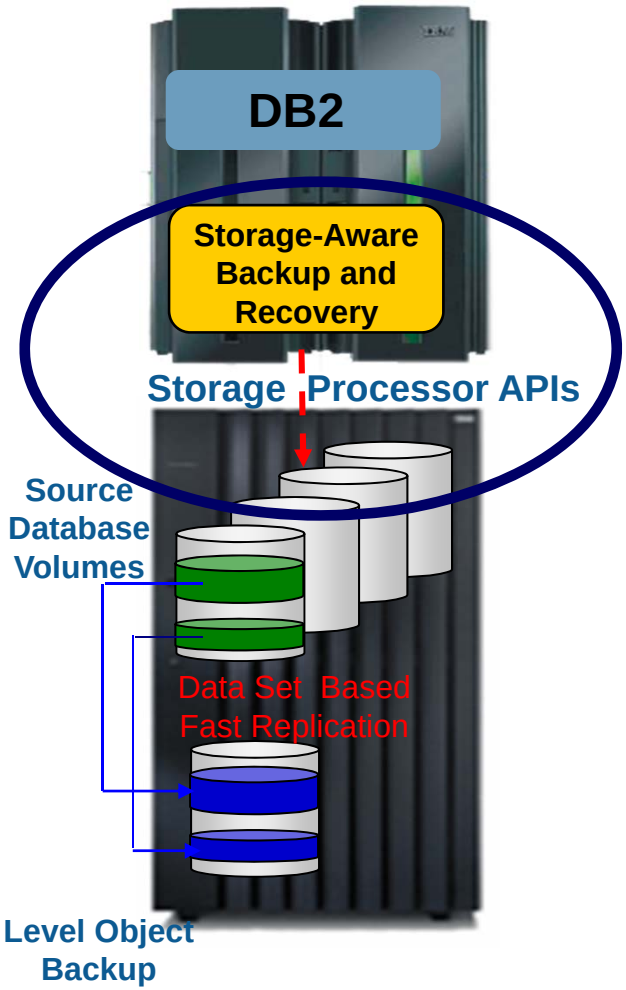
System Level Backup Overview

- Storage-based backup reduces processing and administration costs
- Fast replication is used to perform database backup and restore functions
  - Full system backups complete in seconds
  - Backup performed without host CPU or I/O
- Back up large groups of databases with no application affect or down time
  - Backup windows are reduced or eliminated
  - Extend online or batch processing windows
- Data consistency ensured
  - Database suspend process
  - Storage-based consistency functions
  - DB2 BACKUP SYSTEM
- Automated backup offload management



DB2 Application and Object Backup Using Data Set Based Fast-Replication

- DB2 backups performed at application or object level
- Supports share levels reference and change
- Backups performed using data set fast replication facilities
- Backups can be registered in repository and used for fast restore and parallel recovery
- DB2 image copies can be created and registered

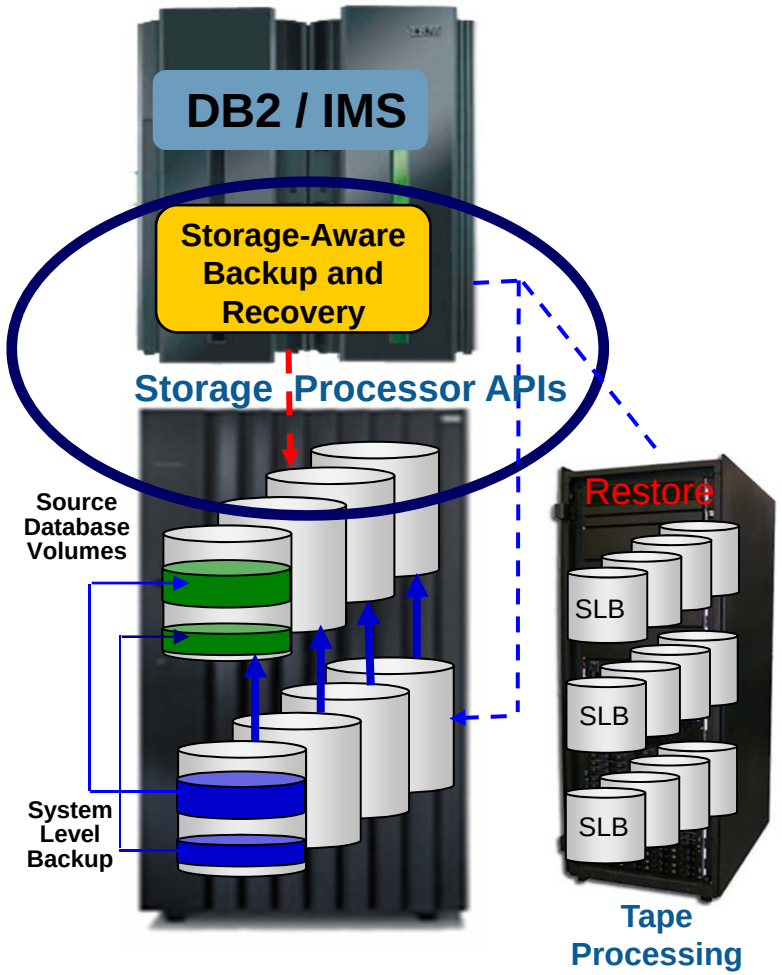


DB2 Image Copy Creation

- Image copies created from a system level backup
  - Eliminate batch window requiremetns
  - Image copies can be created and registered in DB2 syscopy
  - Eliminates I/O contention to maintain production performance
  - All image copies created at the same point in time
  - Reduces recovery time
- Image copy created from a data set fast-replication
  - Can be share level change or reference
  - Share level reference performs tablespace quiesce before data set fast-replication operations
  - FlashCopy copies can be deleted after image copy creation
  - Fast-replication backups can be persistent, registered in repository, and used for restore and recovery operations

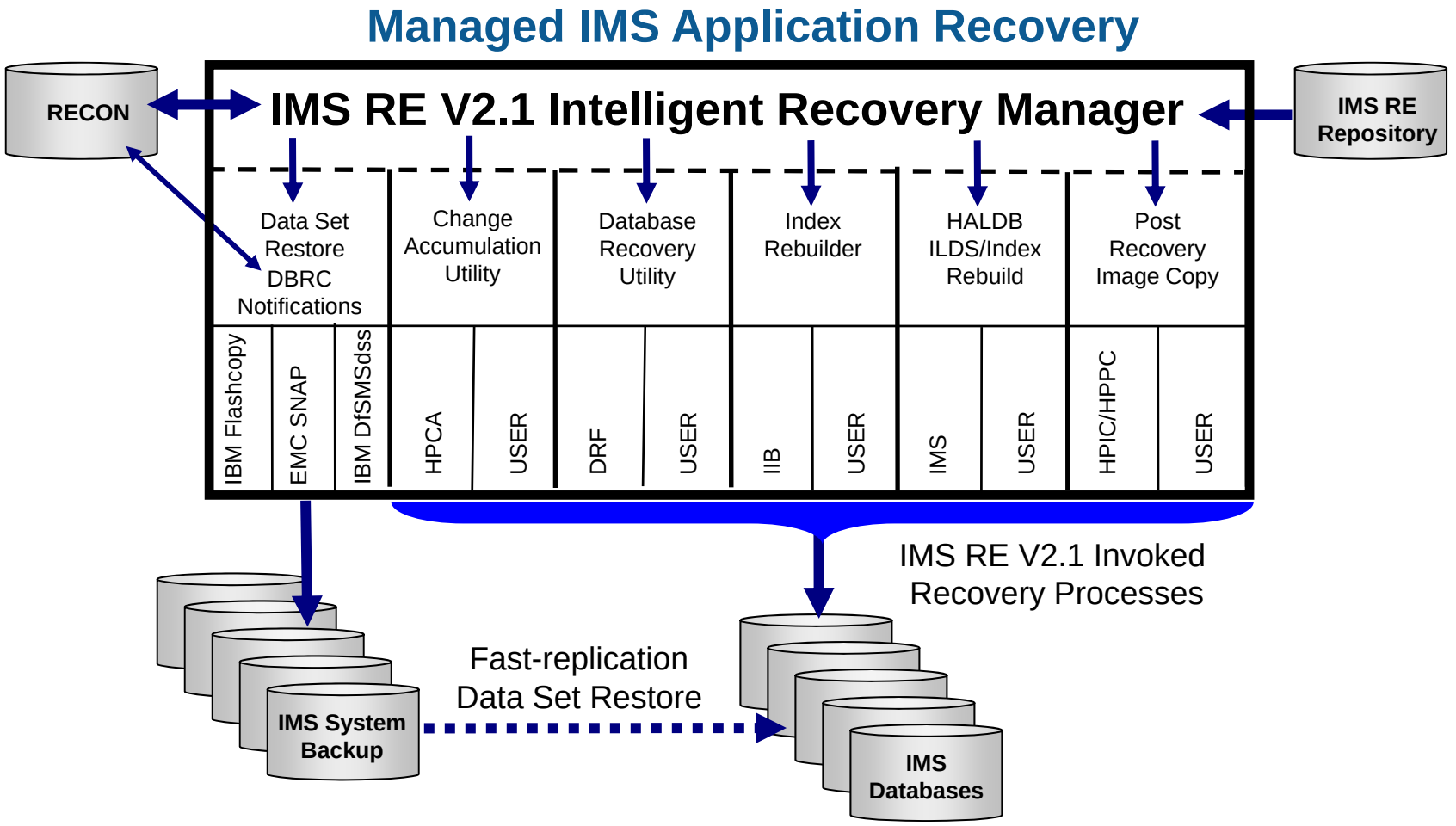
System Level Backup
System and Application Recovery

