Simplify and Improve IMS Administration by Leveraging Your Storage System

Ron Haupert
Rocket Software, Inc.

March 3, 2011
Session Number: 8568

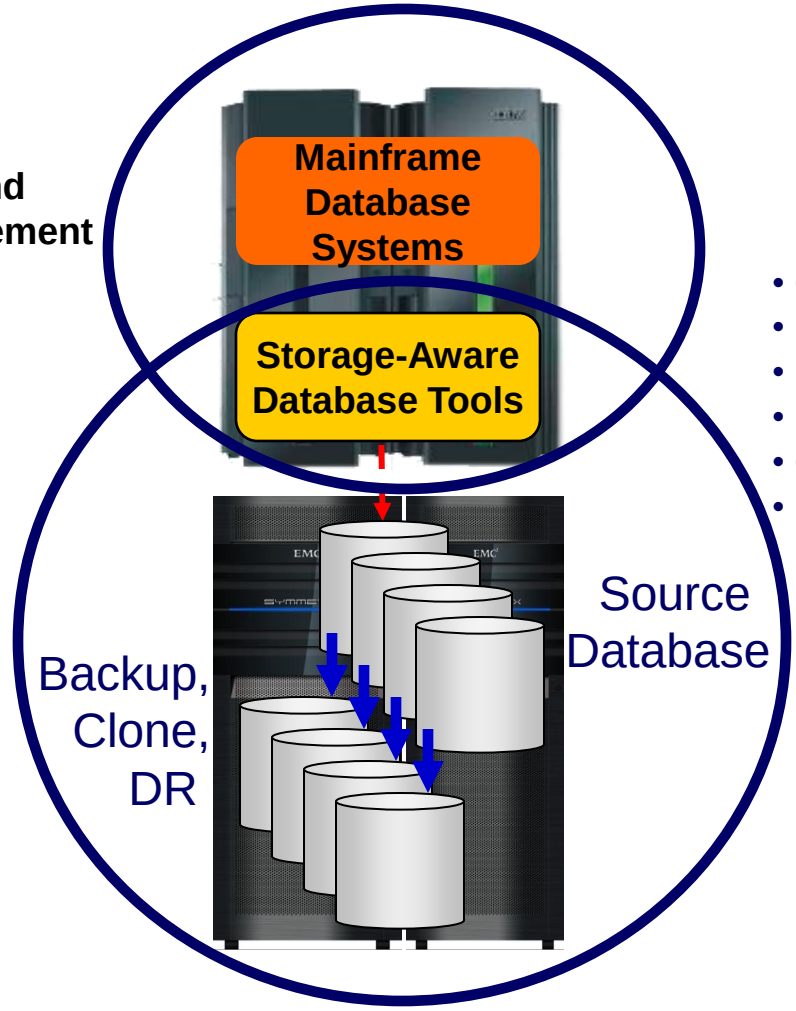
Session Agenda

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

Database and Storage Administration
Trends and Directions

- Large IMS systems require high availability
  - Fast and non-intrusive backup and cloning facilities are required
  - Fast recovery capabilities 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
- Reduce recovery time with fast restore and parallel recovery
- 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 DBAs ***safely and transparently*** using "***storage-aware***" database utilities
- Provide a sophisticated infrastructure and metadata to manage the IMS and storage processor coordination

Database and Storage Integration
New Solutions for DBAs to Consider

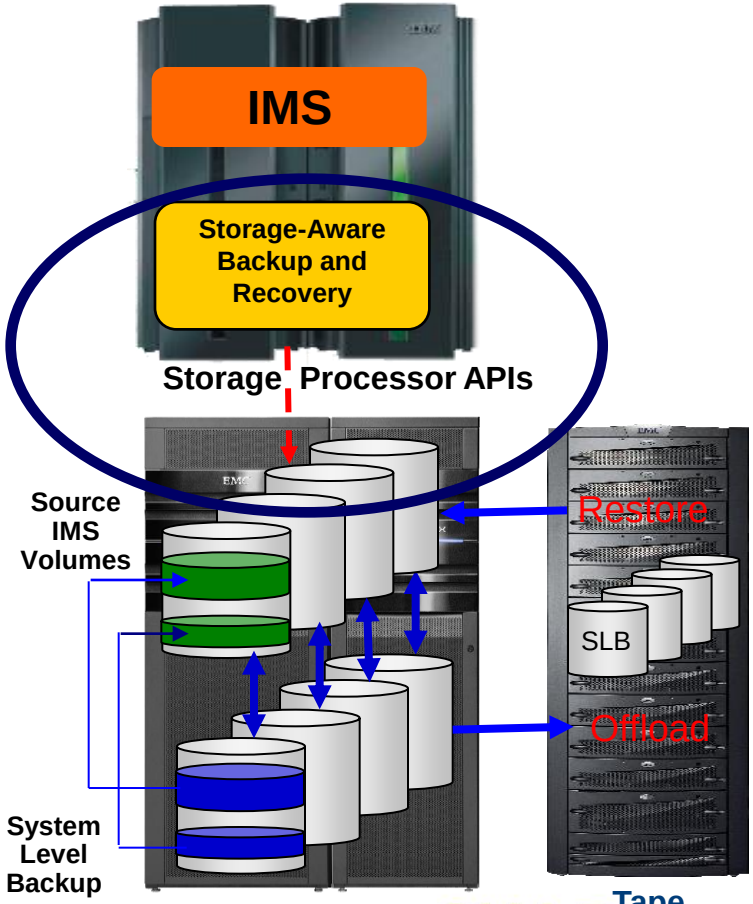
- DBAs use traditional IMS backup and recovery tools
  - Hard to integrate new backup and recovery methodologies
  - Uncomfortable with new backup and recovery solutions
- Lack of IMS and storage-administration coordination
  - Storage processor fast-replication facilities are not well understood by application and DBA personnel
    - *DBAs don't trust storage technologies*
  - IMS applicability of fast-replication not well understood by storage administrators
    - *Storage groups don't trust DBAs*
- Storage-aware IMS utilities resolve these issues

IMS System Level Backup

- Backup complete IMS systems as a unit without affecting running applications
  - IMS backup components include:
    - Active and archive logs
    - RECONs
    - All IMS database 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

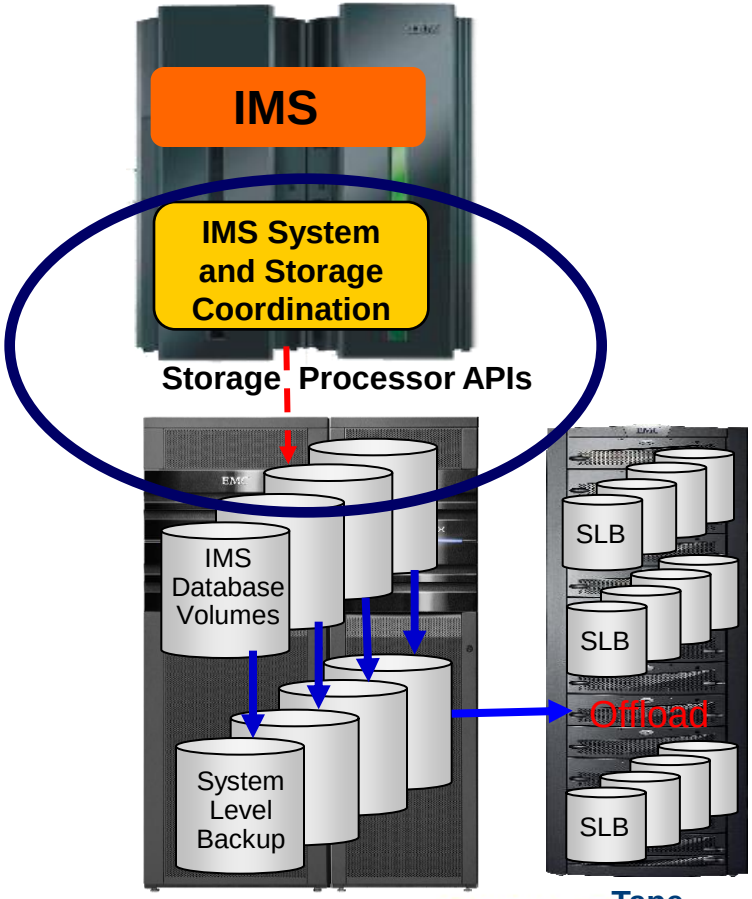
IMS System Level Backup
Functional Requirements

