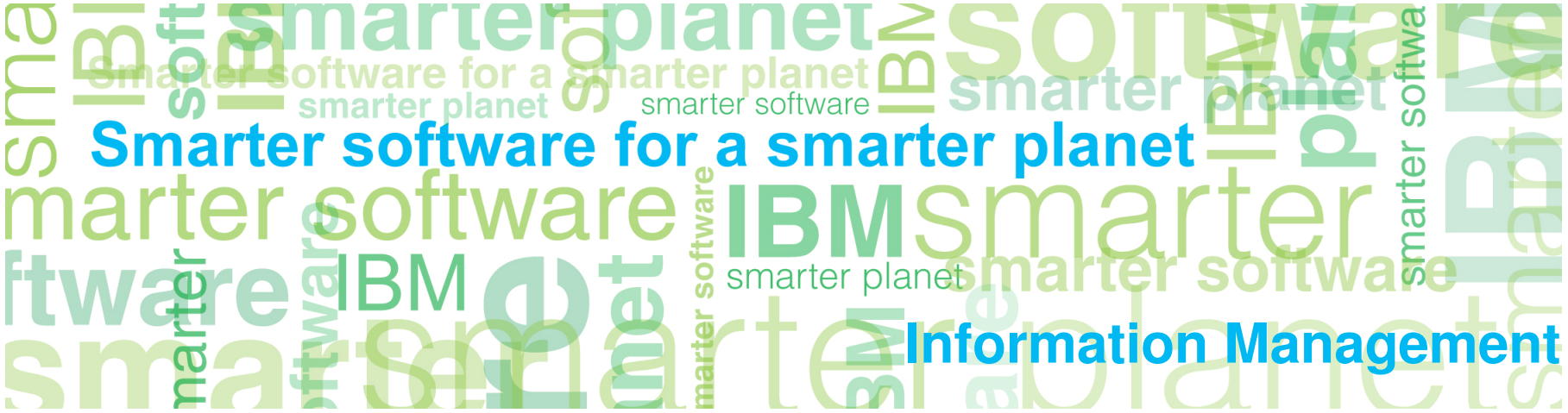
Jay Bruce – IBM DB2 Tools Architect and Strategist
Ron Haupert - Rocket Software, Inc.
April 20, 2010

Improving Your Life as a DBA in Today's Turbulent Environment



Agenda

- Database Management Professionals:
  Improve Your Life Through…

- Managing Native Stored Procedures with DB2 Administration Tool

- Benefiting from the Proactive Alerts in DB2 Query Monitor

- Leveraging Your Storage System and Managing Storage Requirements

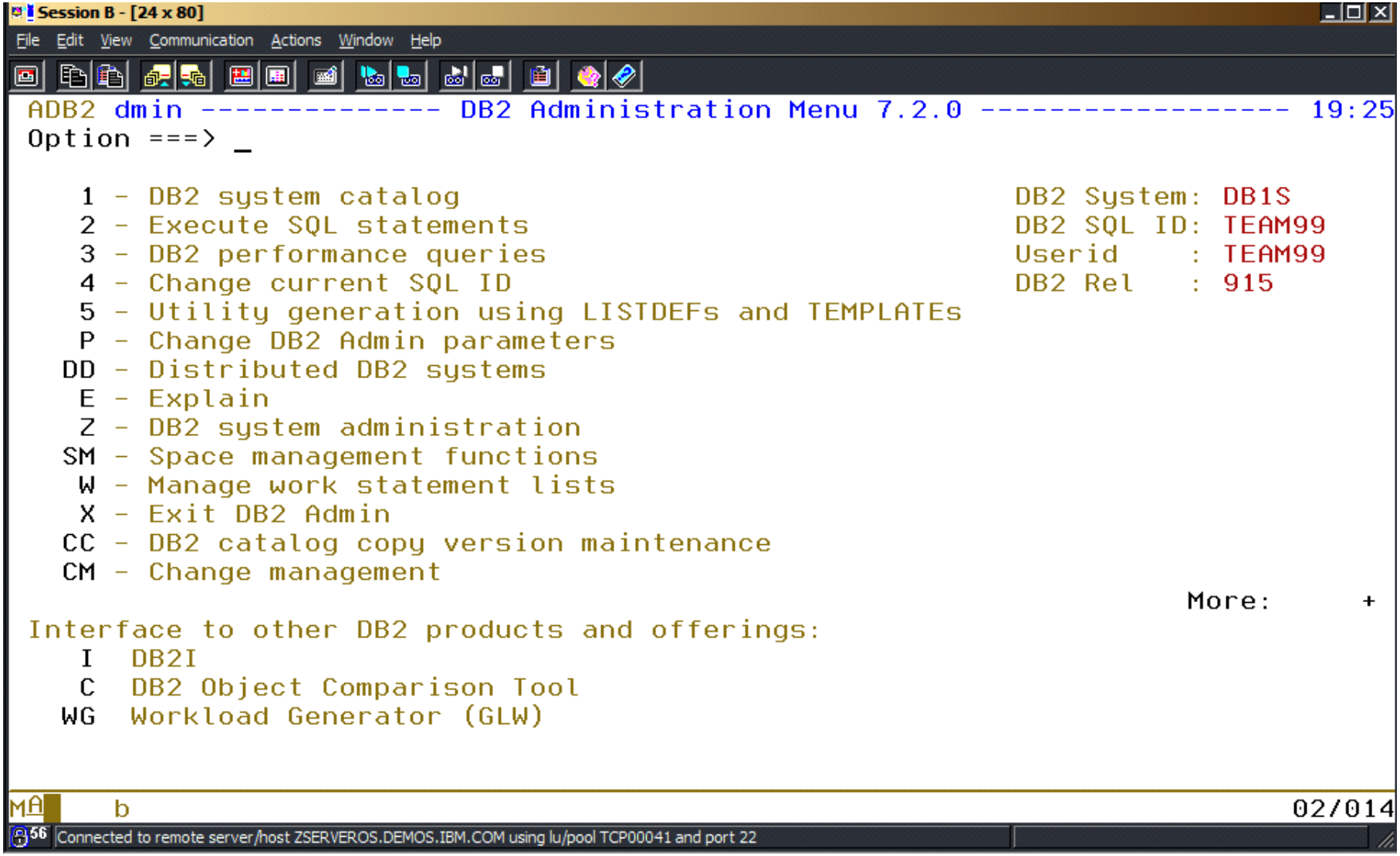
Managing Native Stored Procedures with DB2 Administration Tool

DB2 9 Native SQL Procedures

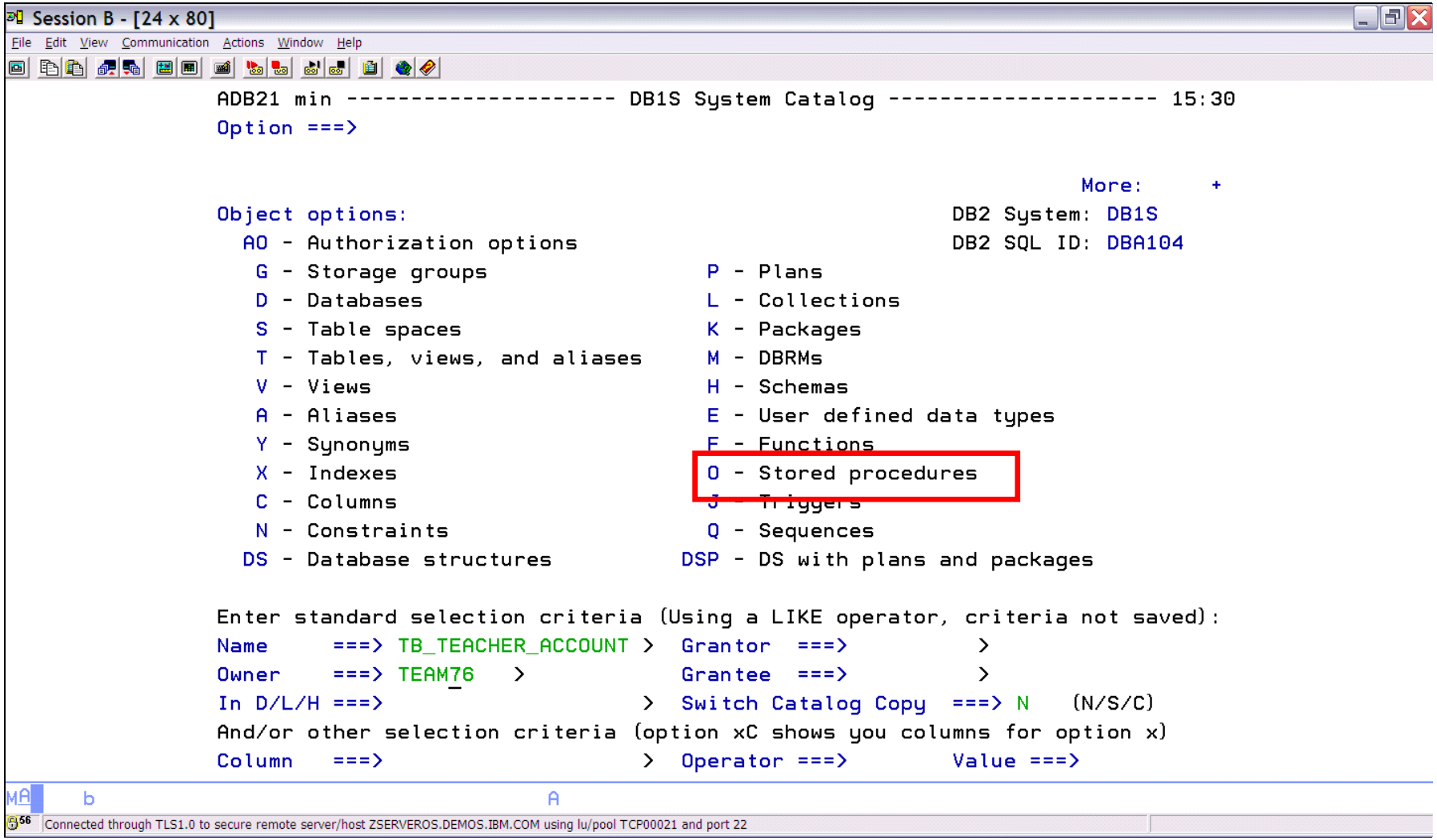
- Native SQL Procedures are new to DB2 9 for z/OS
- Native SQL Procedures are zIIP-eligible when invoked via DDF
- Imbed application logic in SQL Procedure Language
- Minimize network traffic
- Build with Optim Development Studio or IBM Data Studio

- Are you prepared to manage Native SQL Procedures?