- Recover DB2 / IMS systems or application objects from disk or tape automatically
- Intelligent Recovery Manager (DB2 / IMS) 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 object (DB2), database (IMS) or application recovery
  - Data sets snapped to restore data
  - Parallel log apply reduces recovery time
- One system backup used for system, application, and disaster recovery



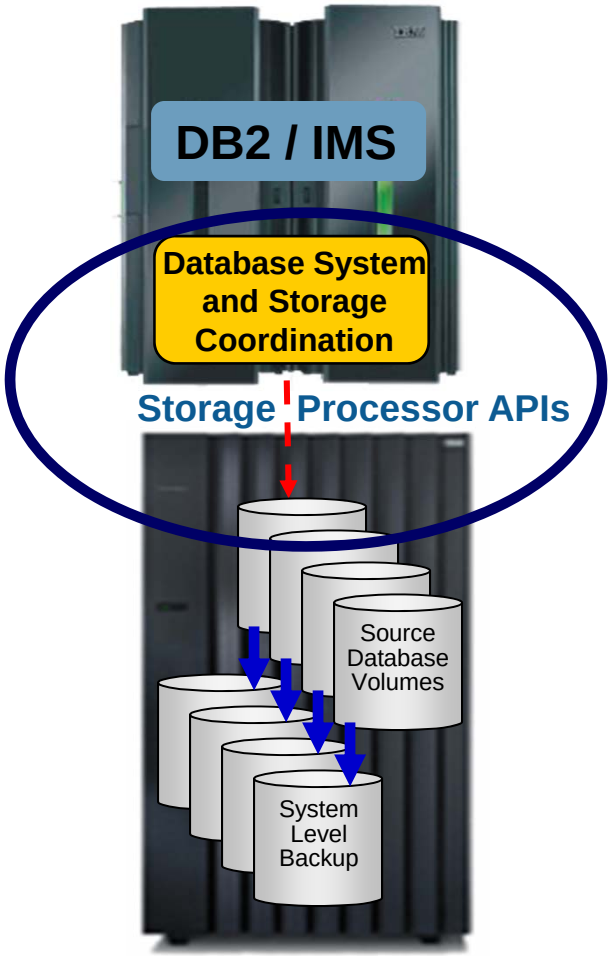
IMS Recovery Expert for z/OS V2.1

Storage Integrated IMS Recovery Example



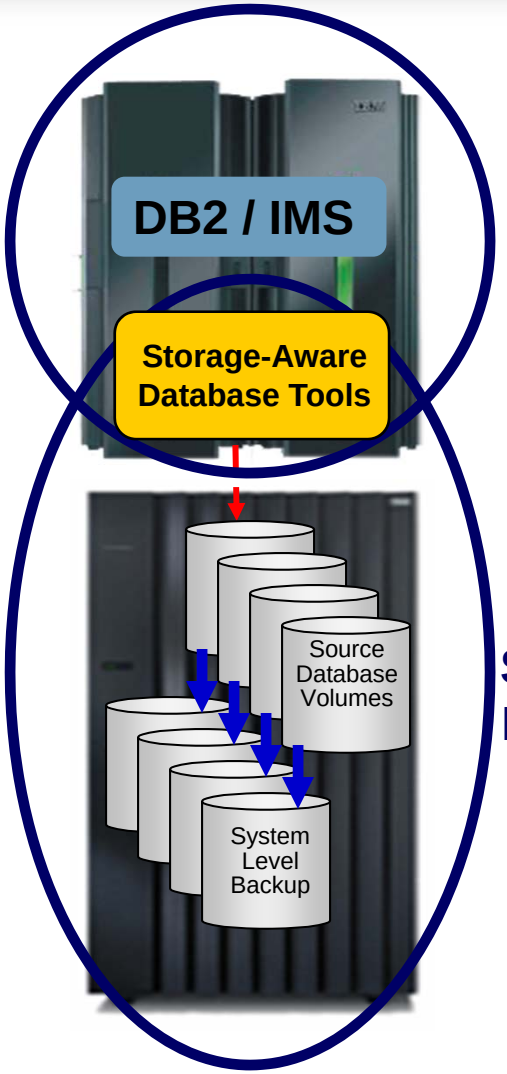
System Level Backup
Disaster Recovery Benefits

- Simplifies disaster recovery operations
  - System level backup for restart
  - System level backup and roll forward
- System 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 (DB2 / IMS)
  - Prepares recovery assets and manages remote restore 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



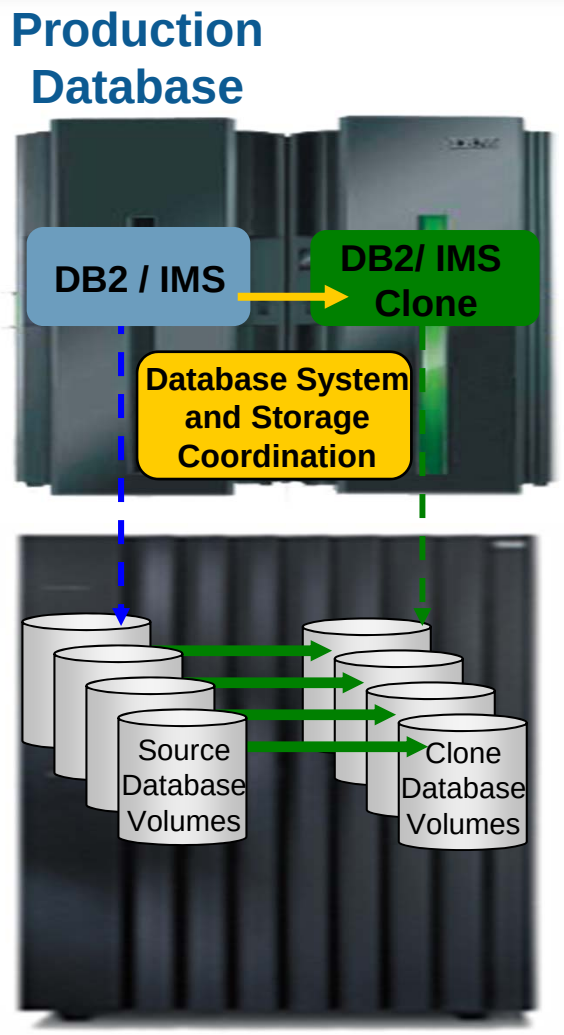
System Level Backup
Storage Benefits

- A system backup used for multiple functions
  - Saves storage and processing resources
- Leverages storage-processor and fast-replication software investments
- Expose fast copy capabilities to the DBAs ***safely and transparently*** using "storage-aware" database utilities
- Provides a sophisticated infrastructure and metadata to manage DB2 and IMS storage processor coordination
- Multiple storage vendor support
  - IBM - FlashCopy
  - EMC - TimeFinder/Mirror/Clone/Snap, FlashCopy
  - HDS – ShadowImage, FlashCopy
  - IBM RAMAC Virtual Array, STK - SnapShot