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



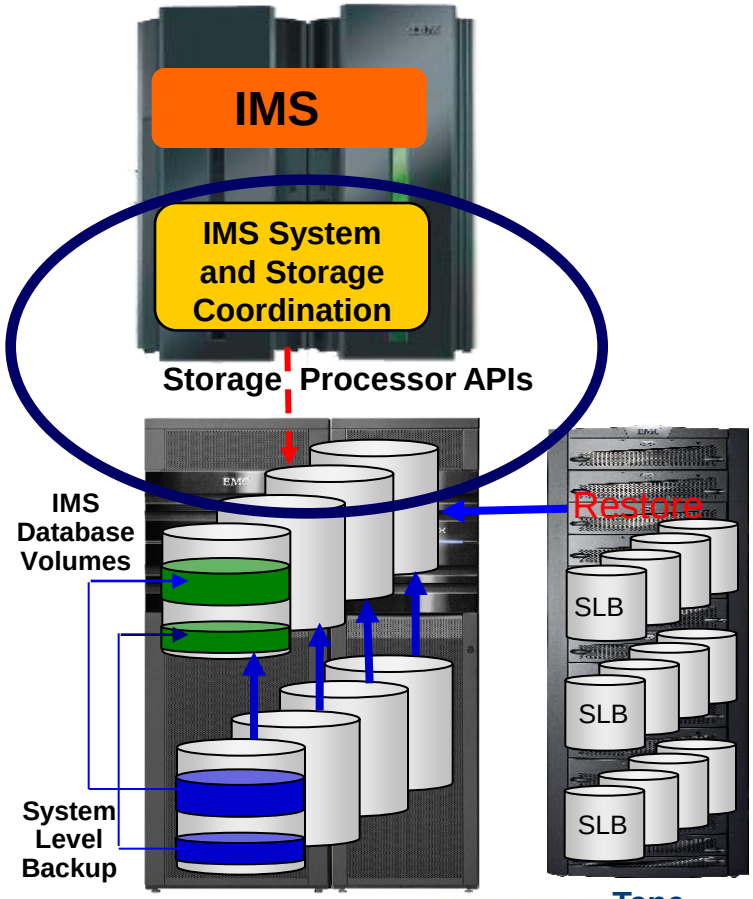
IMS System Level Backup

- Storage-based backup reduces processing and administration costs
- Fast-replication is used to perform IMS backup and restore functions
  - Full system backups complete in seconds
  - Backup performed without host CPU or I/O
- Backup 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
  - IMS suspend process
  - Storage-based consistency functions
- Automated backup offload management

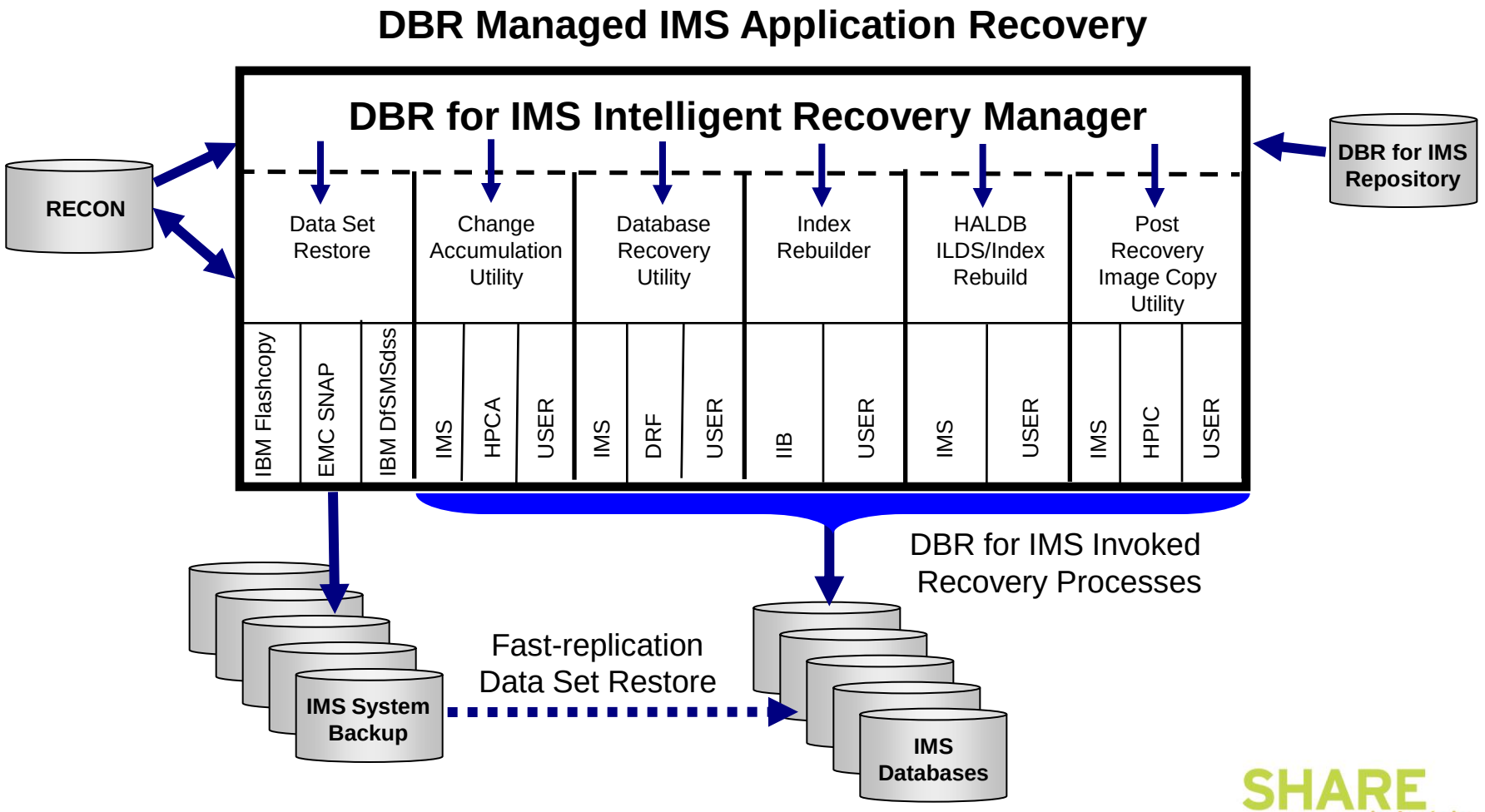


IMS System Level Backup
System and Application Recovery

- Recover IMS systems or databases from disk or tape automatically
- Faster recovery
  - Instantaneous system-restore process
  - Coordinated parallel restore and recovery operations minimize down time
- IMS system backup can be used for database or application recovery
  - Data sets snapped to restore data
  - Parallel log apply reduces recovery time
- One system backup used for system, application, disaster recovery