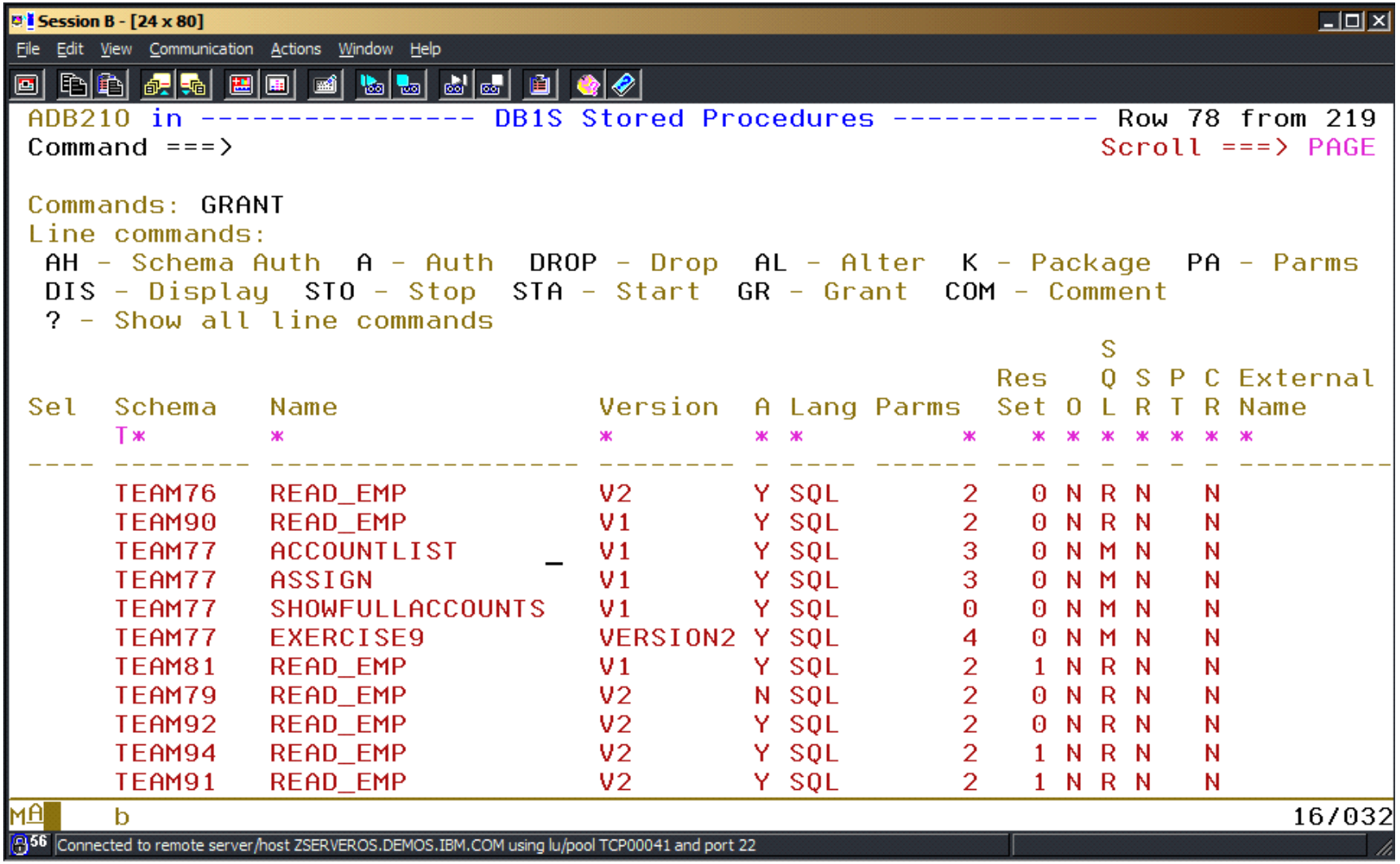
DB2 Administration Tool



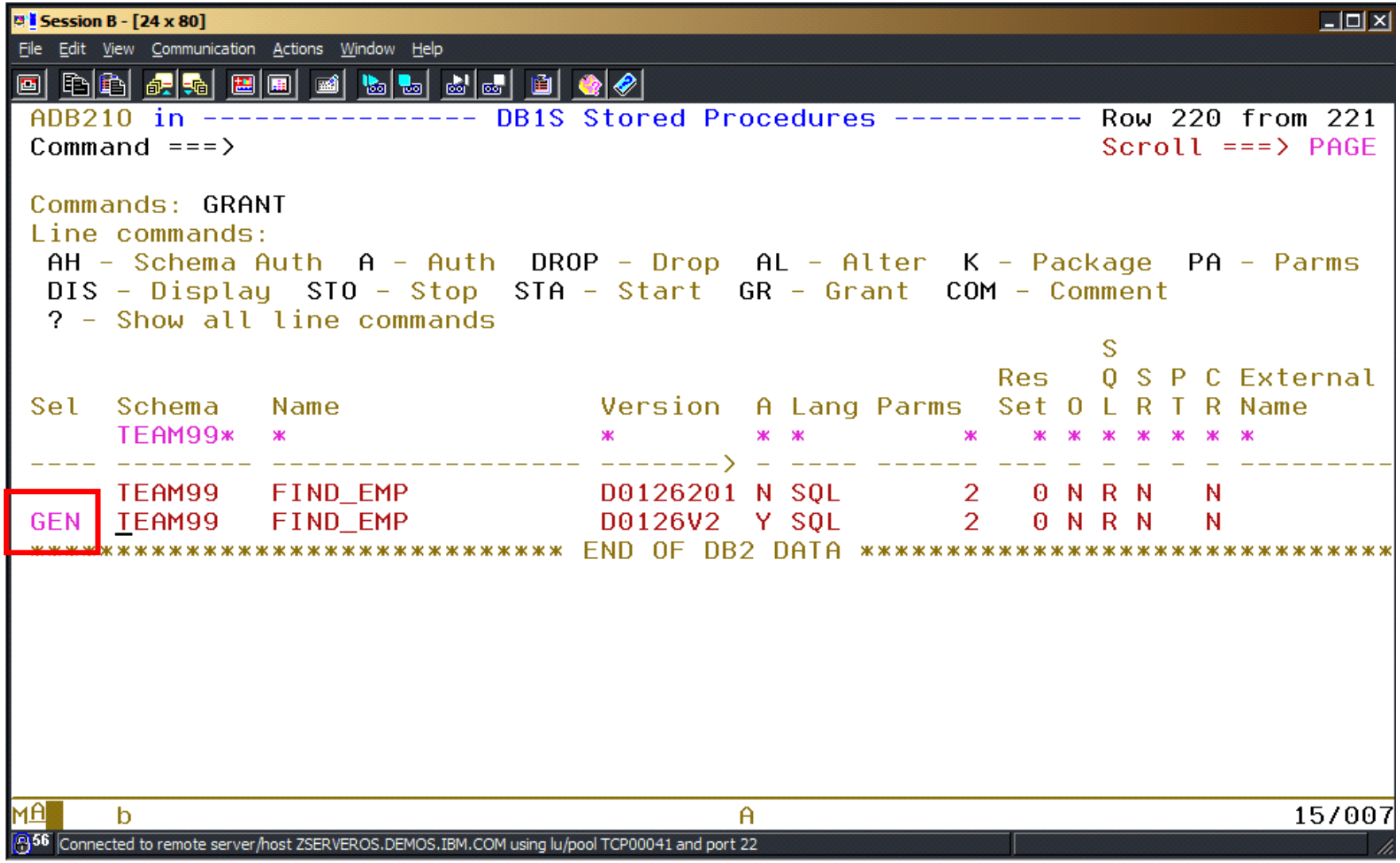
Easily Navigate to Stored Procedures



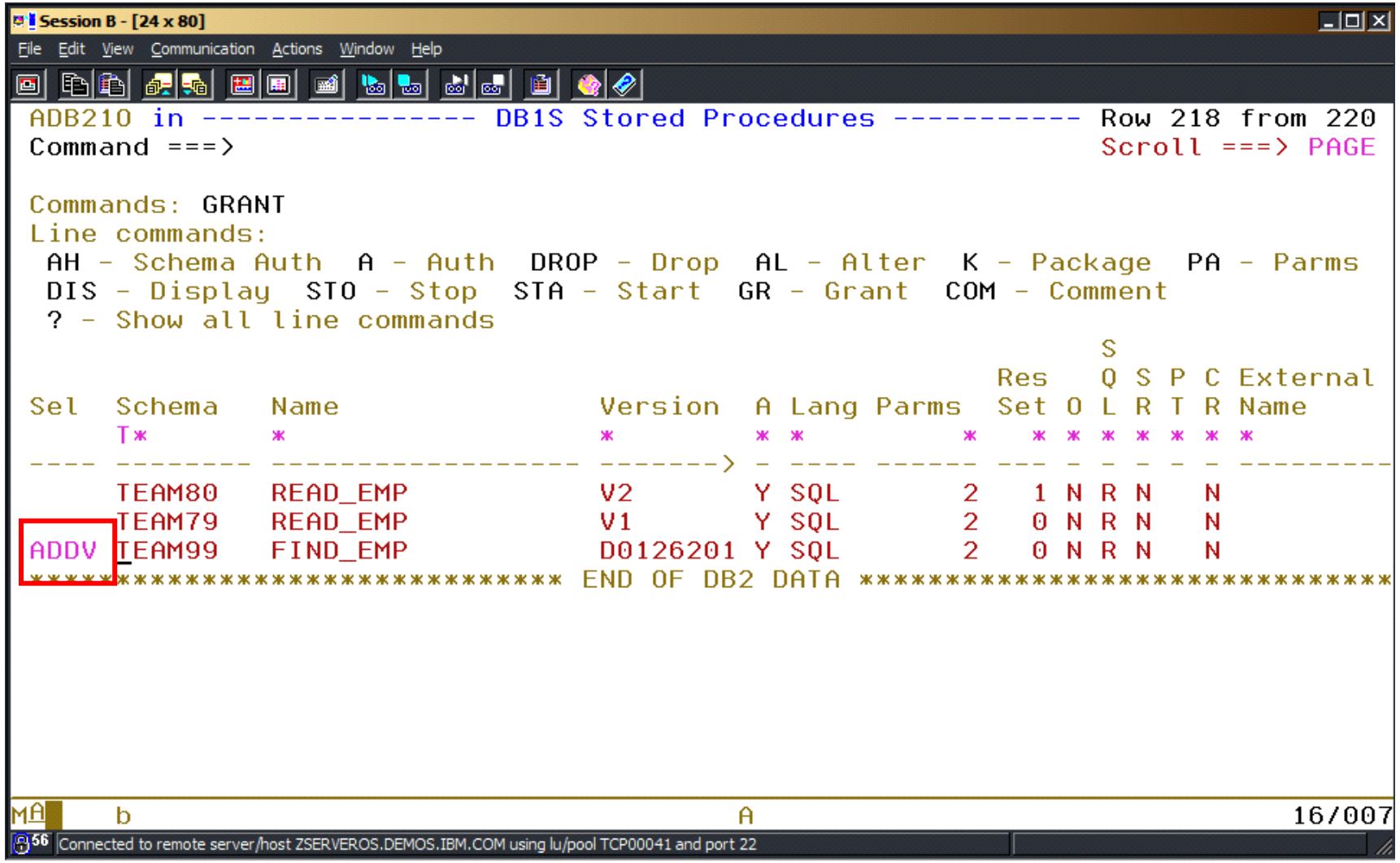
Manage Stored Procedures



Deploy from Development to Production



Easily Add new Versions for Problem Determination



Stored Procedure Commands

```
A         Show authorizations
ACT       Activate version
ADDV      Add version
AH        Show schema authorizations
AL        Alter procedure
BIND      Bind Deploy
BLD       Show build options
COM       Create a comment/remark
CRE       Create procedure
DDL       Generate DDL for the procedure only
DIS       Display procedure status
DROP      Drop procedure
DRPV      Drop version
ENV       Show environment variables
GEN       Generate SQL for procedure from DB2 catalog
GR        Grant procedure privileges
I         Details on procedure