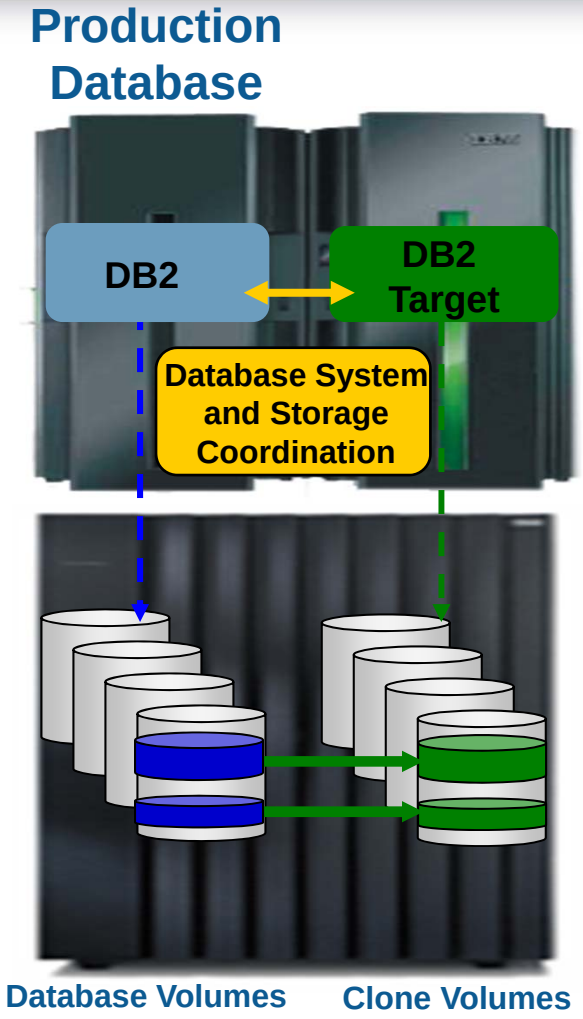
Cloning DB2 and IMS Systems

- Performs DB2 and IMS cloning automation
  - Simplifies database system cloning processes
  - Reduces cloning time and administration costs
- Leverages fast-replication facilities to clone data
  - Data can be cloned while online or offline
- Performs rapid volume reconditioning and data set renaming on cloned database volumes
  - Critical component of the database system cloning process
- Adjusts DB2 target database system to accommodate and accept the cloned data
  - DB2 catalog, directory, BSDS, active / archive log, etc.
- Adjusts target IMS system to accommodate and accept the cloned data
  - IMS RECONs, PROCLIB, JOBS, JCL, MDA members



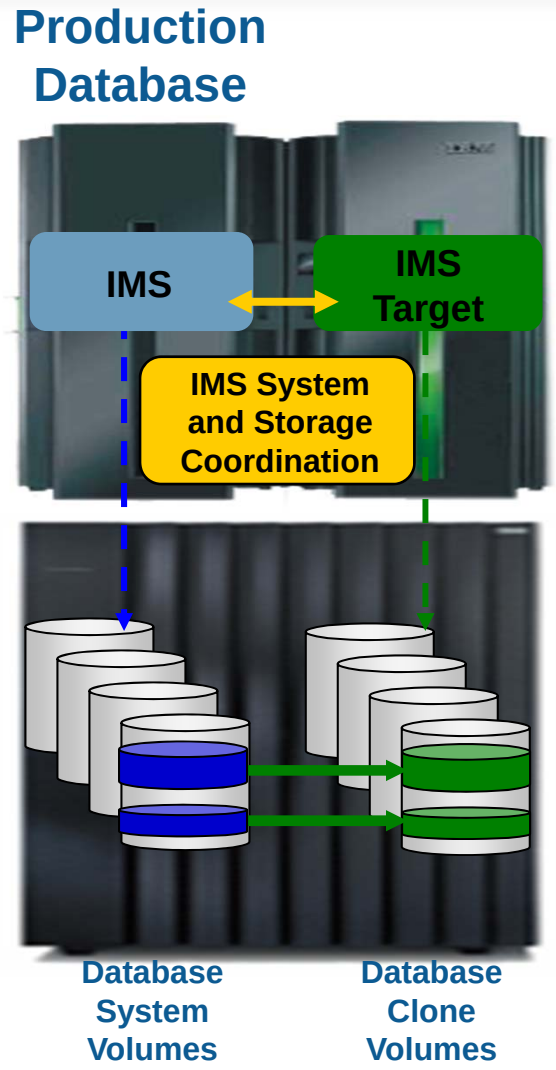
Refreshing DB2 Objects

- Performs automated DB2 table and index space refresh operations
  - Fast refresh of database objects
  - DB2 RI relationships, LOBS, and Identity columns
- Verifies source and target database compatibility
- Objects copied using storage-based data set fast replication
  - Target takes up the same amount of space as the source
- Performs object ID translations and target system metadata management



Refreshing IMS Databases

- Performs automated IMS database refresh operations
  - Fast refresh of IMS databases
  - IMS DB support (FF, HALDB, DEDB)
- Verifies source and target database compatibility
- Databases copied using storage-based data set fast-replication
  - Target takes up the same amount of space as the source
- Performs target system metadata management



Storage-aware Database Products

- **IBM DB2 Recovery Expert for z/OS**
  - DB2 for z/OS backup and recovery
- **IBM DB2 Cloning Tool for z/OS**
  - DB2 system cloning and tablespace refresh
- **IBM IMS Recovery Expert for z/OS**
  - IMS for z/OS backup and recovery
- **IBM - IMS Cloning Tool for z/OS**
  - IMS system cloning and database refresh
- **Mainstar Database Backup and Recovery for DB2 on z/OS**
  - DBR for DB2 – DB2 for z/OS backup and recovery
- **Mainstar Database Backup and Recovery for IMS**
  - DBR for IMS – IMS backup and recovery
- **Mainstar Volume Clone and Rename**
  - VCR – DB2 system cloning automation
- **Mainstar Fast Tablespace Refresh**
  - FTR – DB2 tablespace refresh automation
- **Mainstar Clone and Rename for IMS**
  - ICR - IMS system Cloning Automation
- **Mainstar Rapid Database Refresh**
  - RDR – IMS database refresh automation
- **EMC - Rocket Backup and Recovery for DB2 on z/OS** (EMC Select product)
  - RBR – DB2 for z/OS backup and recovery

Implementation Planning Considerations

- System level backup usage
  - Determine how SLB(s) will be used
- SLB type
  - Determine full, data-only, or partial SLB requirements
- Backup frequency and space utilization
  - Determine backup frequency, performance, and space efficient fast-replication requirements
- Disaster restart considerations
  - Determine offsite disaster restart resources and preferences (RTO, RPO) to define appropriate disaster recovery profiles
- Copy blade selection
  - Determine storage processor capabilities, available facilities and fast-replication preferences