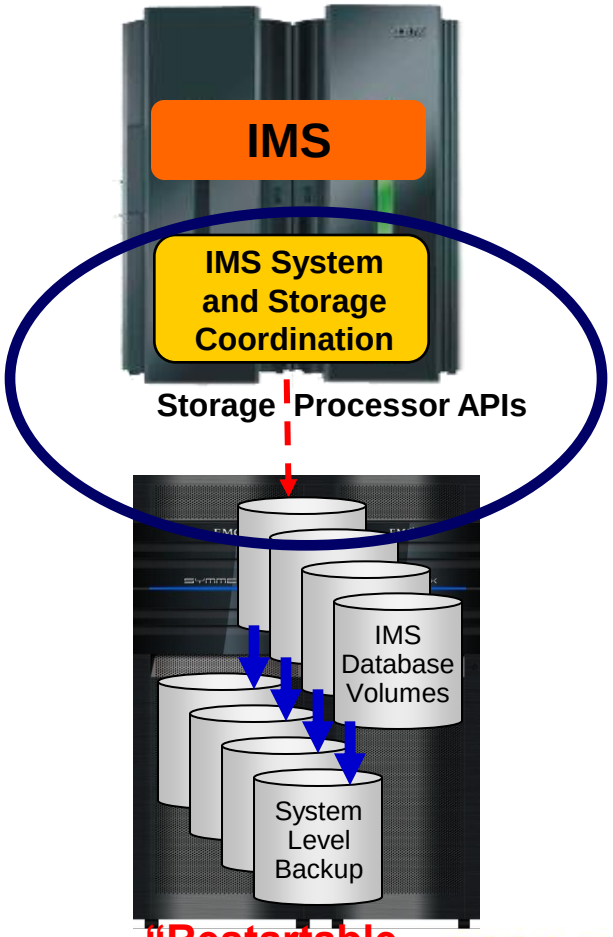


Mainstar DBR for IMS
Storage Integrated IMS Recovery Example



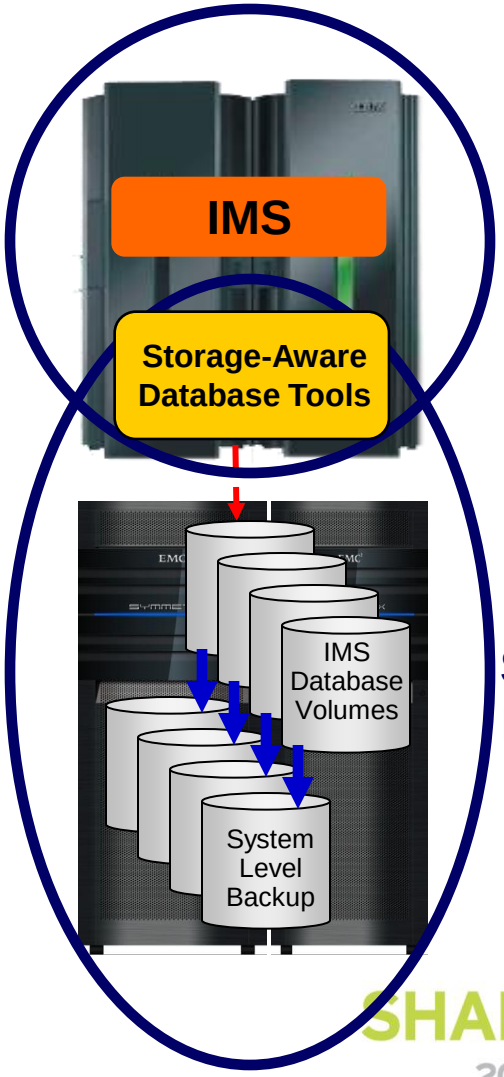
IMS System Level Backup
Disaster Recovery Benefits

- 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 database initialization process
  - Disaster recovery is as simple as restarting from a power failure
- Reduced recovery time at a DR site
- Transforms tedious disaster recovery procedures into a tape-based disaster restart process
  - Tape-based disaster restart solutions provide similar benefits as storage-based remote replication solutions



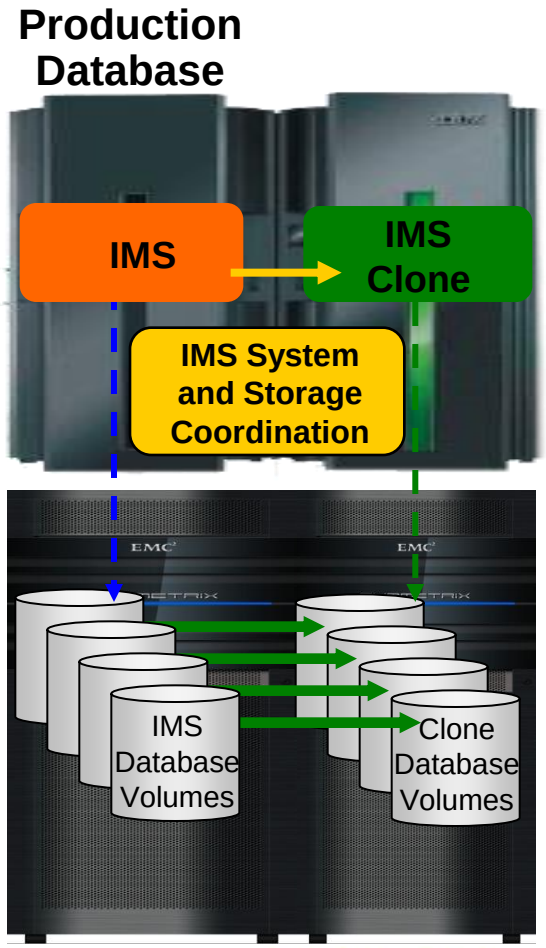
IMS System Level Backup
Storage Benefits

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



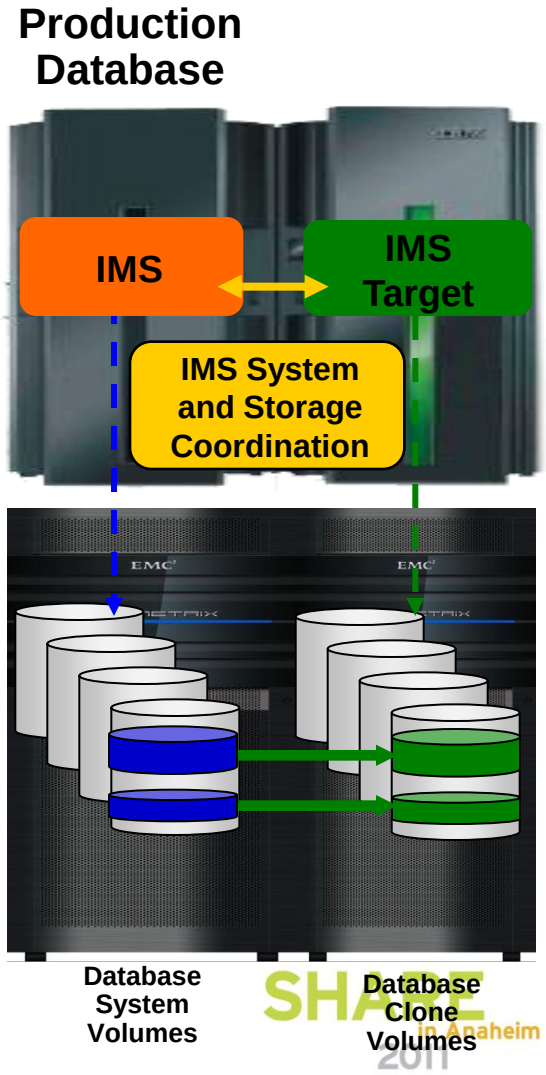
Cloning IMS Systems

- Performs IMS cloning automation
  - Simplifies IMS system cloning processes
  - Reduces cloning time and administration costs
- Leverages fast-replication facilities to clone data
  - Data can be cloned while on-line or off-line
- Performs rapid volume reconditioning and data-set renaming on cloned IMS volumes
  - Critical component of the IMS system cloning process
- Adjusts target IMS system to accommodate and accept the cloned data
  - IMS RECONs, PROCLIB, JOBS, JCL, MDA members



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



IMS Storage-Aware Database Products

- **IBM - IMS Cloning Tool for z/OS**
  - IMS system cloning and database refresh
- **Mainstar - Database Backup and Recovery for IMS**
  - DBR for IMS – IMS backup and recovery
- **Mainstar - Clone and Rename for IMS**
  - ICR – IMS system Cloning Automation
- **Mainstar - Rapid Database Refresh**
  - RDR – IMS database refresh automation