K         Show packages on procedure
PA        Show parameters for procedure
REG       Regenerate version
REM       Create a comment/remark
REP       Generate report from the DB2 catalog
REPV      Replace version                              \
RO        Show owner role
SRC       Show source
STA       Start procedure
STO       Stop procedure
```

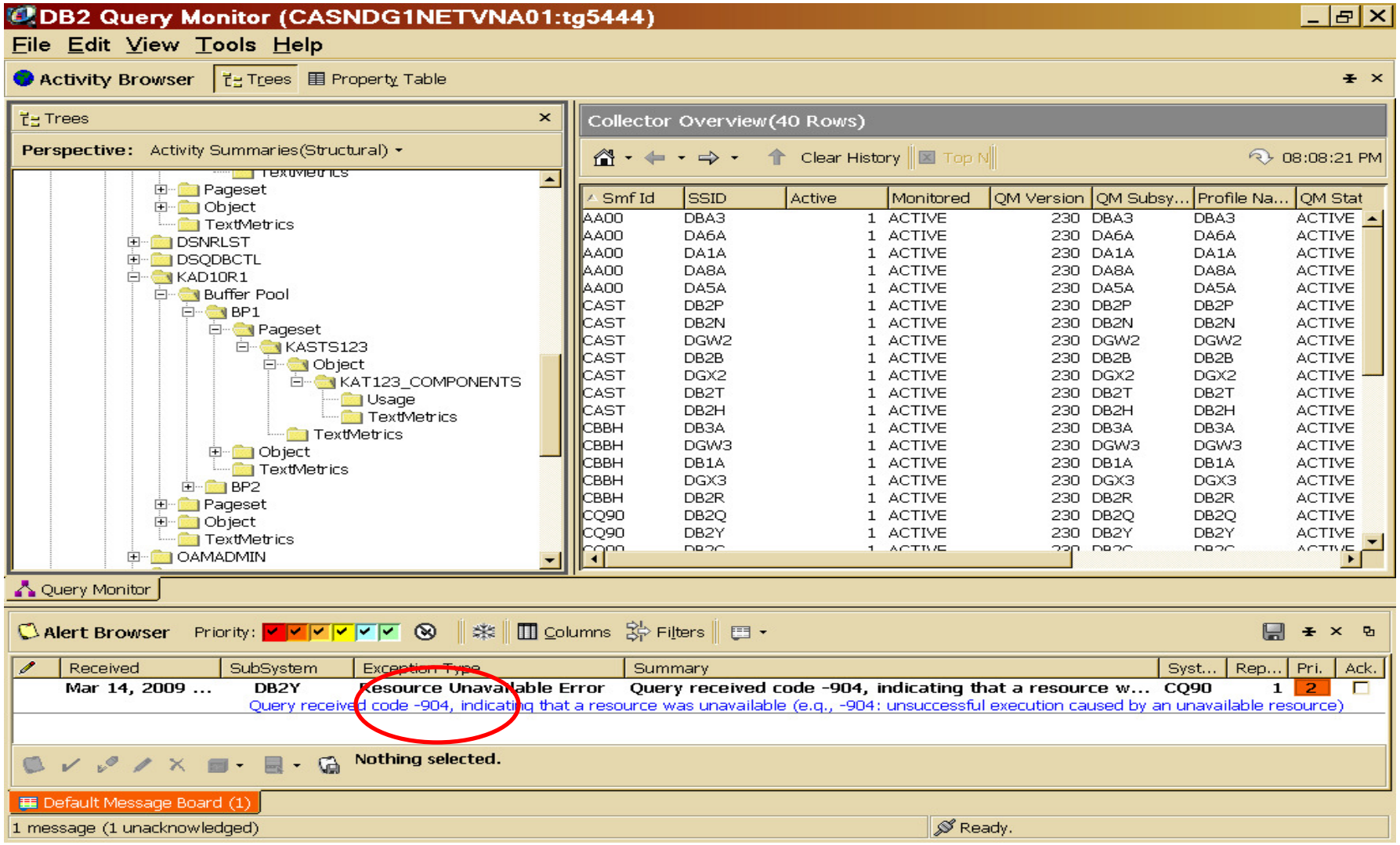
Proactive Alerts Using DB2 Query Monitor

Surprising Things You Can Do with DB2 Query Monitor

Something for the DBA, Appl. Programmer & System Programmer

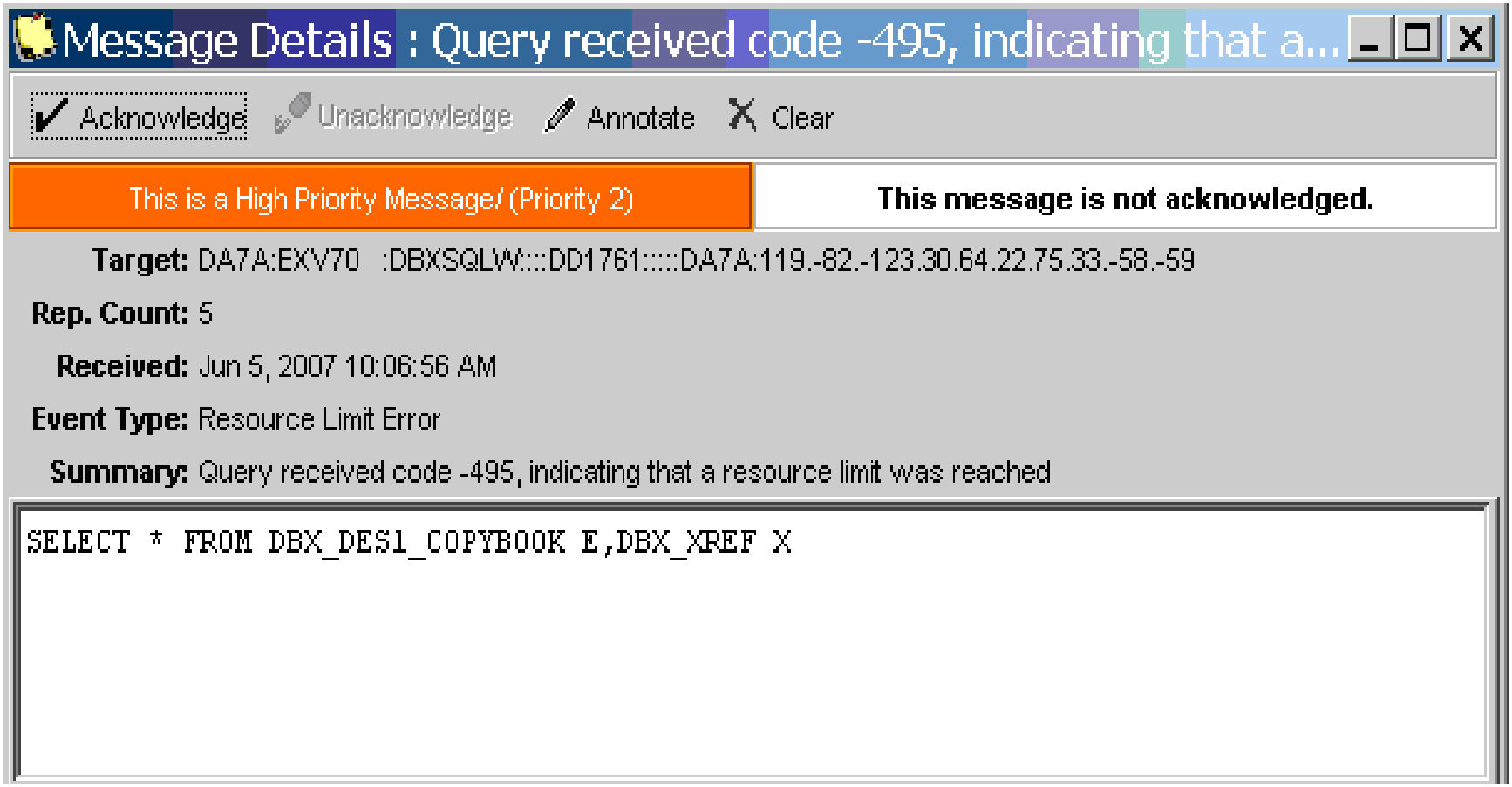
1. Research DB2 Commands
2. Display Host Variables
3. Exploit DB2 Resource Limit Facility
4. Display SQL Communications Area
5. Determine SQL Error Patterns
6. Explore Dynamic SQL Overhead
7. Identify Resource Unavailable - 904 Errors
8. Determine Access Path Changes
9. Identify Logging Increases
10. Display DB2 Subsystem Statistics