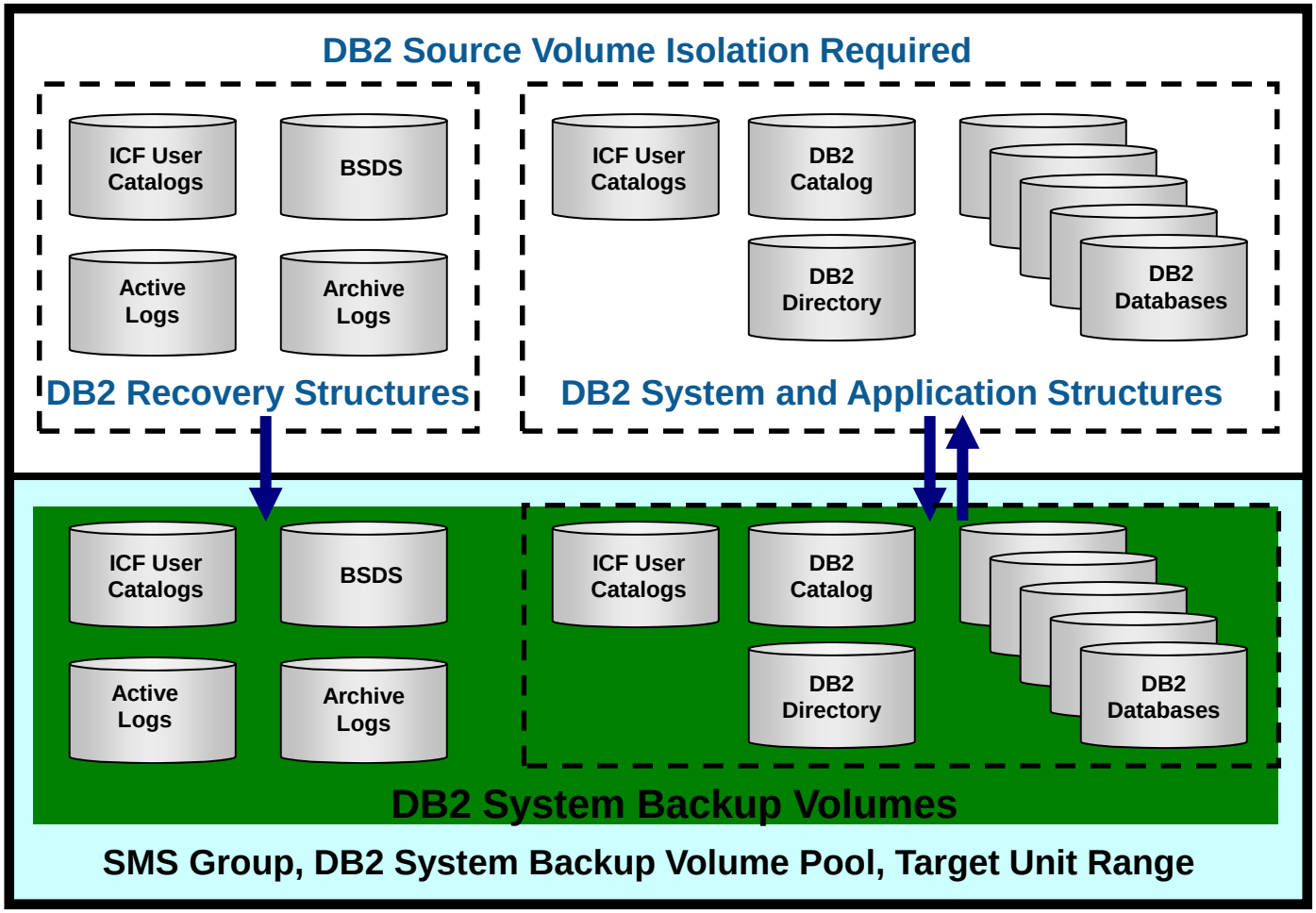
System Level Backup Usage and Data Set Layout Considerations

- SLB used for local system recovery
  - Database data and recovery structure isolation required
  - Database system isolation may be required
    - *Non-database data sets will get restored when DB2 or IMS system is restored*
    - *User catalogs will get restored*
- SLB used for application, DB2 object, or IMS database recovery
  - Data and recovery structure isolation is not required
- SLB used for remote disaster restart operations
  - Recovery structure isolation is not required
  - Database system isolation may be required
    - *Non-database data sets will get restored when DB2 or IMS system is restored*
    - *User catalogs will get restored*

DB2 System Level Backup Usage

Data Set Layout for Full Backup / System Recovery

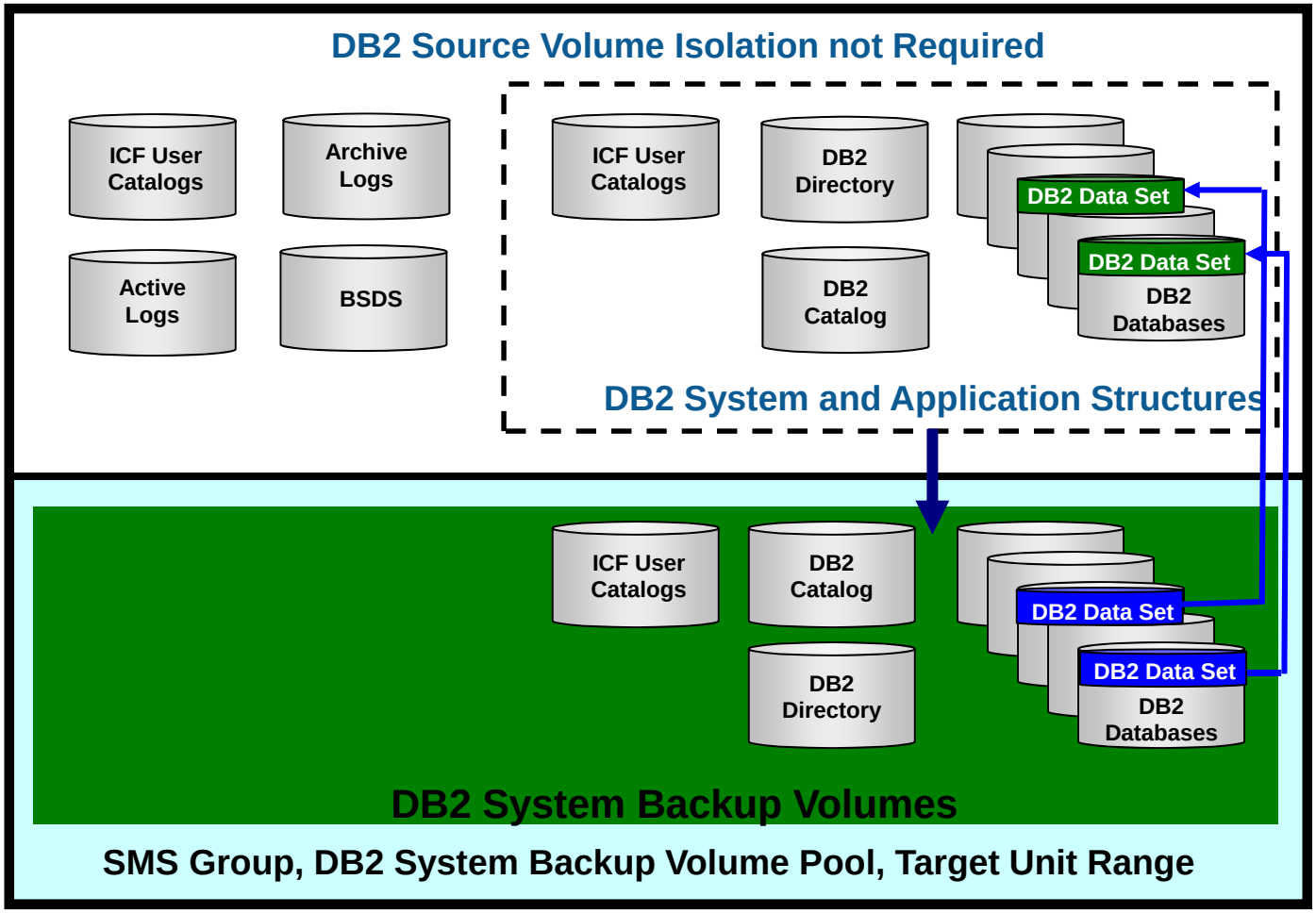
DB2 on z/OS System and Database Environment