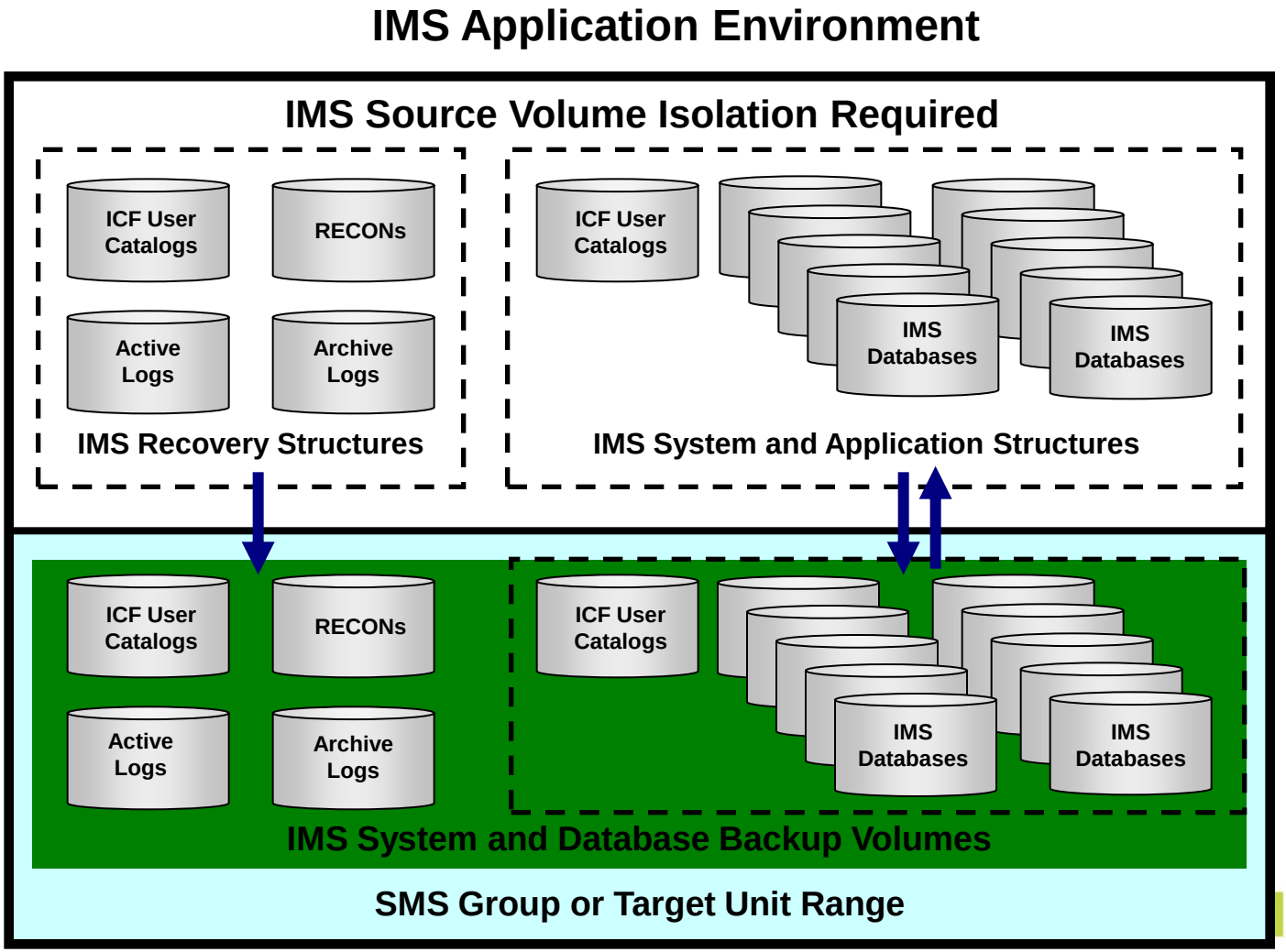
Implementation Planning Considerations
Examples based on DBR for IMS, ICR, EMC and IBM Storage

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

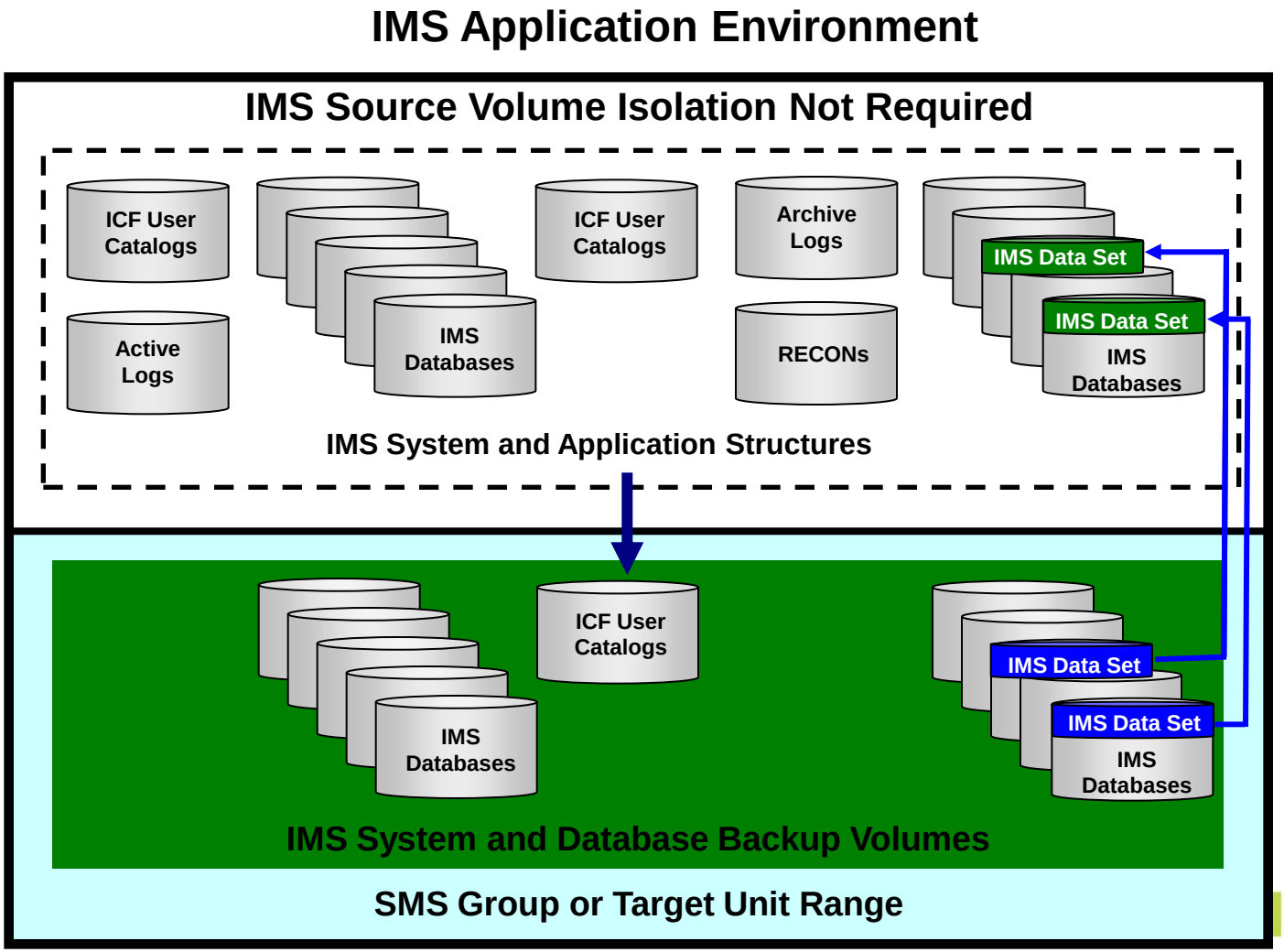
Implementation Planning
System Level Backup Usage