DB2 Query Monitor



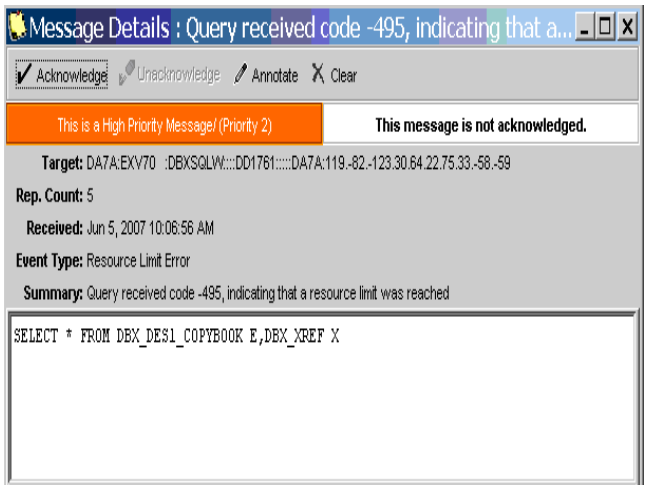
DB2 Query Monitor

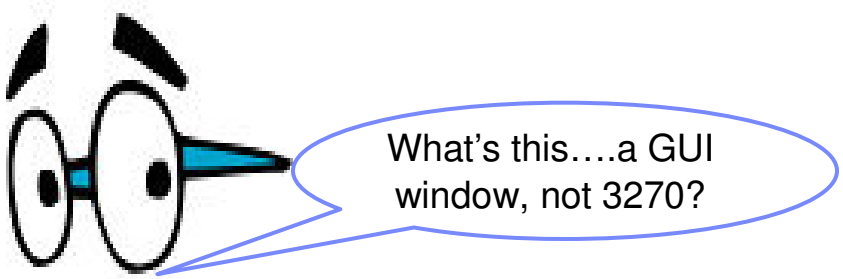
Resource Limit Facility (RLF)



DB2 Query Monitor

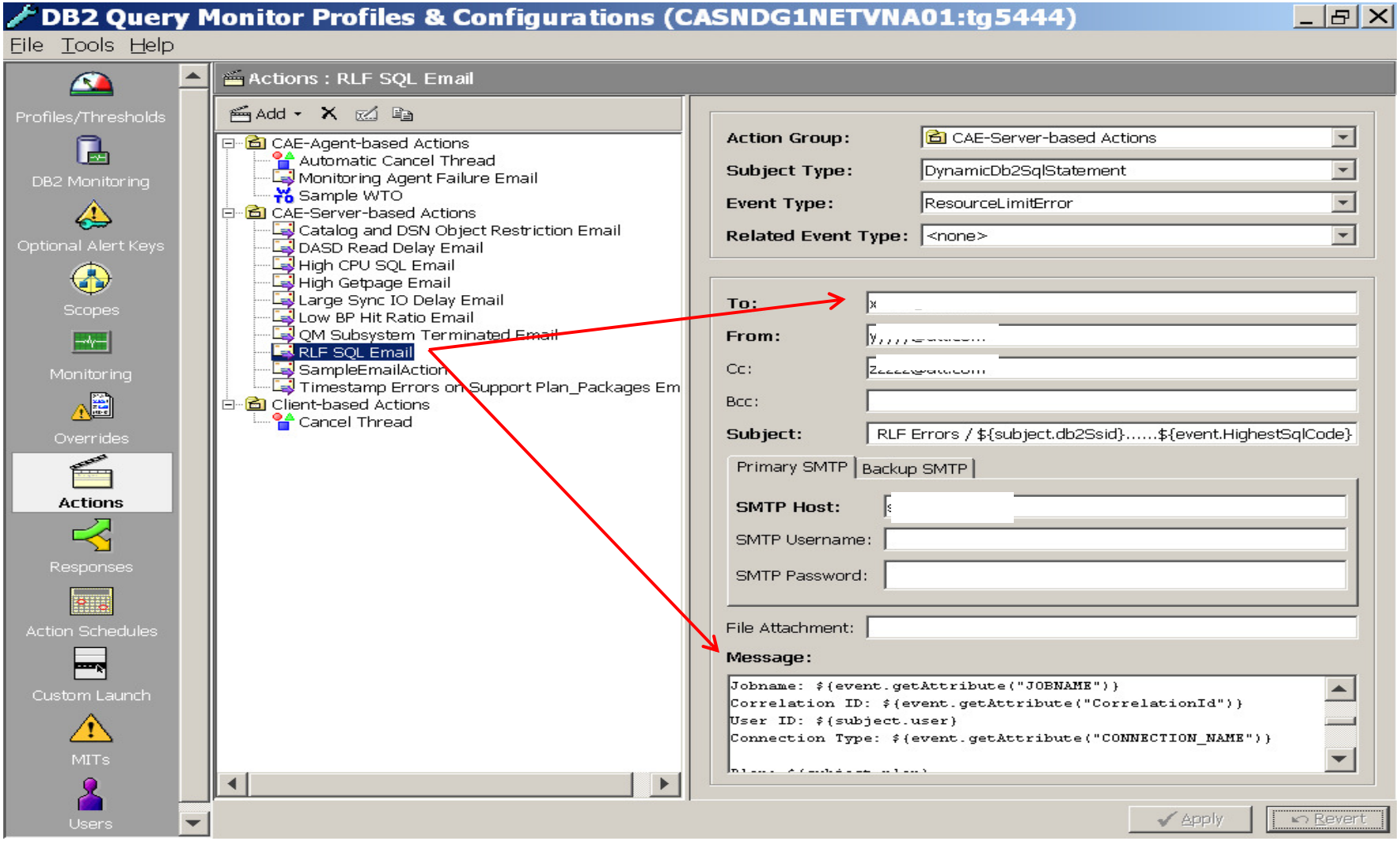
Resource Limit Facility (RLF)





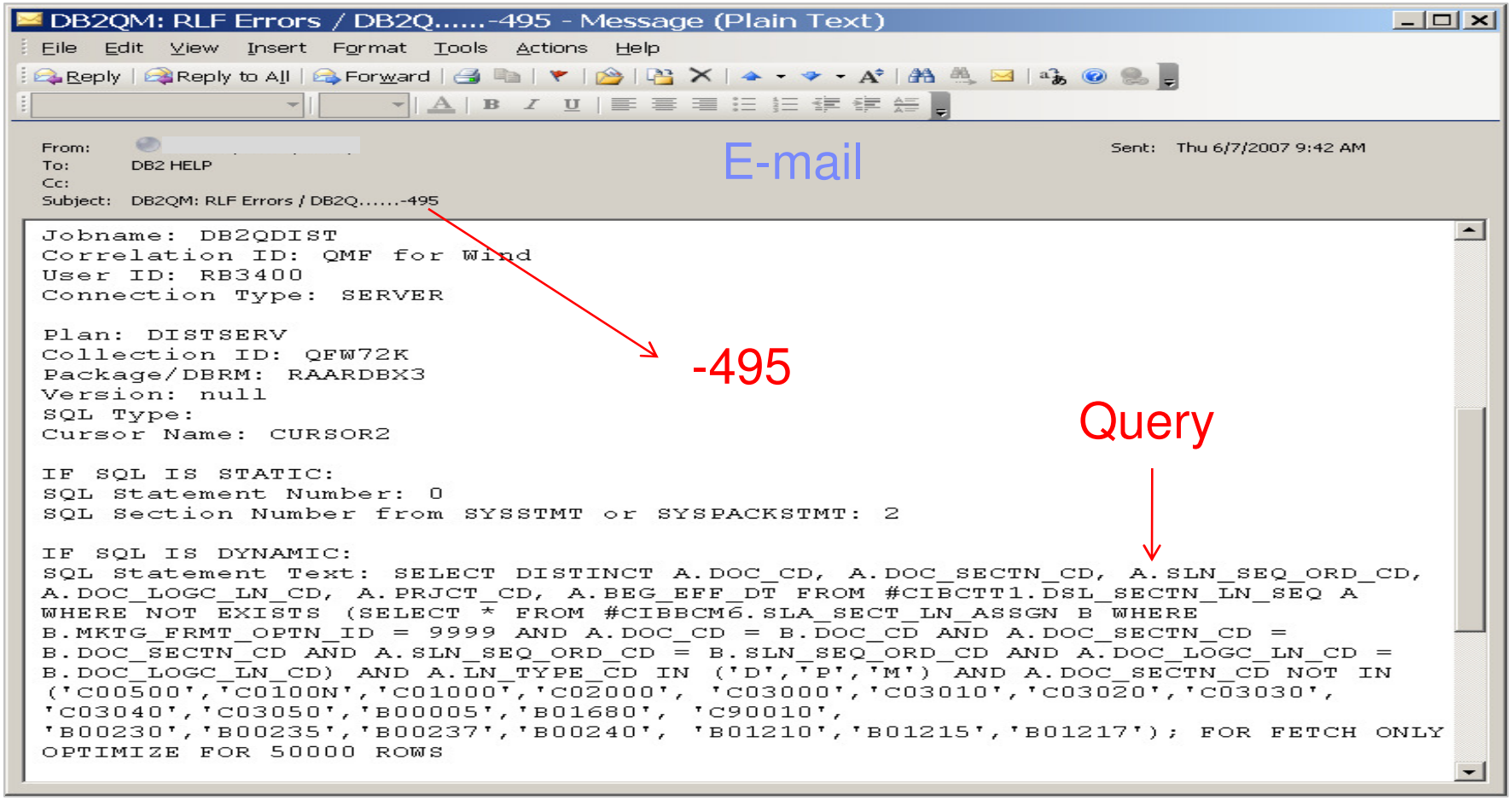
CAE (Consolidation and Analysis Engine)