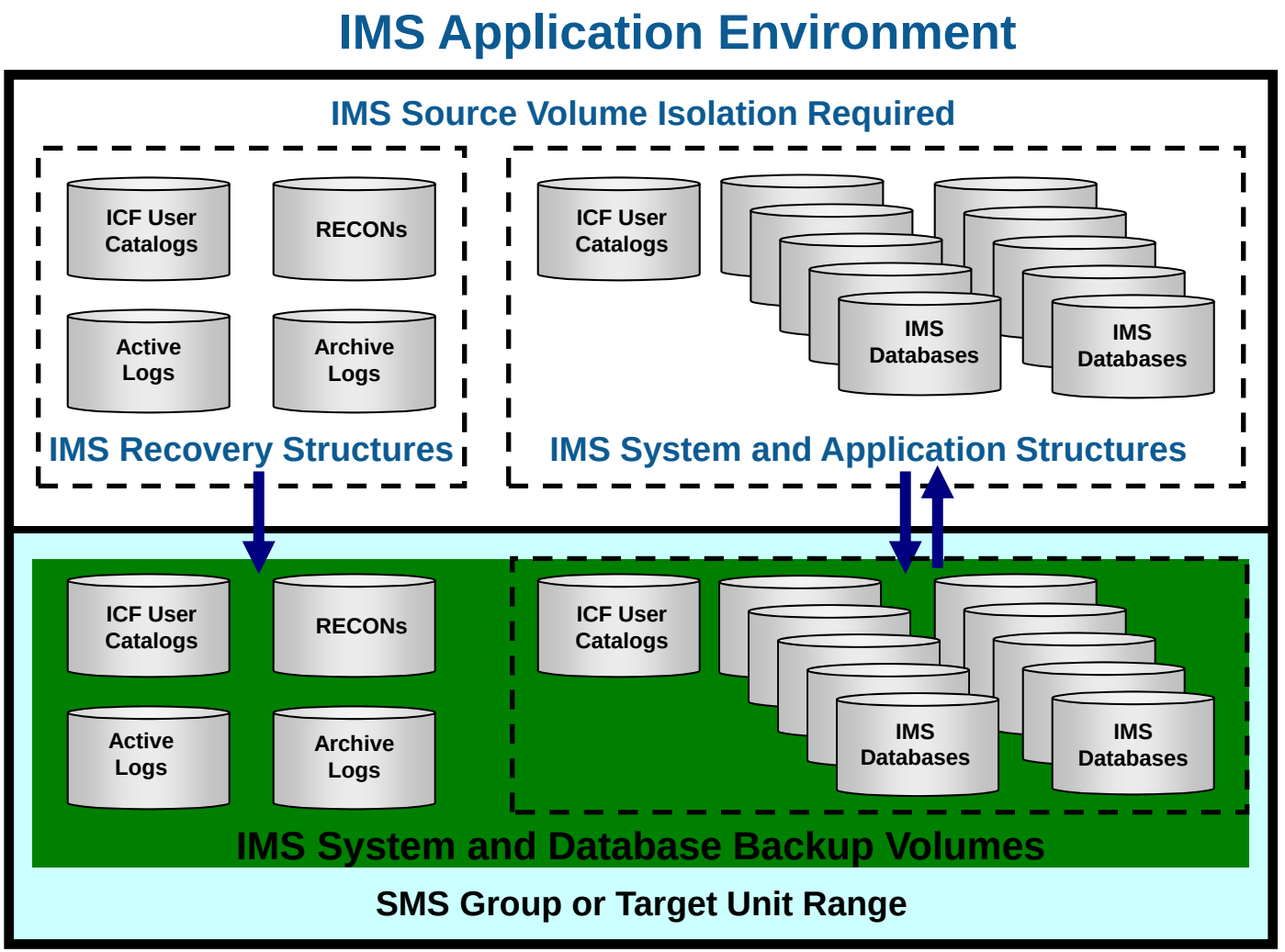
DB2 System Level Backup Usage

Data Set Layout for Data Only / Application Recovery

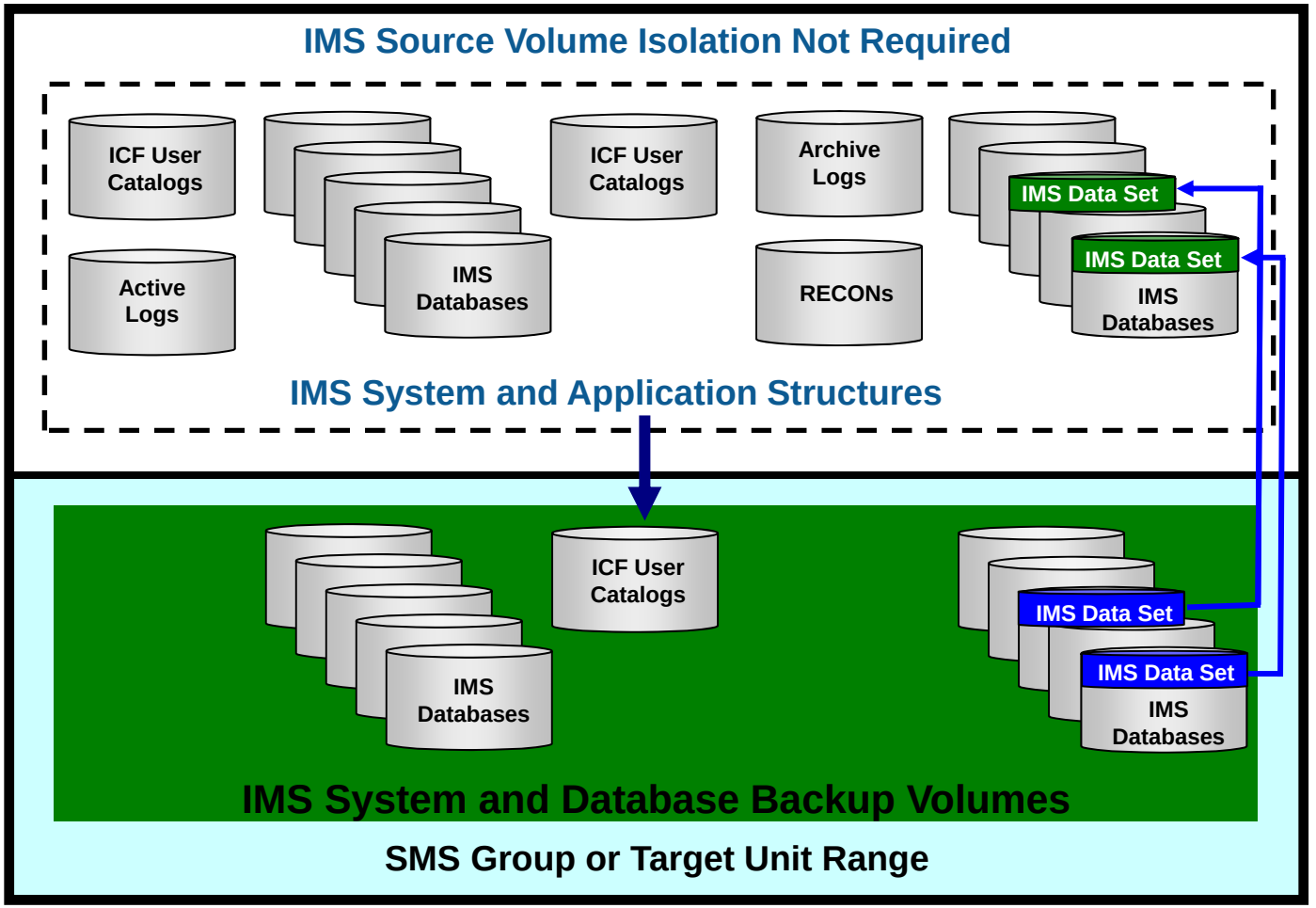
DB2 on z/OS System and Database Environment