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

IMS System Level Backup
Data-Set Layout for System Recovery



IMS System Level Backup
Data-Set Layout for Application Recovery



Implementation Planning
Partial System-Level Backup

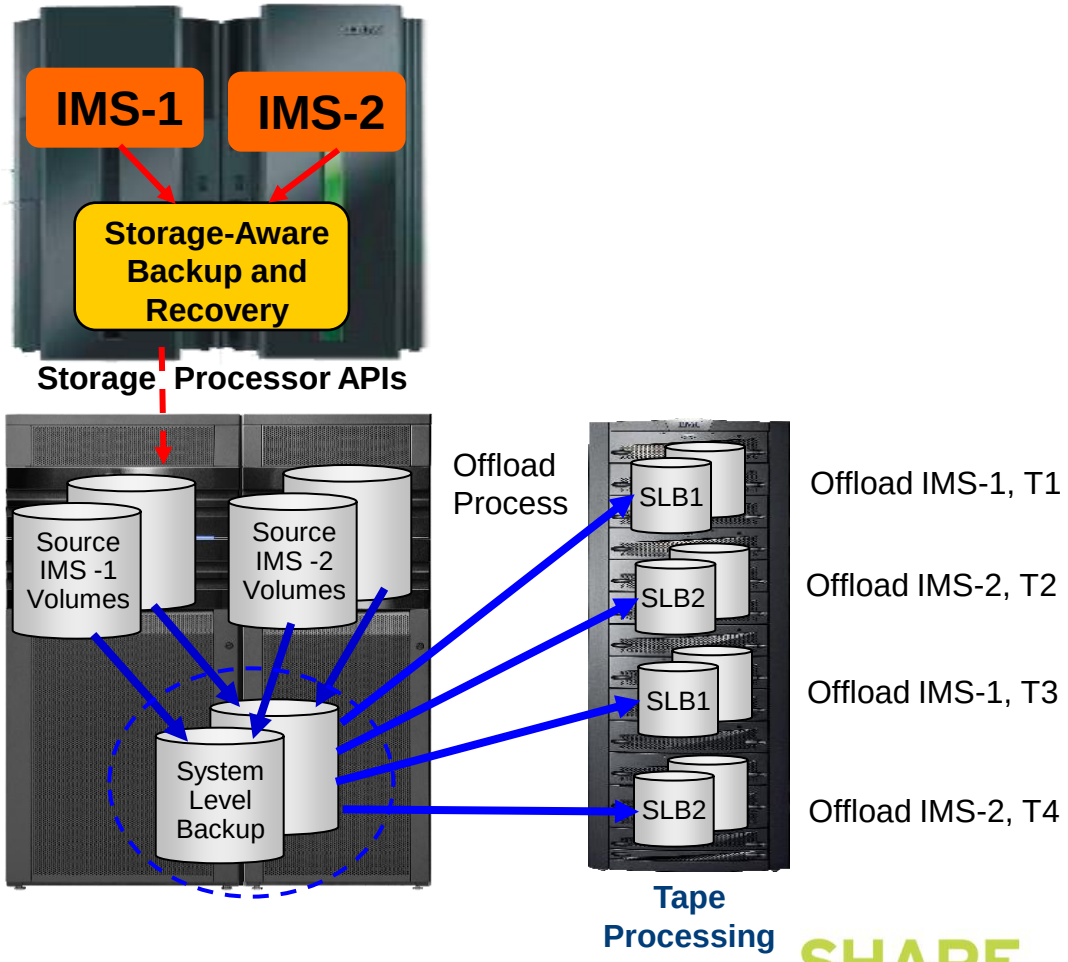
- Partial system-level backup (PSLB)
  - Backup volumes representing a subset of the IMS system
  - PSLBs used for database or application recovery only
  - Data set fast replication used to restore data
  - Log and data isolation not required
  - Desired IMS databases data should be grouped on volumes 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
  - Reduce disk utilization
  - Support more backup generations

Implementation Planning
Backup Frequency and Space Utilization

- SLB type: Full, Data only, or Partial
- 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 space-efficient fast-replication methods like EMC VDEVs to save space
- Consider using one set of volume targets to support multiple IMS systems
  - Saves fast-replication target volume (DASD) requirement
- Consider cloning database systems to space efficient volumes using a SLB as the source

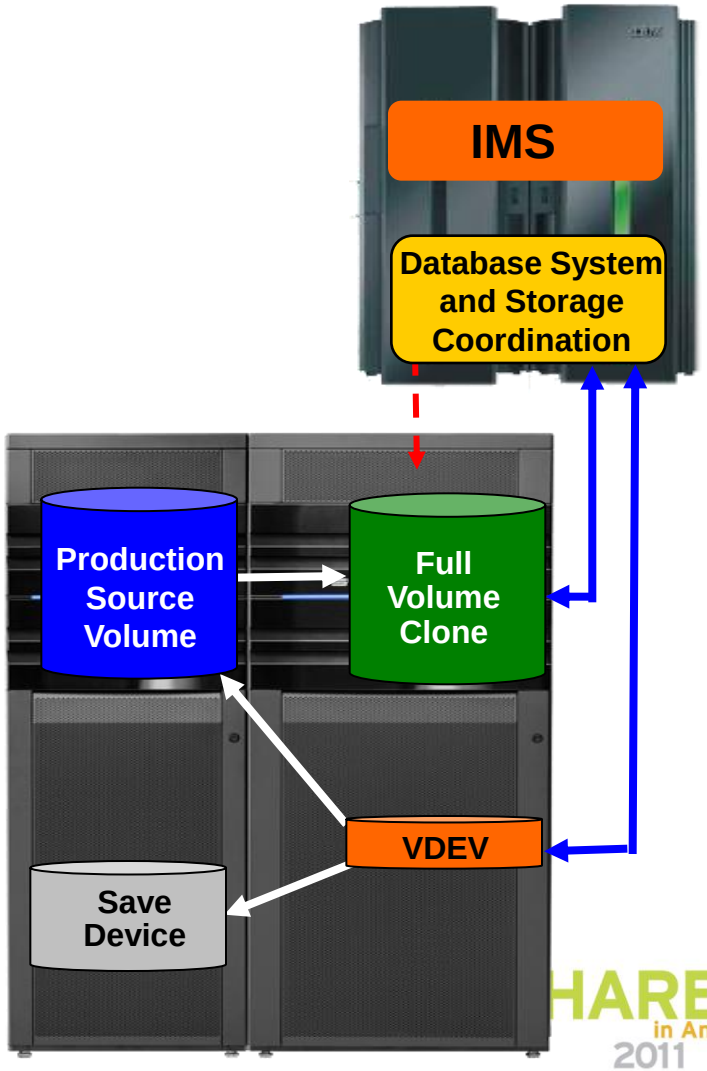
One Set of Backup Volumes for Multiple IMS Systems

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

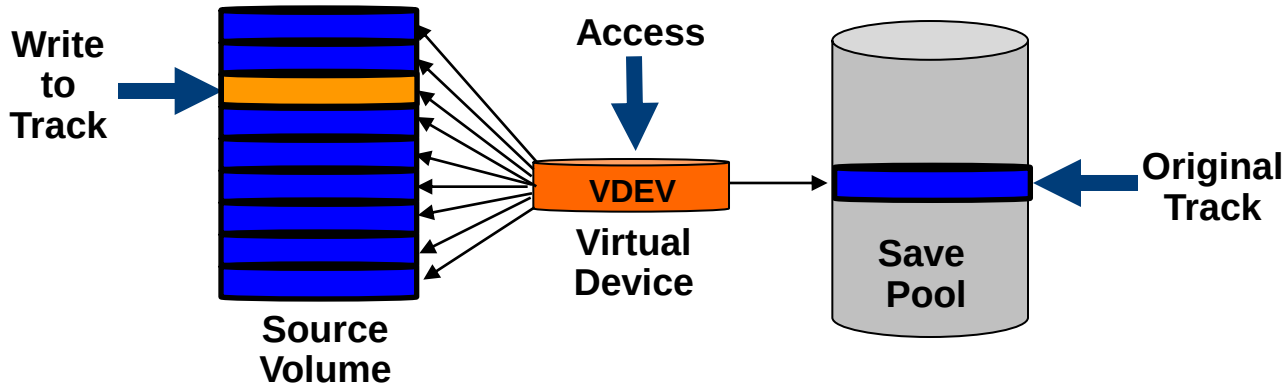


Create SLBs and Clone IMS Systems
Full and Space Efficient Volumes

- EMC TimeFinder example
- TimeFinder/Clone
  - Full volume copy
  - Relationship can be retained with production volume
  - Allows TimeFinder/Clone incremental resynchronization
- TimeFinder/Snap Virtual Device (VDEV)
  - Space efficient copy
  - Allows TimeFinder/Snap incremental restore
  - Can have multiple TimeFinder/Snap volumes associated with production volume