DB2 Query Monitor



DB2 Query Monitor

Resource Limit Facility (RLF)

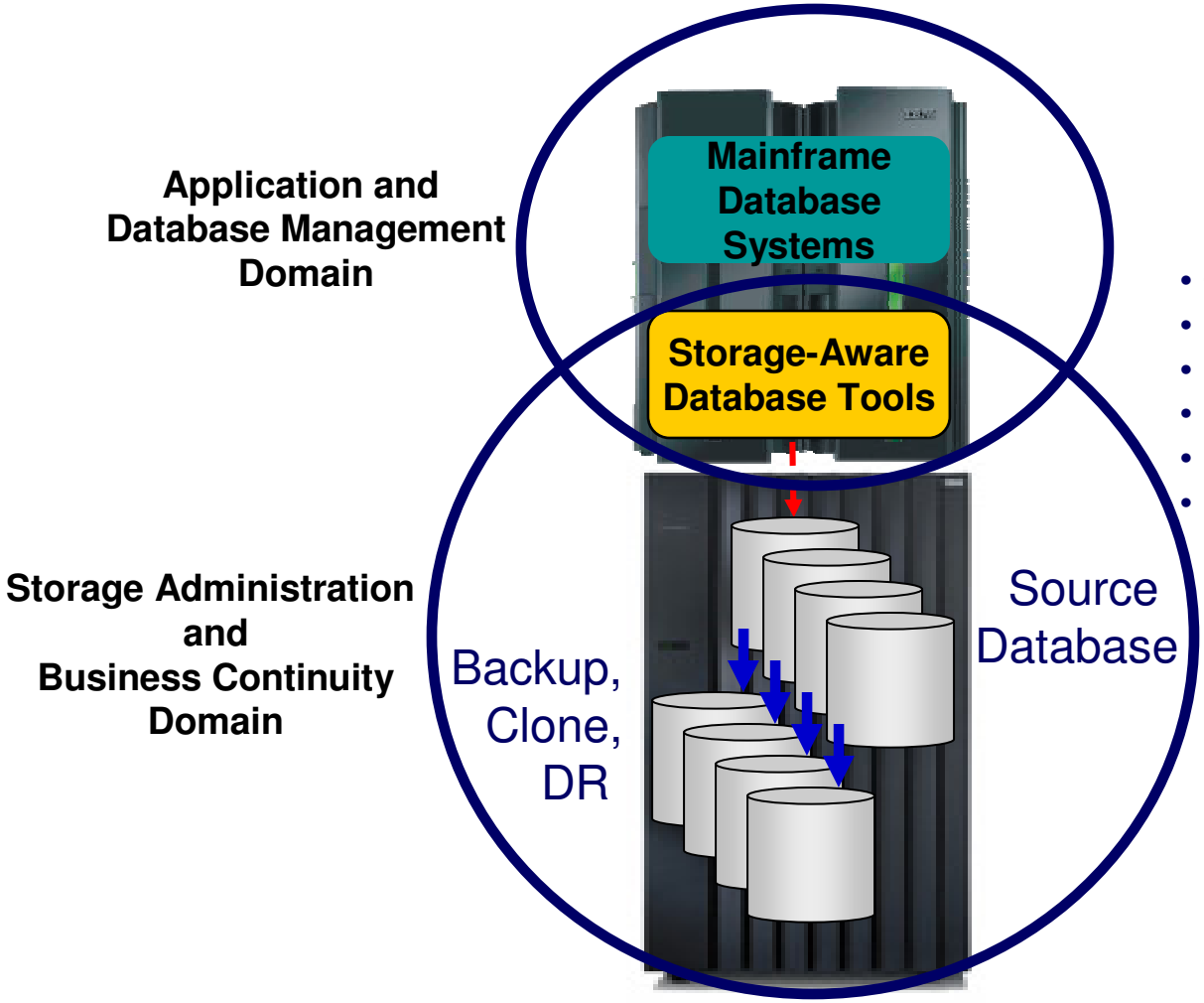


Storage-Aware Data Management Solutions

Leveraging Your Storage System and Managing Storage Requirements

Ron Haupert
Rocket Software Inc.

Database and Storage Integration



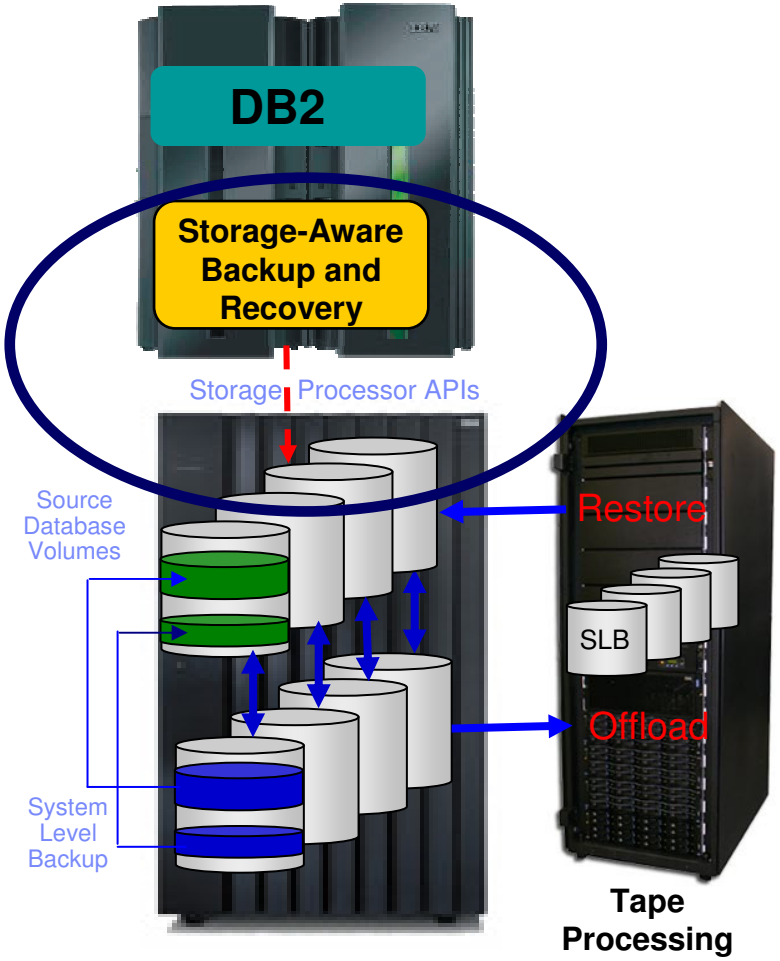
- Organizational Integration
- New Backup Methods
- New Recovery Strategies
- Business Recovery Monitoring
- Cloning Automation
- Disaster Restart Solutions

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

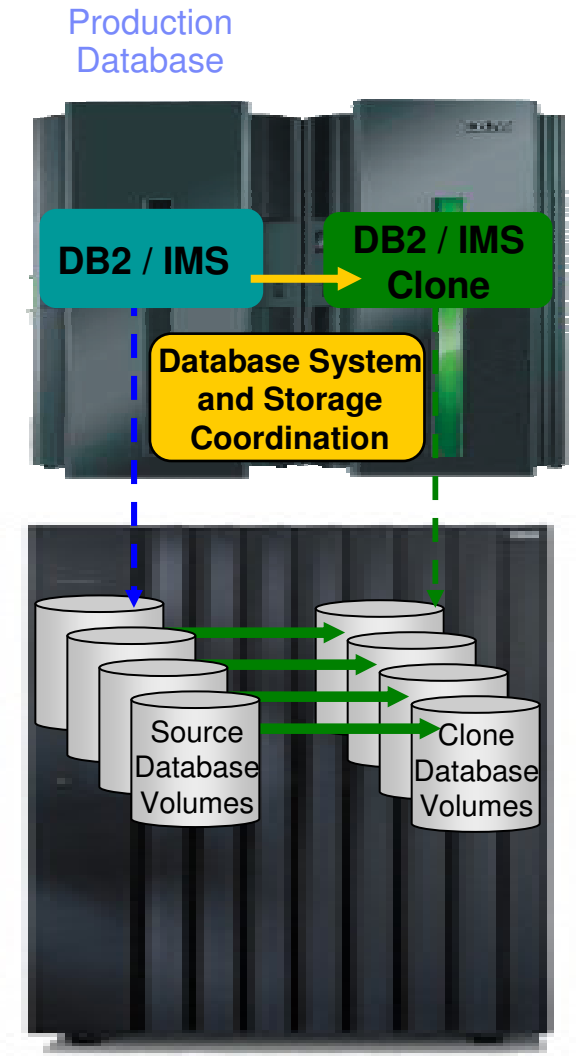
DB2 Recovery Expert - System Level Backups
Functional Requirements

- Integrate DB2 backup, restore, and recovery process with storage-based fast replication
- Provide easy and fast backup and restore of DB2 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