IMS System Level Backup
Data-Set Layout for System Recovery



IMS System Level Backup
Data-Set Layout for Application Recovery

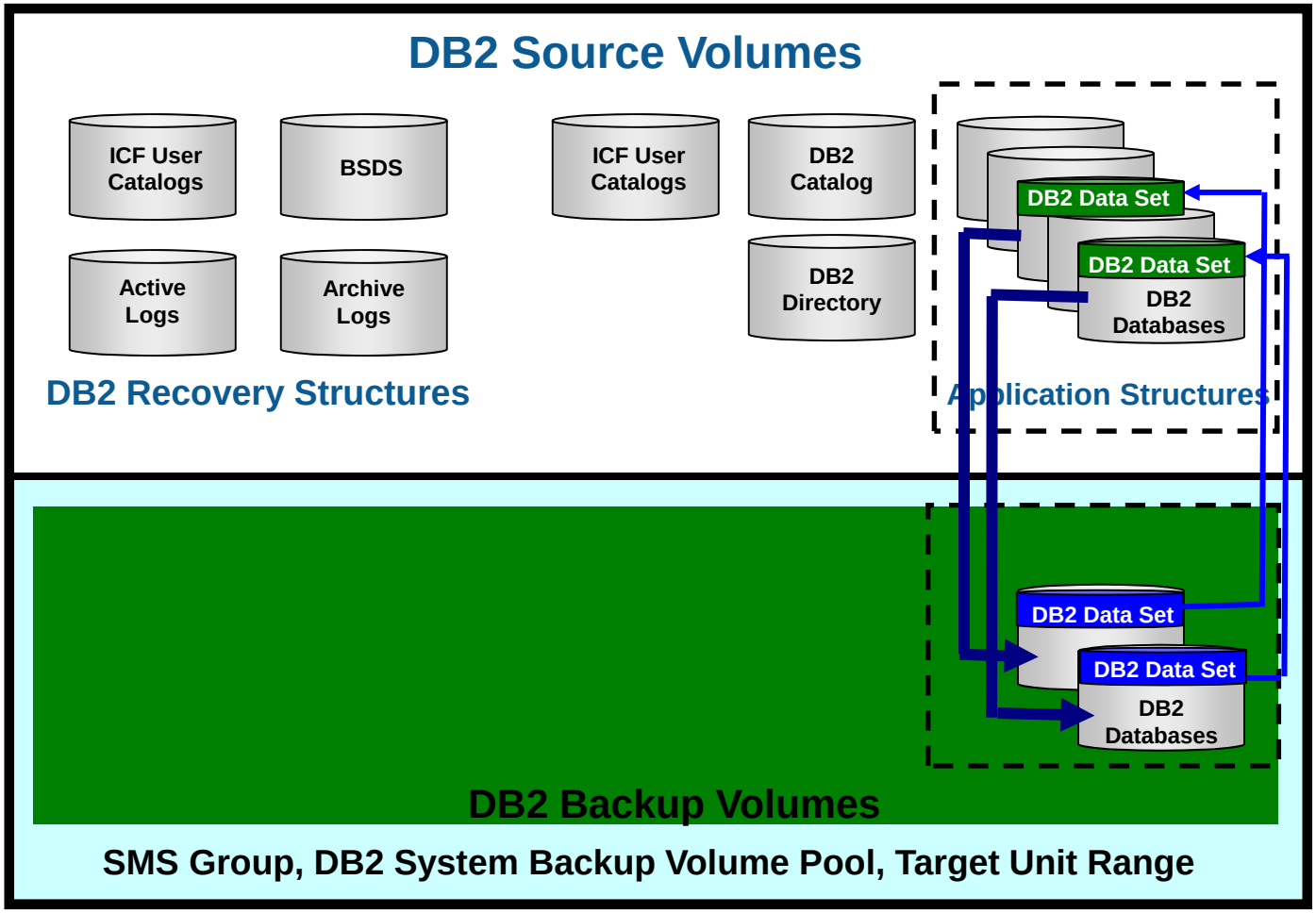


Partial System Level Backup

- Partial system level backup (PSLB)
  - Backup volumes representing a subset of the database system
  - PSLB's used for database or application recovery only
  - Data set fast replication used to restore data
  - Log and data isolation not required
  - Desired application database data should be grouped on volumes as a best practice
- PSLB cannot be used for system recovery
  - System recovery requires all volumes in SLB
- PSLB usage
  - Large databases or applications having unique backup requirements
  - Creating image copies from a PSLB
  - Reduce disk utilization
  - Support more backup generations

DB2 Partial System Level Backup
Data Set Layout for Application Recovery

DB2 on z/OS System and Database Environment



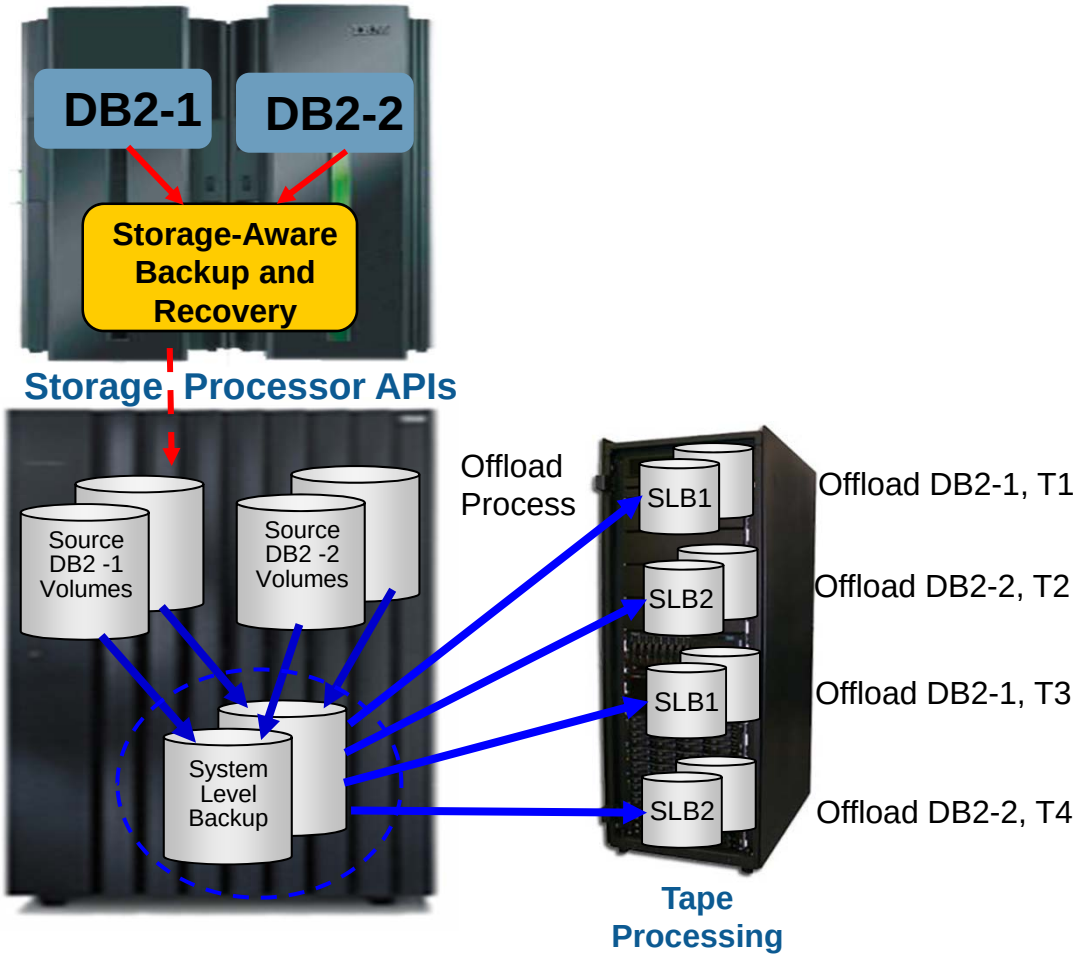
Implementation Planning

Backup Frequency, Space, and Resource Usage

- SLB type: full, data-only, or partial – shown in previous slides
- Determine optimal backup frequency
- Determine number of backups to keep online (on disk)
  - Establish online backup duration requirements
    - *SLB or PSLB used for IC creation may be deleted after ICs complete*
- Determine offline (tape) backup requirements
- Consider incremental fast-replication options to reduce background copy time and resources
- Consider using one set of volume targets to support multiple database systems – next slide
  - Saves fast-replication target volume storage requirements
- Consider using space efficient fast-replication methods like EMC VDEVs to save space – later slides
- Consider cloning database systems to space efficient volumes using a full volume clone or SLB as the source – later slides

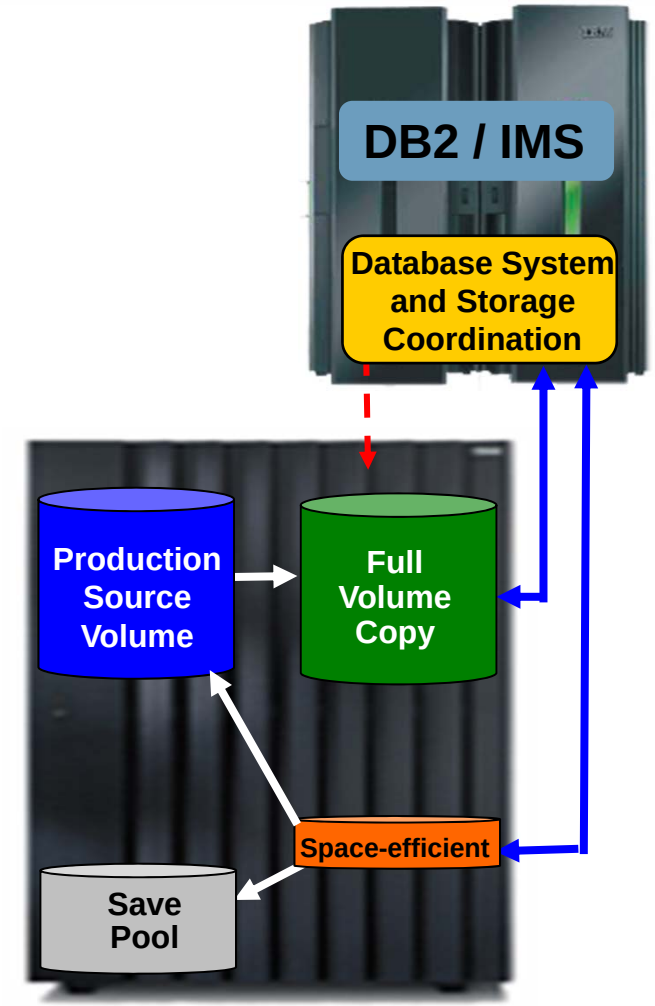
One Set of Backup Volumes for Multiple DBMS Systems (DB2 Example)