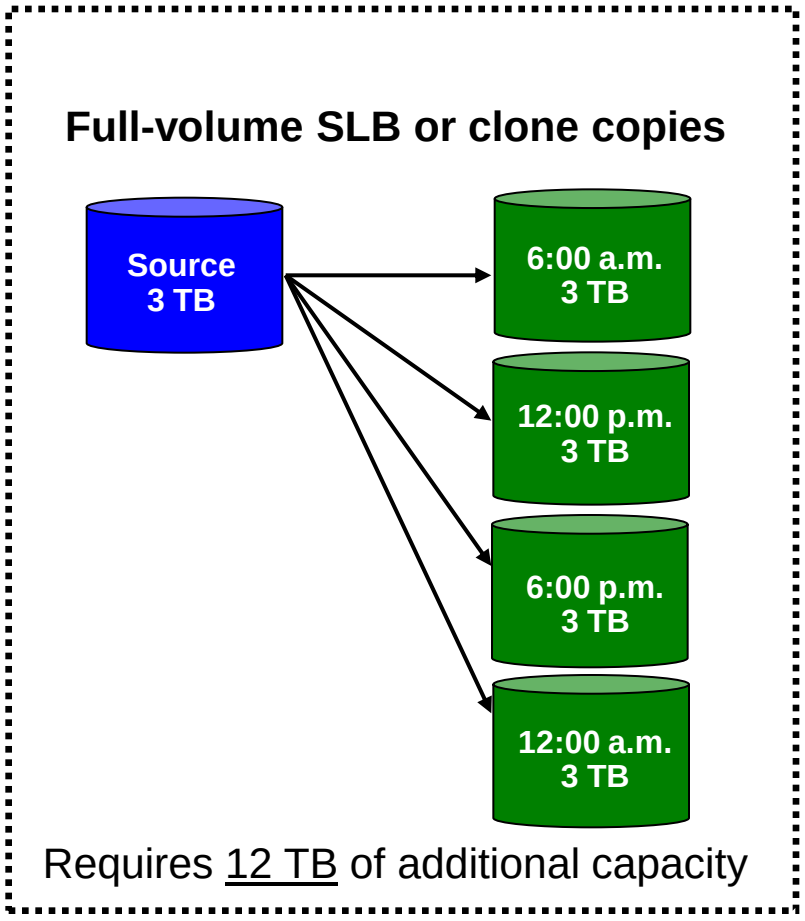


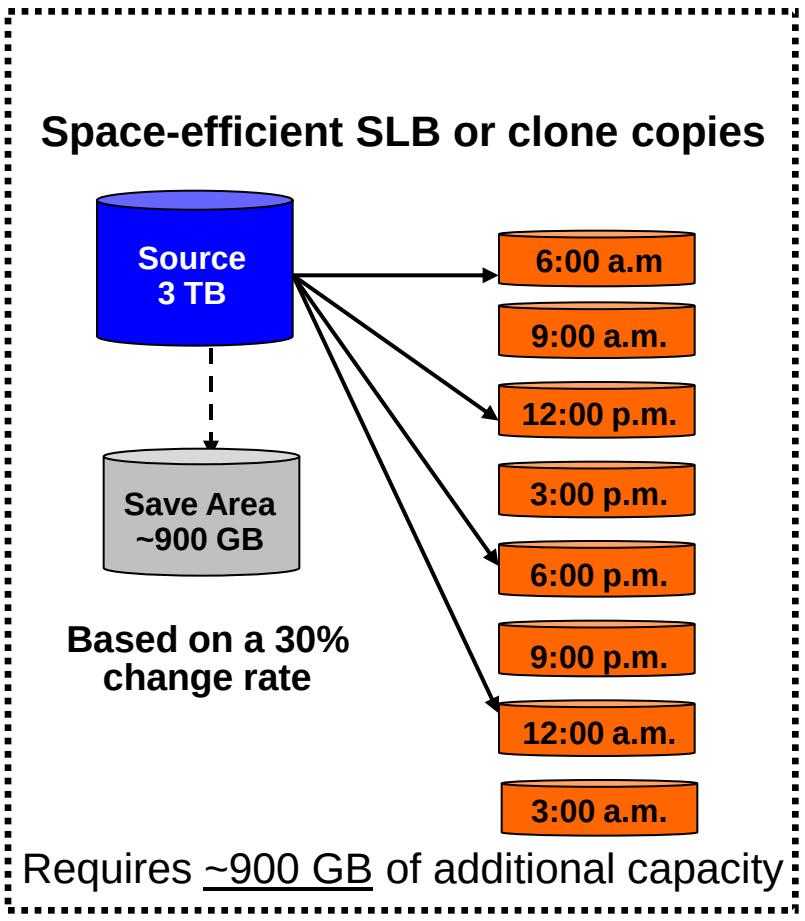
TimeFinder/Snap VDEV Operation Overview



- The Snap target is accessible when the copy session is activated
- The first time a track on the source volume is written to:
  - Original data on the source volume is copied to a save volume (pool)
  - Pointer on the VDEV device is changed to point to the save pool
  - The host write is written onto the track of the source volume in cache
- The track on the source volume is then updated
- Unchanged data stays in place on the source volume

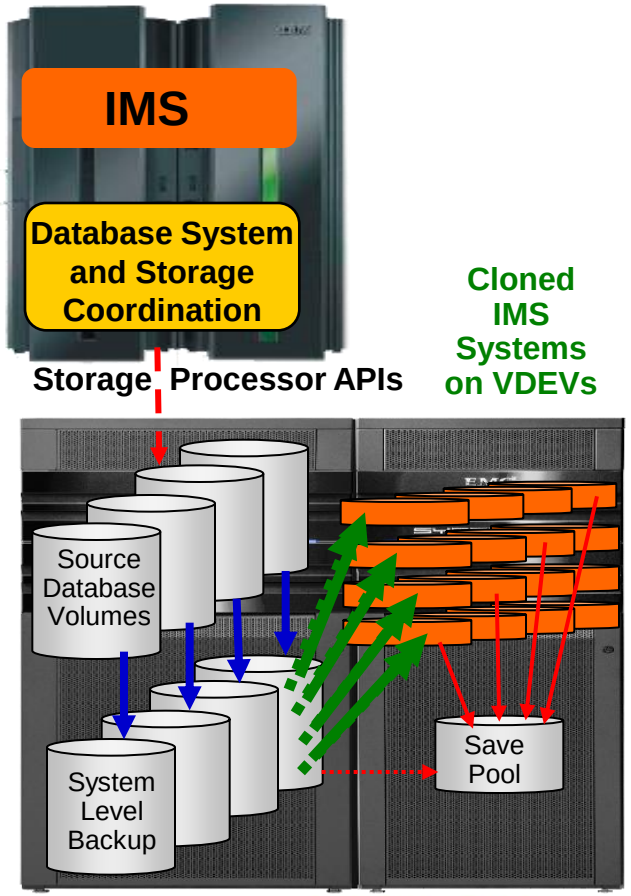
Space Efficient Usage Economics
Enable Frequent IMS SLB or Clone Copies





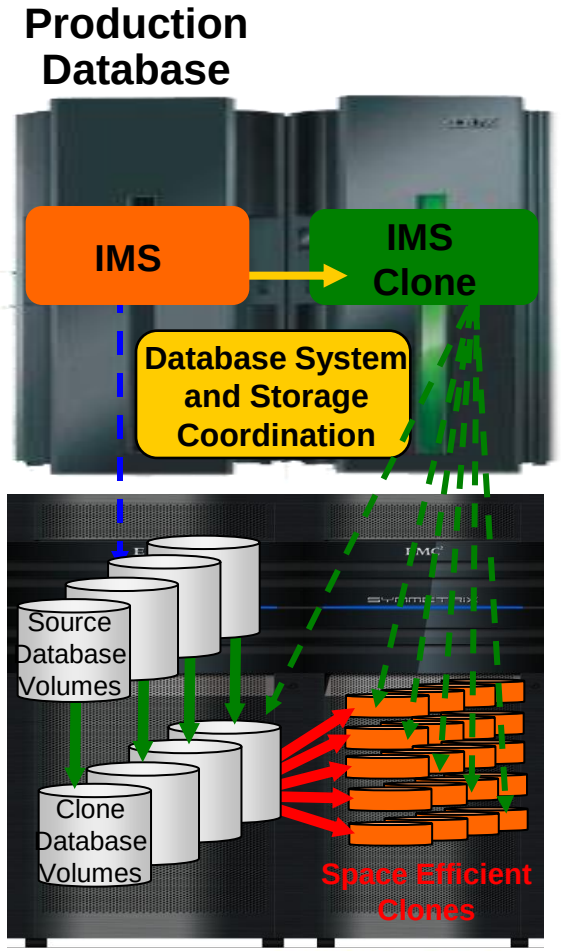
Full Volume and Space Efficient
Usage Example