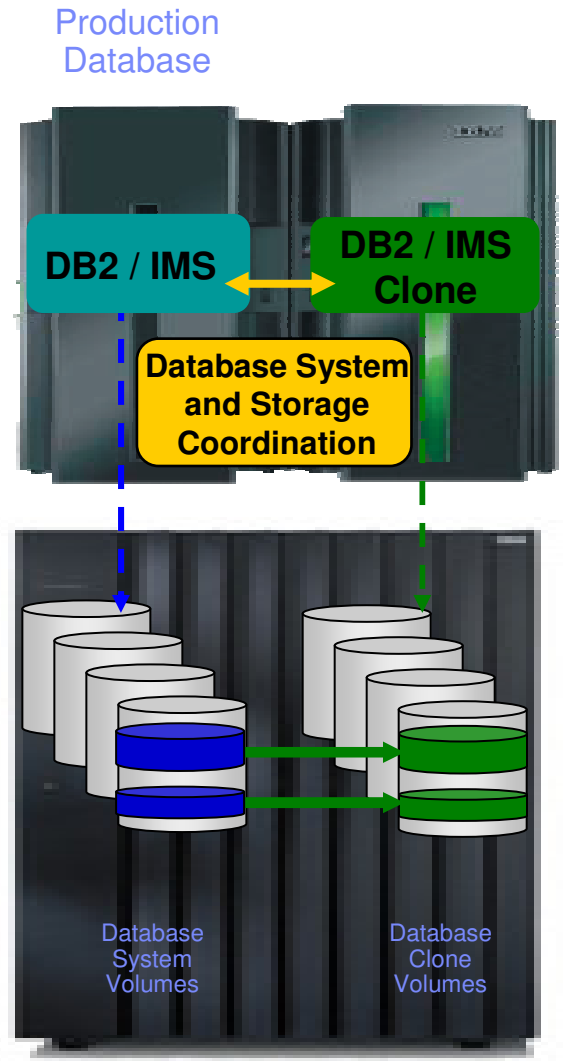
Cloning Database Management Systems Using DB2 and IMS Cloning Tools

- Performs DBMS 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 target database system to accommodate and accept the cloned data
  - DB2 catalog, directory, BSDS, active / archive log, etc.
  - IMS RECONs, PROCLIB, JOBS, JCL, MDA members



Refreshing Database Objects Using DB2 and IMS Cloning Tools

- Performs automated IMS database and DB2 table and index space refresh operations
  - Fast refresh of database objects
  - DB2 RI relationships, LOBS, and Identity columns
  - IMS DB support (FP, HALDB, DEDB)
- 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



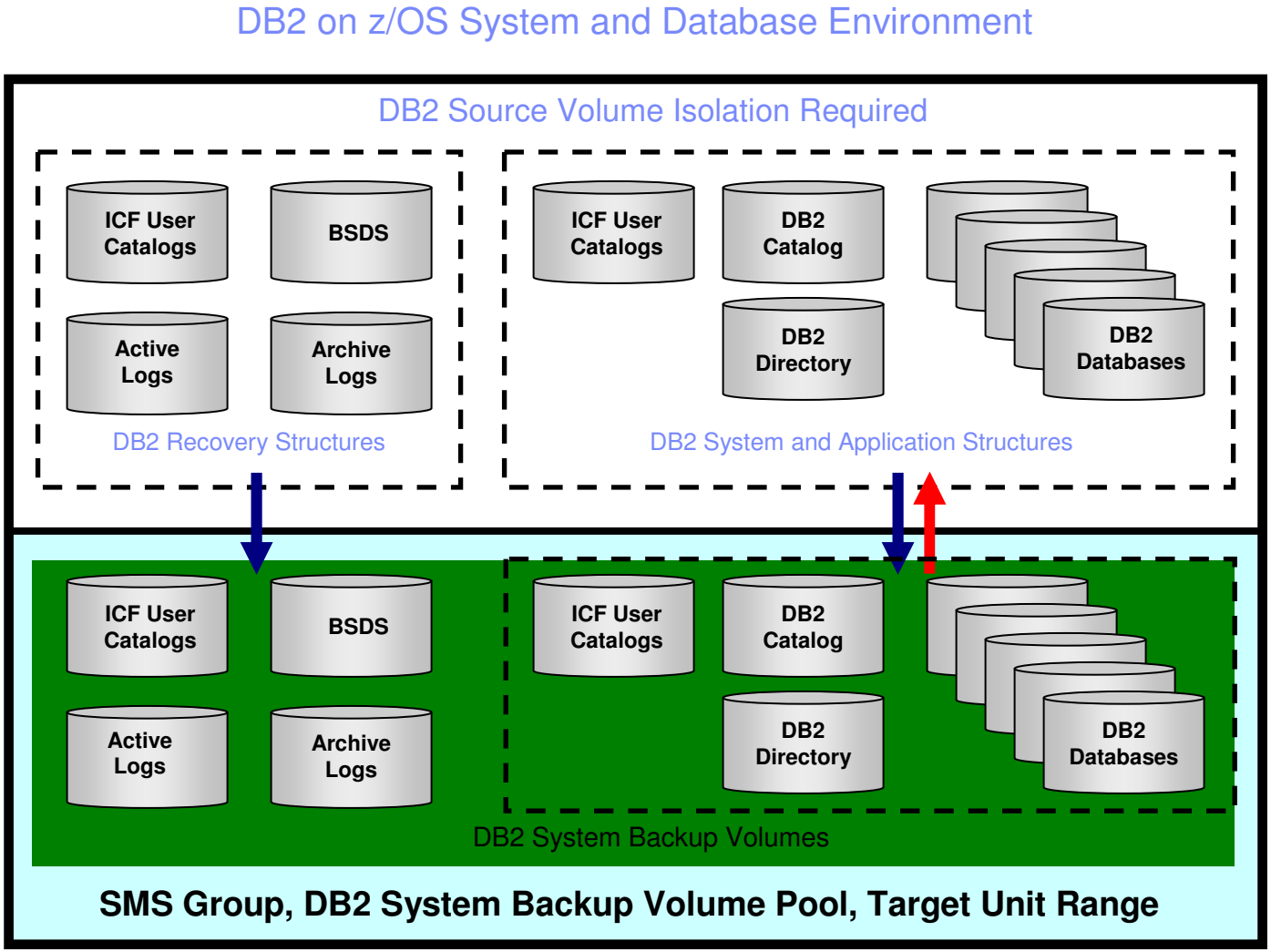
Storage-aware Data Management Implementation Planning Considerations

- 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

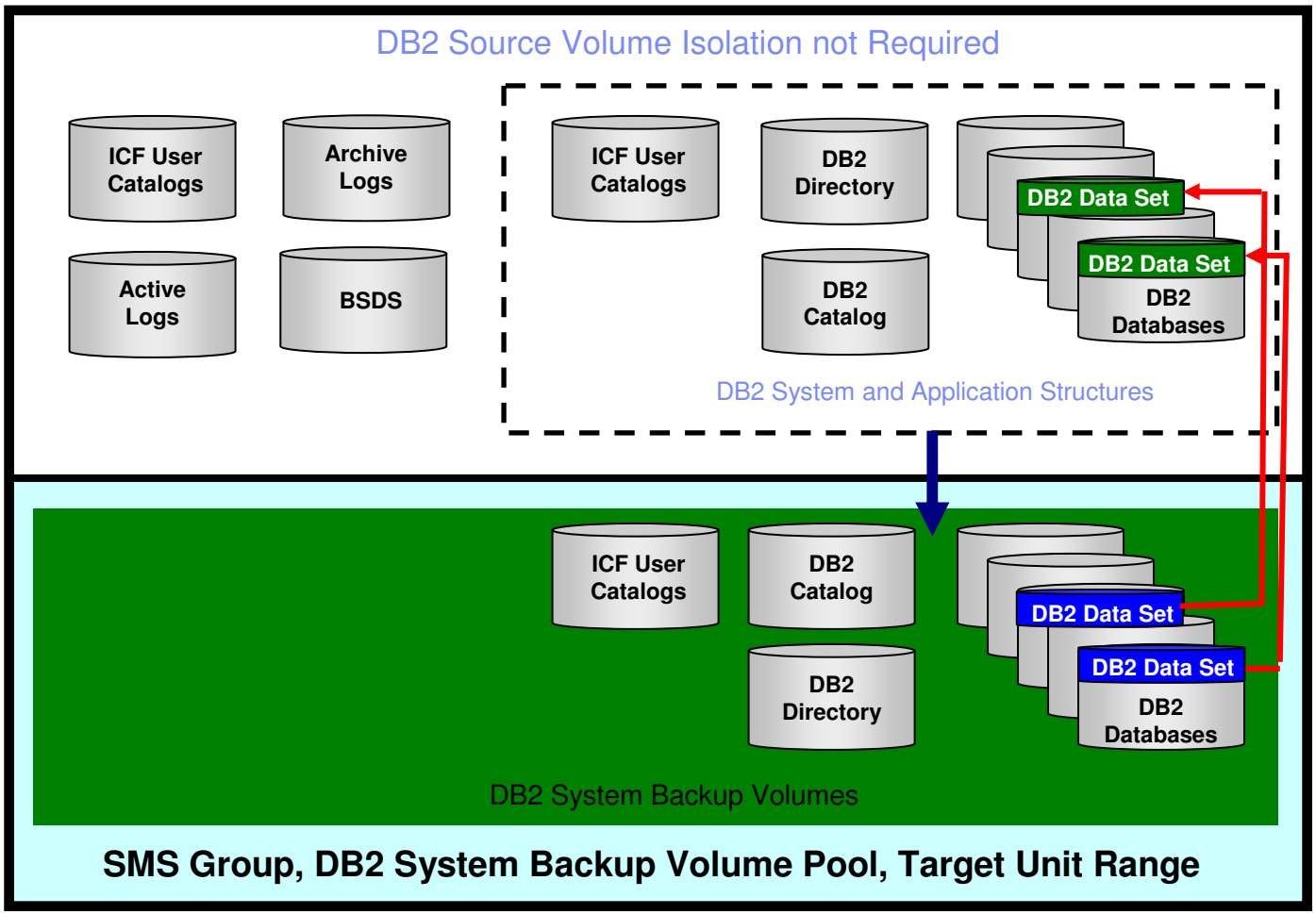
System Level Backup Usage and Data Set Layout Considerations