- Backup DB2–1
  - SLB-1 created on disk
  - Archive SLB-1
  - Backup volumes are available after archive completes
- Backup DB2–2
  - SLB-2 created on disk
  - Archive SLB-2
  - Backup volumes are available after archive completes
- Repeat for DB2-1
- Repeat for DB2-2

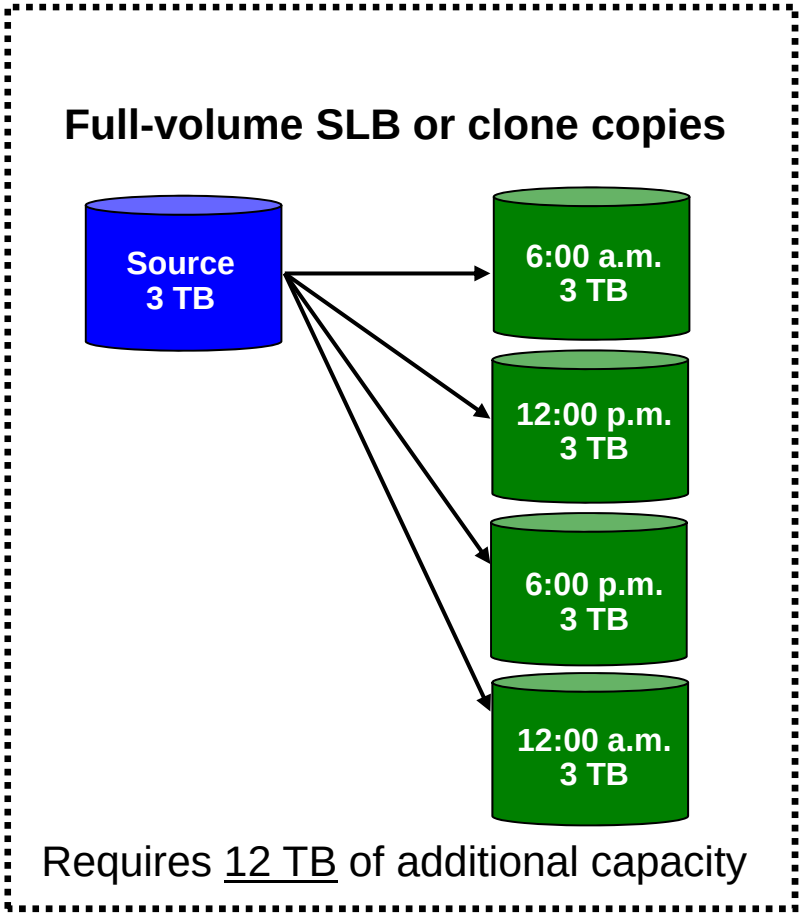


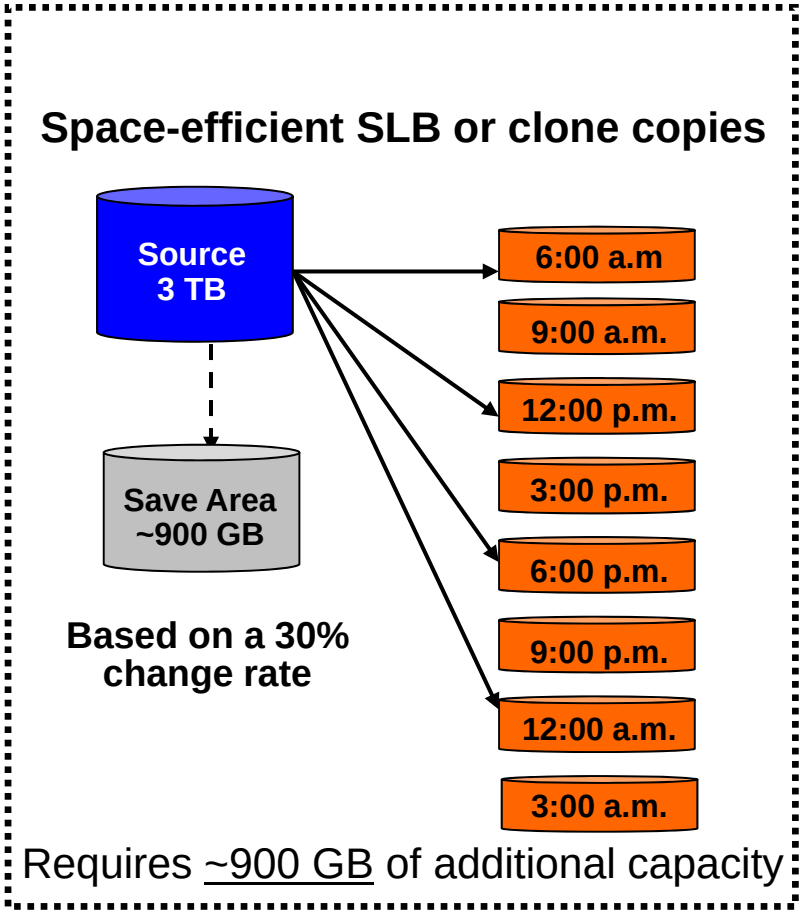
Create SLBs and Clone DB Systems
Full and Space Efficient Volumes

- Full volume fast-replication copy
  - Full volume copy
    - *Target is same size as source*
  - Relationship can be retained with production volume
  - Allows incremental resynchronization
- Space efficient copy
  - Change tracks copied before update
  - Allows incremental restore
  - Can have multiple space-efficient volumes associated with production volume



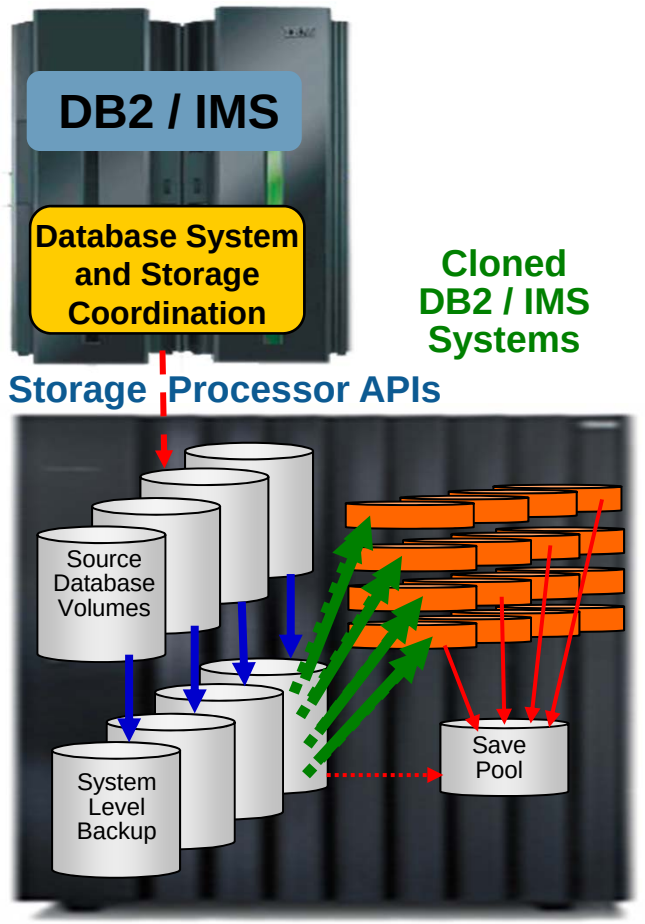
Space Efficient Usage Economics
Enable Frequent SLB or Clone Copies