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



Full Volume and Space Efficient
Usage Example (2)

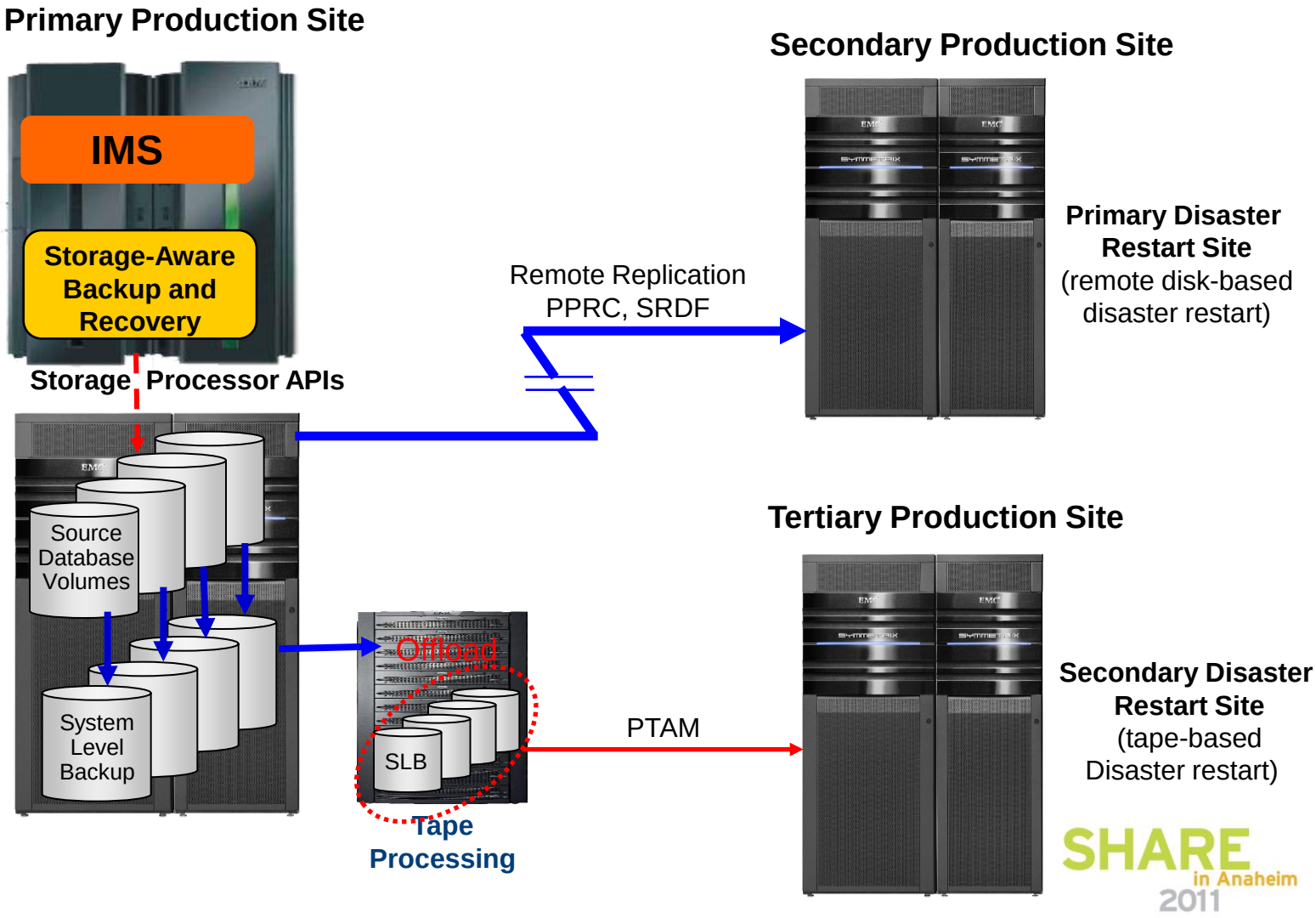
- Perform full volume IMS cloning automation
  - Requires same amount of space as the source
- Perform space efficient clone operations
  - Use full volume clone as the source
  - No real space used for space efficient clones unless they are updated
- Operational automation may be required to re-instantiate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



Implementation Planning
Disaster Restart Considerations

- SLB should contain IMS data only
  - Can contain other data that is restarted together
    - Recovering IMS and other data together may require using a storage based consistency function to create the SLB
    - Cannot roll forward if IMS 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 DBRs Disaster Recovery PDS is taken offsite with archive logs and image copies
  - Reduces Recovery Point Objectives (RPO)

Using IMS SLBs for a Tertiary DR Site

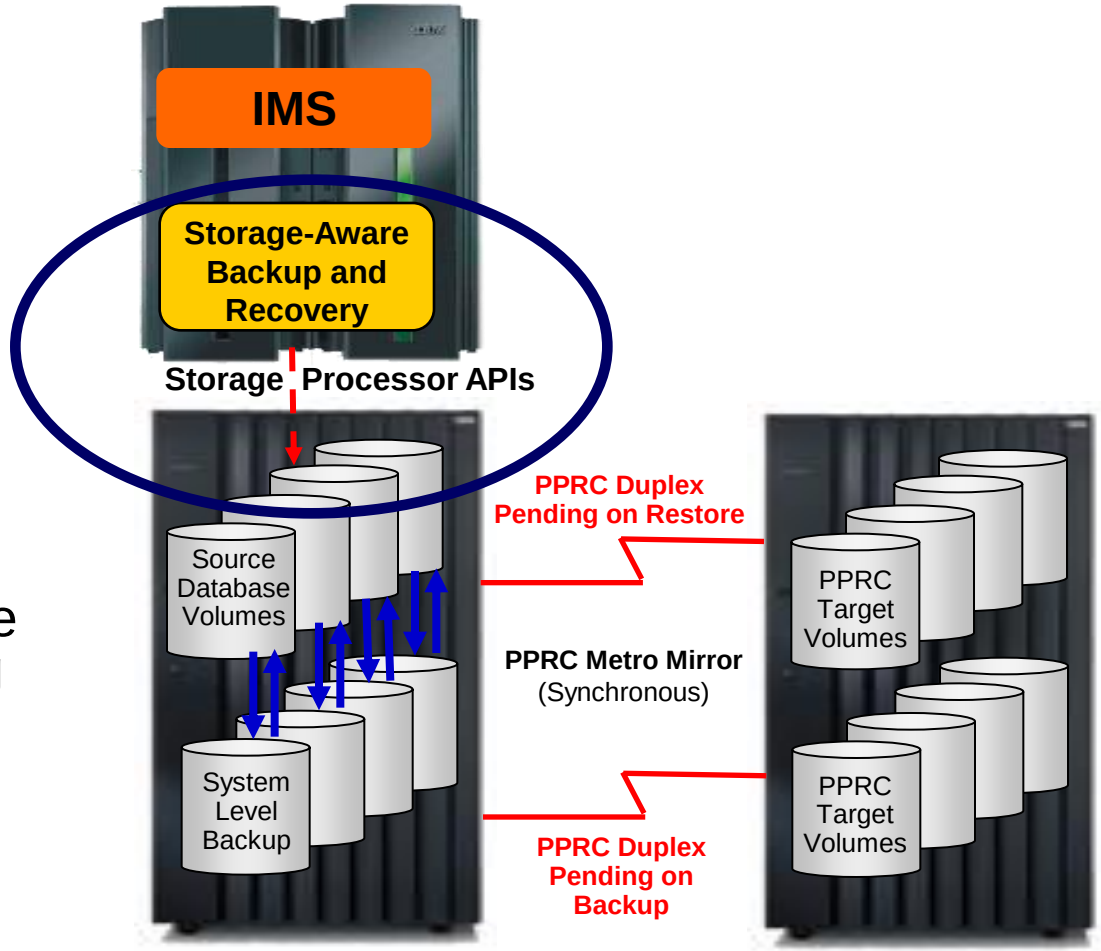


IMS SLBs with PPRC Remote Pair FlashCopy

- Storage Aware Backup/Recovery and “Remote Pair FlashCopy” Support
  - FlashCopy to PPRC Primary volume **while maintaining Full Duplex**
  - FlashCopy Metro Mirror implementations only
- Preserve Mirror support option specified in installation ParmLib (FCTOPPRCP)
  - N - Do not allow the PPRC primary to become a FlashCopy target
  - Y - The pair can go into a duplex pending state
  - P - It preferable that the pair does not go into a duplex pending state.
  - R - It is required that the pair not go into a duplex pending state
- Copy Blade Support
  - FlashCopy blade
  - DFSMSdss copy blade