- 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 database system is restored*
    - *User catalogs will get restored*
- SLB used for application, object (DB2), or 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 database system is restored*
    - *User catalogs will get restored*

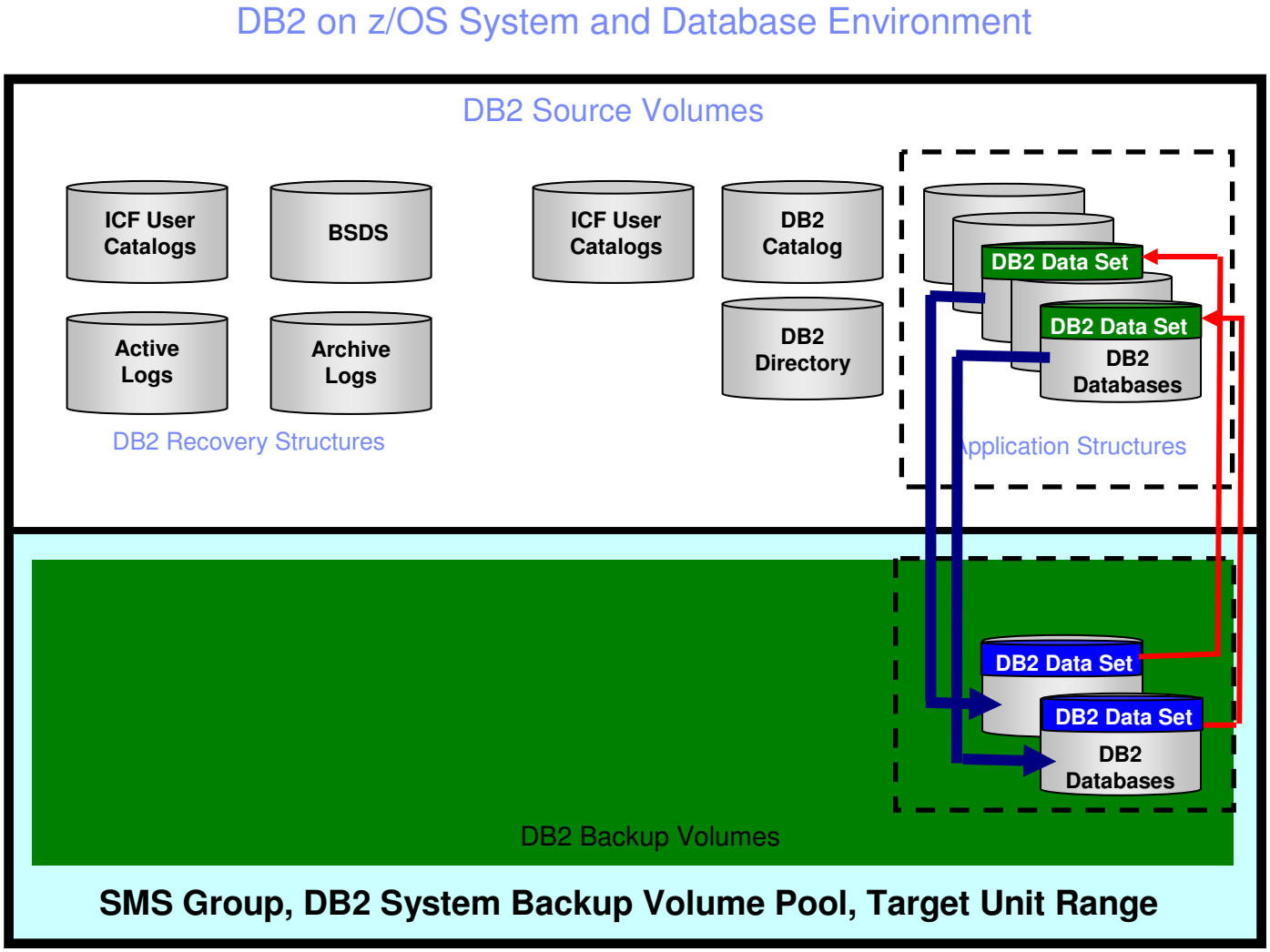
DB2 System Level Backup Usage
Data Set Layout for Full Backup / System Recovery



DB2 System Level Backup Usage
Data Set Layout for Data Only / Application Recovery



DB2 Partial System Level Backup
Data Set Layout for Application Recovery



Partial System Level Backup

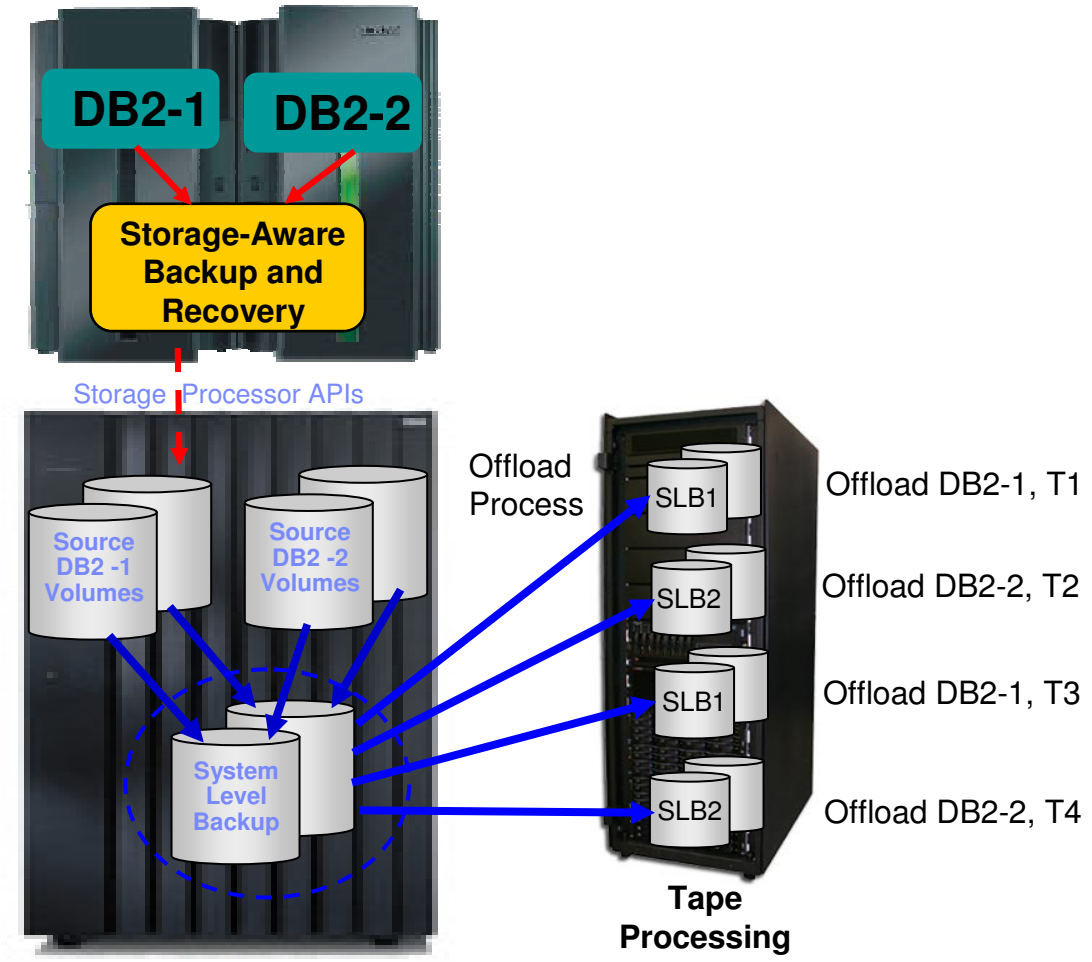
- Partial system level backup (PSLB)
  - Backup volumes representing a subset of the database system
  - PSLB's used for database or application recovery only
  - Data set fast replication used to restore data
  - Log and data isolation not required
  - Desired application database data should be grouped 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

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 FlashCopy methods 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 Used for Multiple Database Systems

- 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



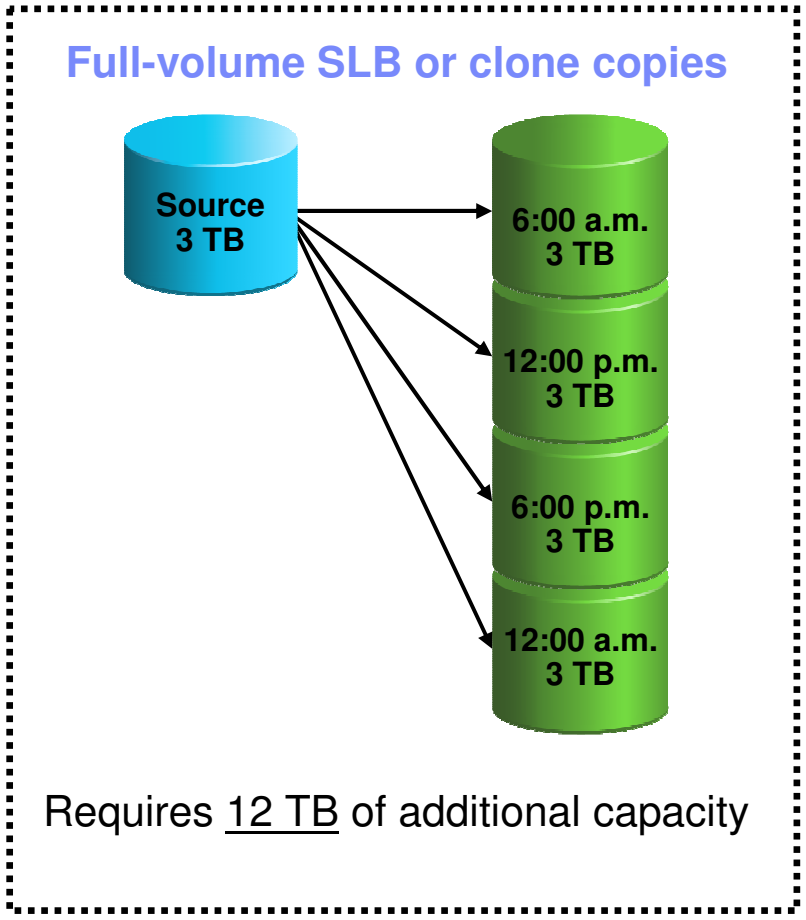
Creating Image Copies from a System Level Backup