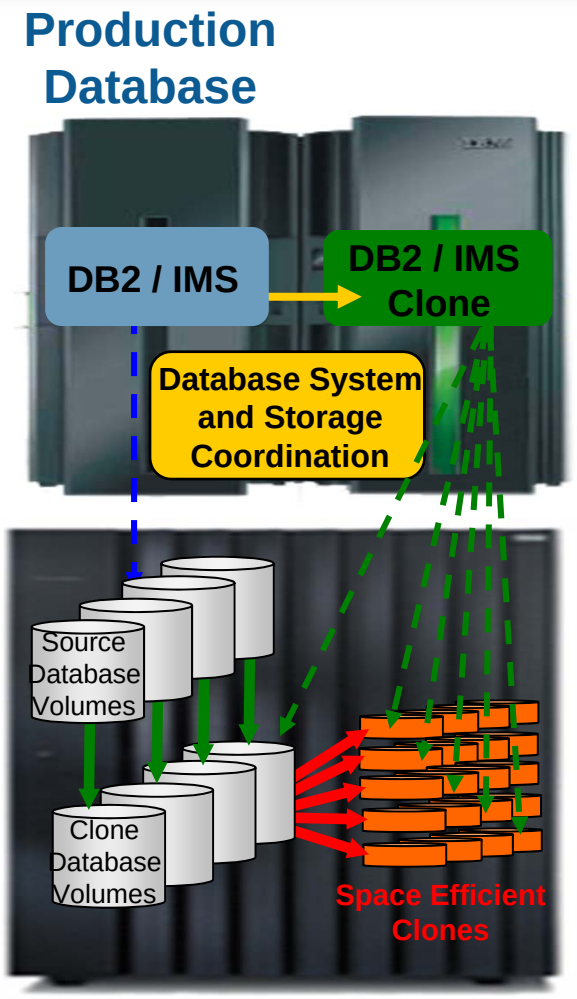
Full Volume and Space Efficient
Usage Example

- Full system-level backup created using full volume fast-replication
- Clone operations performed using SLB backup volumes as source
- Cloned database systems use space efficient target devices
  - SLB volumes are used to service I/O for clone access
  - Clone writes (few) go to save pool
  - SLB writes (none) go to save pool
- Storage-aware database tools provides infrastructure and metadata to manage database and storage processor coordination



Full Volume and Space Efficient
Usage Example (2)

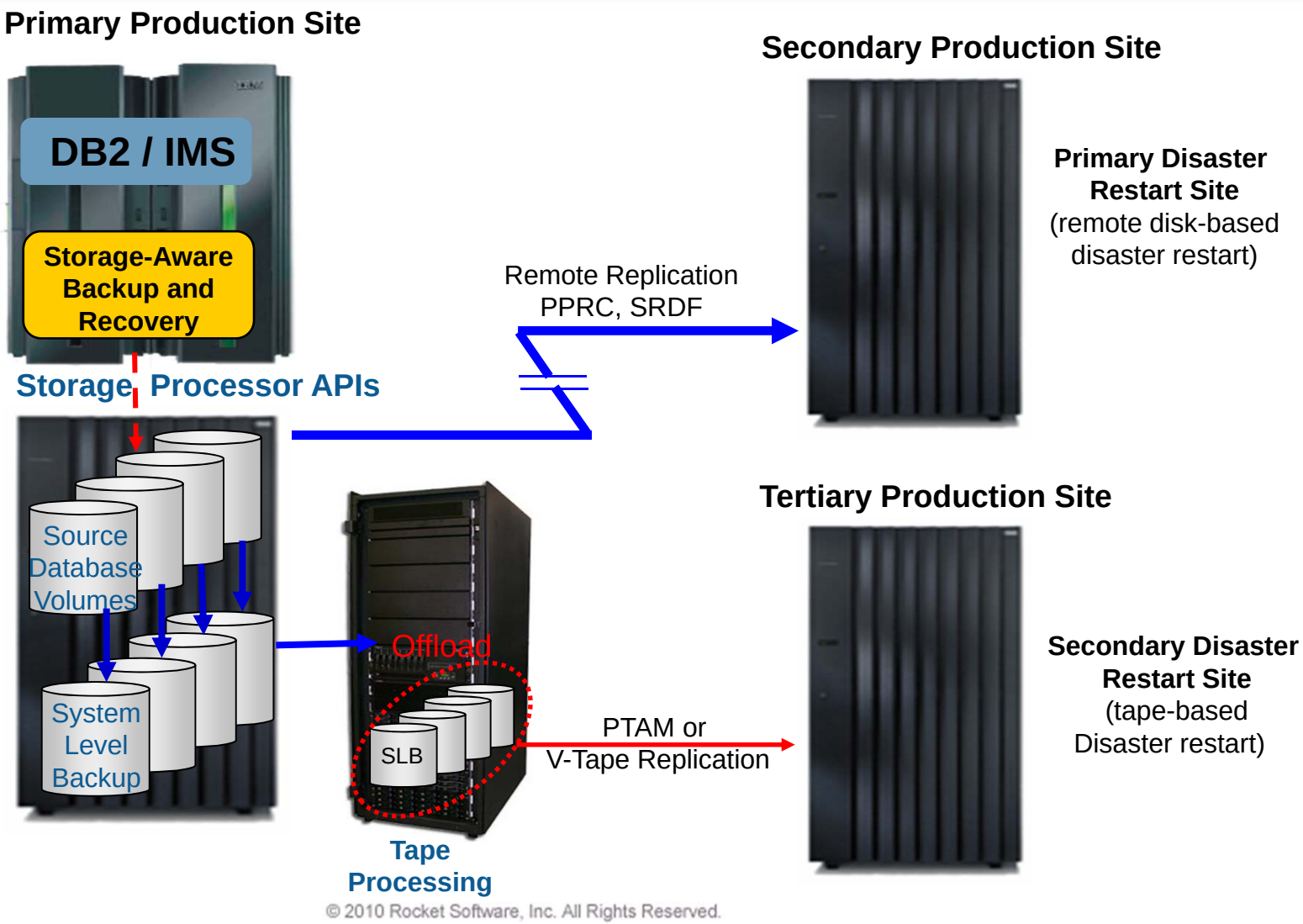
- Perform full volume DB2 / IMS cloning automation
  - Requires same amount of space as the source
- Perform space efficient clone operations
  - Use full volume clone as the source
  - No real space used for space efficient clones unless they are updated
- Operational automation may be required to re-instantiate space efficient clones when the full volume clone is re-instantiated



Implementation Planning
Disaster Restart Considerations

- SLB should contain database system data only
  - Can contain other data that is restarted together
    - *Recovering database and other data together may require using a storage based consistency function to create the SLB*
    - *Cannot roll forward if database and other data require consistency*
- Use disaster recovery profiles to prepare for roll-forward recovery at the DR site
  - Disaster recovery profiles specify options on how to copy log data for DR site, etc.
  - Ensure disaster recovery metadata is taken offsite with archive logs and image copies (Example DBR for DB2 DR PDS)
  - Reduces recovery point objectives (RPO)

Using SLBs for a Tertiary DR Site



Implementation Planning
Copy Blade Selection

- Know your storage processing infrastructure
  - What fast-replication facilities are licensed and preferred
- Determine storage blade and fast-replication facilities to use
  - DB2 Backup System Blade
  - DFSMSdss Blade
  - IBM FlashCopy Blade
  - EMC TimeFinder Blade
  - HDS ShadowImage Blade
- Determine which type of consistency function is best for your environment
  - Database suspend, storage-based consistency

Session Summary

- Storage-aware database utilities provide storage integration to simplify database administration tasks
- System-level backup solutions leverage storage-based fast-replication facilities and investments
  - Fast and non-intrusive backup operations with less administration
  - Reduces host CPU, I/O and storage utilization
  - Backups can be used for system, application, disaster restart
  - Parallel recovery reduces system and application recovery time
- Database system cloning automation allows production data to be leveraged easily and effectively
- DB2 table and index spaces and IMS databases refreshed easily
- Less skills required to implement advanced backup, recover, disaster recovery, and cloning solutions
- Implementation planning is important to optimize the benefits