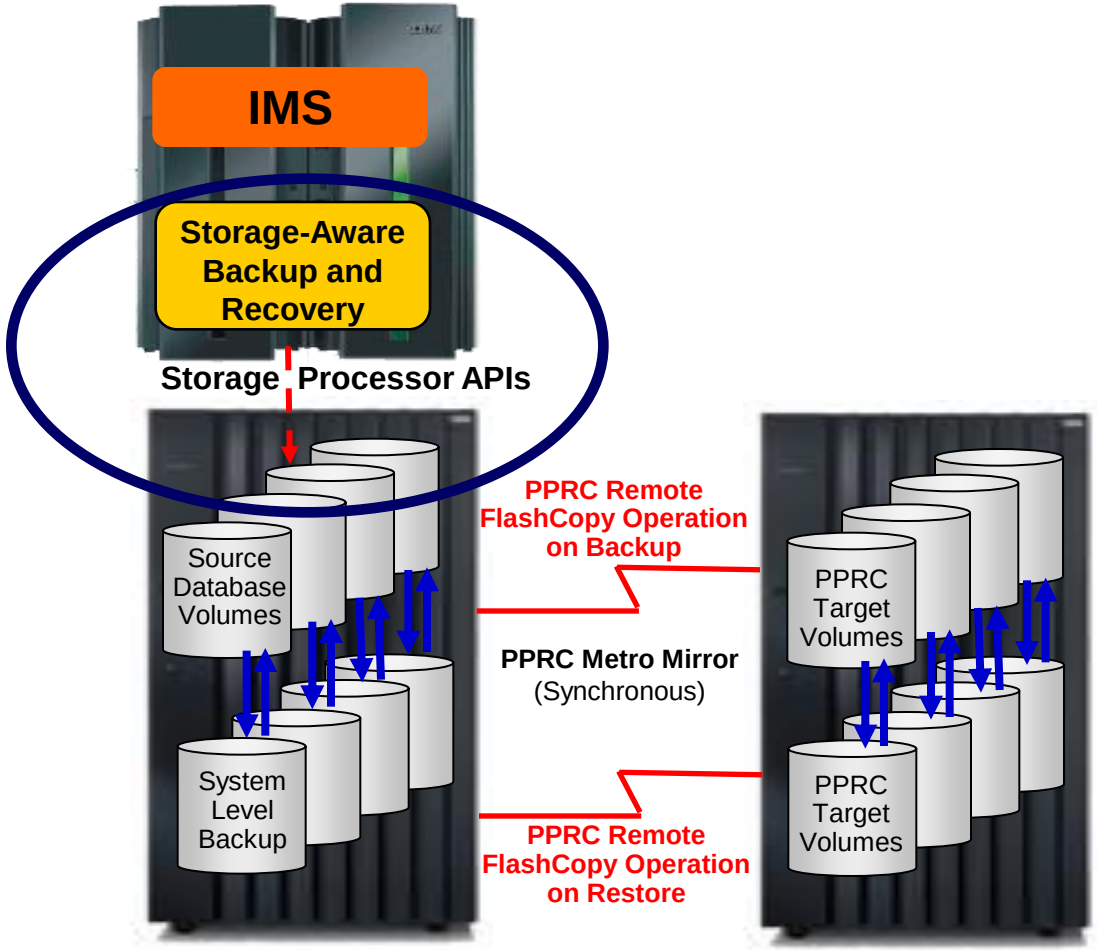
System Level Backup Without Remote Mirror FlashCopy

- SLB causes backup volume data to be copied through PPRC link
- SLB can cause PPRC duplex pending state
- SLB restore can cause PPRC duplex pending state



System Level Backup With Remote Mirror FlashCopy

- FlashCopy data is not copied over PPRC links
- SLB drives remote pair FlashCopy operation
  - Remote PPRC production volumes Flashed to remote PPRC SLB volumes
- System level restore drives remote pair FlashCopy operation
  - Remote PPRC SLB volumes Flashed to remote PPRC production volumes



IMS SLBs with XCR and PPRC without Remote Pair FlashCopy

- Assume IMS volumes are primary volumes in a PPRC metro mirror or XRC relationship
- Backup target volumes must not be in a PPRC or XRC relationship
- Backup volumes cannot be used for IMS system recovery without duplex pending state
- IMS application and object recovery allowed
  - DBR for IMS performs application and object recovery by copying data sets from the backup volumes to the source volumes
  - DFSMSdss used to copy data sets
    - Fast Replication Preferred option used to copy data
    - DFSMSdss uses slow copy methods as data sets cannot be Flashed to source PPRC or XRC volumes.

Implementation Planning
Copy Blade Selection

- Know your storage processing infrastructure
  - What storage processors are used (EMC, IBM, HDS)
  - What fast-replication facilities are licensed and preferred
- Determine storage blade and fast-replication facilities to use
  - DFSMSdss Blade
  - IBM FlashCopy Blade
  - EMC TimeFinder Blade
  - HDS ShadowImage Blade
- Know the type of consistency function is best for your environment
  - IMS Suspend, Storage-based consistency

IBM Copy Blades

- IBM FlashCopy Blade
  - Provides support for IBM FlashCopy V2
  - Data set FlashCopy support for fast object / application recovery
  - ANTRQST calls issued to drive FlashCopy volume commands (fast performance)
  - Requires IMS Log Suspend
  - Supports IBM, EMC, HDS FlashCopy products
- IBM DFSMSdss Copy Blade
  - ADRDSSU utility invoked to perform volume copies
  - Fast replication (preferred) is used – Will support non fast replication DASD
  - Data set FlashCopy support for fast database / application recovery
  - Slower than using ANTRQST in native FlashCopy blade
  - Requires IMS Log Suspend
  - Supports FlashCopy (IBM, EMC, HDS), SnapShot (STK, RAMAC Virtual Array)

EMC Copy Blades

- EMC TimeFinder Blade
  - TimeFinder/Mirror
  - TimeFinder/Clone Mainframe Snap Facility
  - TimeFinder/Snap Virtual Devices
    - Allows multiple backups with reduced storage utilization
  - Incremental copy support for all copy methods
  - EMC Consistency Technology support for all volume copy methods
    - Reduce the need for database suspend functions
  - TimeFinder Data Set Snap facility to perform fast replication application / object restores.
  - IMS suspend not required when storage-based consistency technology is used

Hitachi Data Systems Copy Blades

- ShadowImage Blade (backup product implementation example)
  - Supports HDS native ShadowImage volume copy processes
  - Invoked using FlashCopy backup profile
    - Checks *shadow_image* field in backup product parameter library
      - *N – DBR drives FlashCopy*
      - *Y – DBR drives ShadowImage*
  - Incremental Copy Support
  - Requires an IMS log suspend operation
  - Can support IMS systems that span HDS and IBM storage using native methods (ShadowImage and FlashCopy)
  - HDS data set FlashCopy emulation used for fast replication object / application restores

Session Summarization

- IMS storage-aware database utilities provide storage integration to simplify database administration tasks
- IMS system 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 database recovery time
- IMS system cloning automaton allows production data to be leveraged easily and effectively
- IMS databases refreshed easily
- Fewer skills required to implement advanced IMS backup, recover, disaster recovery, and cloning solutions
- Implementation planning is important to optimize the benefits

Complimentary SHARE Sessions

- Simplify and Improve DB2 Database Administration by Leveraging Your Storage System
  - Tuesday March 1, 2011
    - 9:30 – 10:30 AM

- Instant IMS and DB2 Backup and Restore – Really?!
  - Mainstar Vendor Session
  - Tuesday March 1
    - 1:30 PM
    - Room 207D.