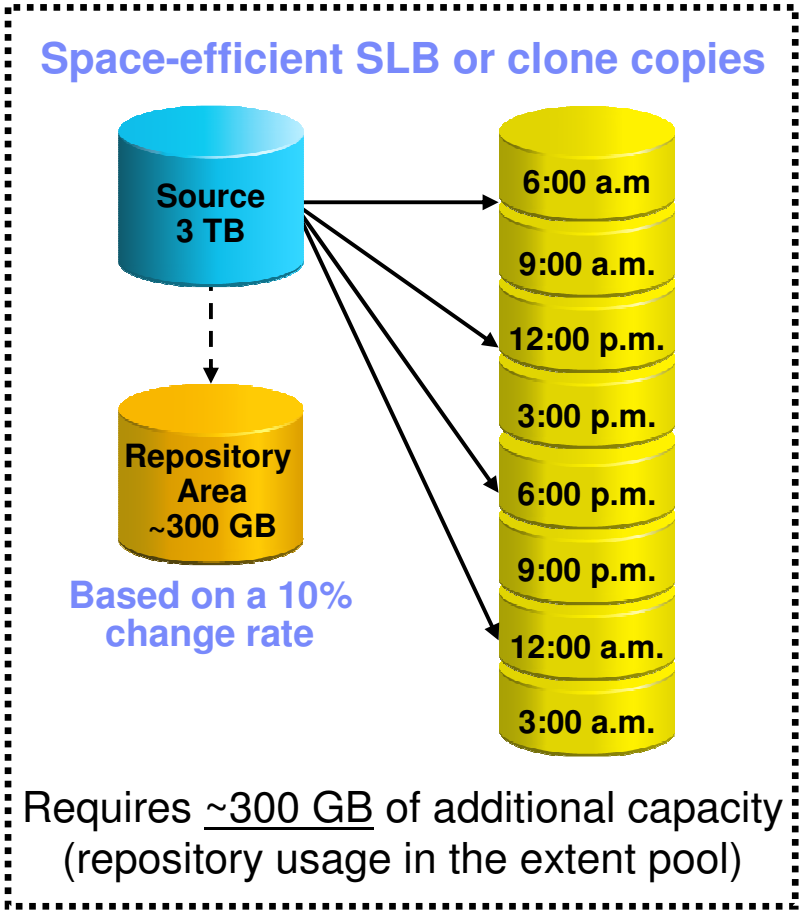
- Image copies can be generated from a DB2 Recovery Expert generated system level backup (SLB)
- Image copies are registered DB2 image copies
- Image copies can be used for object recovery and other operational procedures
- All image copies are created at the same point in time
  - No affect on the application for image copy creation
  - Reduces recovery scope for coordinated object recoveries
  - Reduces I/O contention caused by performing traditional image copy processing during high transaction activity

Full Volume vs Space Efficient FlashCopy Operations

- Full volume copy
  - Clone requires same amount of storage as the source
  - Relationship can be retained with production volume
  - Allows incremental resynchronization
  - Full volume restore used for system restore operations
  - Data set level FlashCopy used for application or object recovery from non-archived backups
- Space efficient FlashCopy
  - Requires minimal additional storage
  - Allows incremental restore
  - Can have multiple volumes associated with production volume
  - Full volume restore used for system restore operations
    - Changed tracked restored from repository in extent pool
  - DFSMSdss **host** copy methods used for application or object recovery from non-archived backups

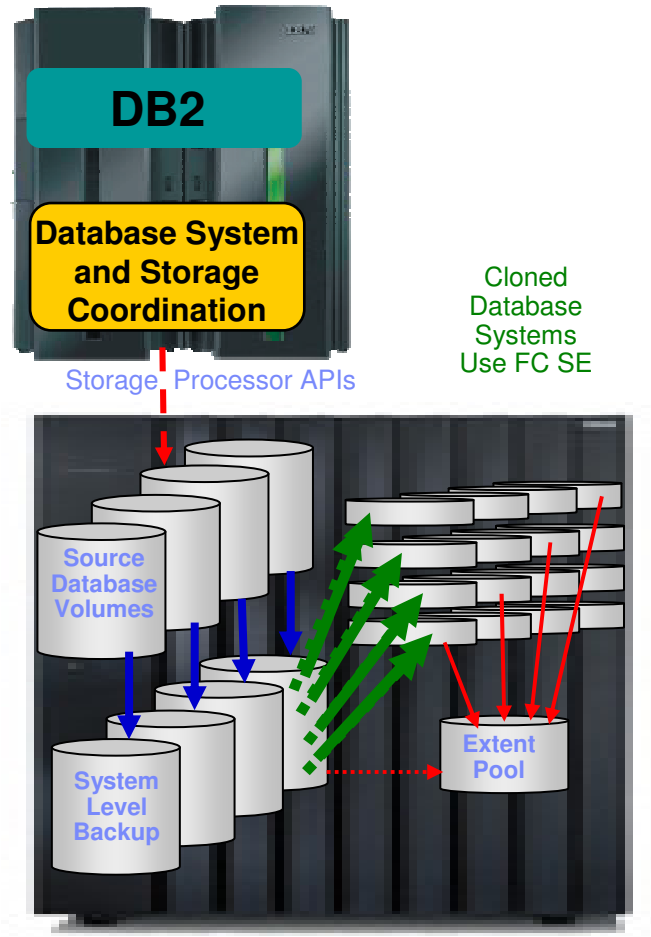
Space Efficient FlashCopy Usage Economics
Enable Frequent SLB or Clone Copies





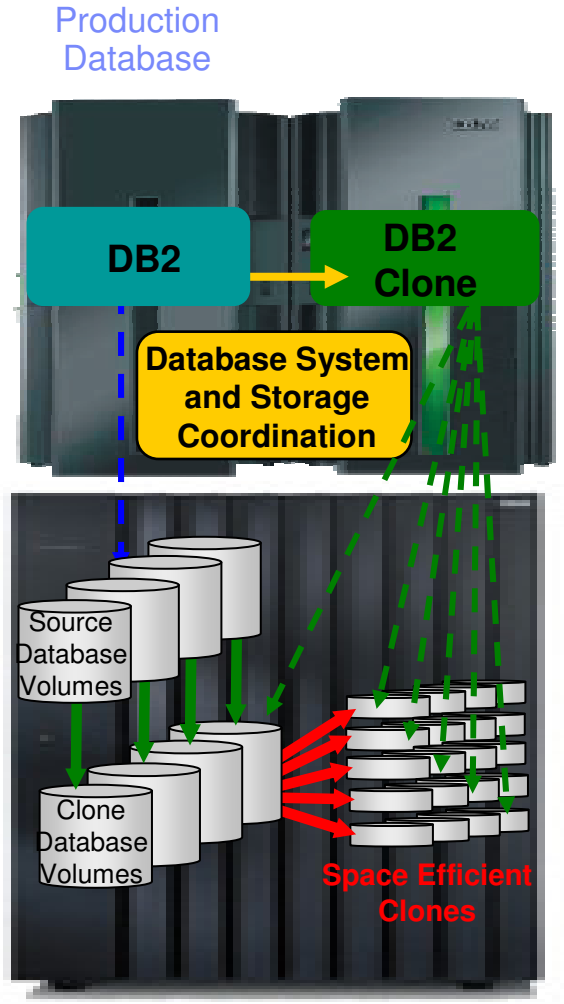
Clone from a System Level Backup without using Additional Storage

- Full system-level backup created using full volume fast-replication
- Database clone operations performed using SLB backup volumes as source
- Cloned database systems use Space Efficient FlashCopy
  - SLB volumes are used to service I/O for database clone access
  - Database 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



Make Multiple Clones without Duplicating Storage Requirements

- Perform full volume DB2 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 DB2 Recovery Expert disaster recovery PDS metadata is taken offsite with archive logs and image copies
  - Reduces recovery point objectives (RPO)
- SLBs can provide an excellent and cost effective tertiary DR solution

Using DB2 Recovery Expert with XRC and PPRC

- DB2 Recovery Expert provides “Remote Pair FlashCopy” DS8000 support (PPRC Metro Mirror)
  - 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 (Requires Remote Pair FlashCopy support enabled)

- Using DB2 Recovery Expert with XRC and PPRC without Remote Pair FlashCopy
  - Backup target volumes must not be in a PPRC or XRC relationship
    - SLB volumes will not be remotely replicated
  - Backup volumes **cannot** be used for DB2 system recovery without duplex pending
    - SLB volumes cannot be “Flashed” to PPRC primary volumes (Duplex pending)
  - DB2 application and object recovery **is** allowed
    - DB2 Recovery Expert performs application and object recovery by copying data sets from the backup volumes (SLB) 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
  - IBM DB2 Backup System Blade
  - IBM DFSMSdss Blade
  - IBM FlashCopy Blade
  - EMC TimeFinder Blade
  - HDS ShadowImage Blade
- Determine which type of consistency function is best for your environment
  - DB2 Backup System
  - DB2 suspend
  - Storage-based consistency

Session Summary

- Storage-aware database utilities provide storage integration to simplify database administration tasks
- Database 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 application recovery time
- Database system cloning automaton allows production data to be leveraged easily and effectively
- DB2 table spaces refreshed easily
- Less skills required to implement advanced backup, recover, disaster recovery, and cloning solutions
- Implementation planning is important to optimize the benefits

Jay Bruce - IBM

jmbruce@us.ibm.com

Ron Haupert - Rocket Software

RHaupert@rocketsoftware.com