



# EMC for Mainframe „Tape on Disk” Solutions

May 2012



zMainframe

Never trust a computer you can lift!

# EMC & Bus-Tech for Mainframe

- EMC supports mainframe systems since 1990 with first integrated cached disk array Symmetrix
- Bus-Tech was founded in 1987 as a developer of mainframe channel emulation technology
- 6 year partnership with Bus-Tech culminates into acquisition in 2010
- 3 lines of products
  - DLm1000 (gateway)
  - DLm2000 (integrated)
  - DLm6000 (integrated)



# People – EMC BRSM

- A Division of BRS focusing on Mainframe Tape Solutions
- Created from the acquisition of Bus-Tech
- World wide responsibility to develop the DLM products within EMC
- A Specialty Sales/TC Force within BRS
- Work with field BRS Mainframe TC Specialists, BRS Reps and TCs



# Typical Mainframe Tape Challenges:



- Improve performance of tape applications
- Improve SLA's
- Reduce batch and backup windows
- Reduce CPU consumption
- 100% disaster recovery compliance
- Eliminate exposure to stolen tapes
- Reduce operating costs (tapes, power, etc.)
- Eliminate data loss (multiple tapes)
- Increase efficiencies of storage personnel

# Typical Mainframe Use Cases for Tape

## BACKUP

- 3390 DASD volume dumps
  - Fixed size volumes
  - 3, 9, 27, and 54 GB
- z/OS leading backup applications
  - FDR—Innovation Data Processing
  - DSS—IBM

## HSM MIGRATION

- Migrates data between different storage classes
- Meant to conserve DASD usage
- Can use significant CPU cycles

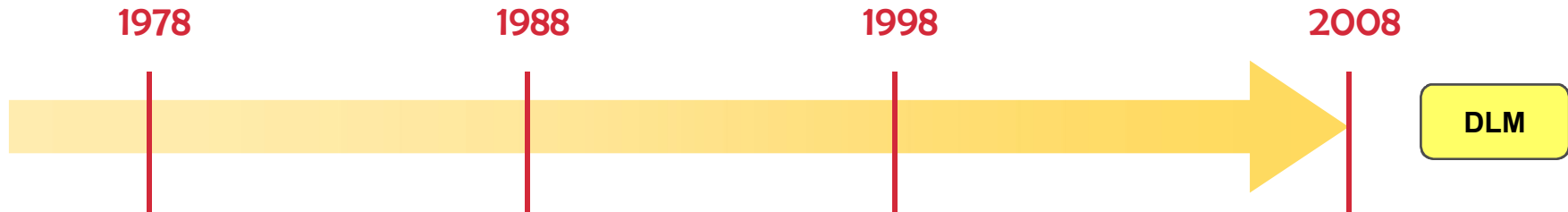
## DATA ARCHIVE

- Fixed content data
  - Check images, etc.
  - Variable data
- z/OS leading archive applications
  - ASG-ViewDirect
  - IBM ImagePlus

## WORK TAPES

- Short retention—temporary tapes
- High read/write requirements
- Example: Syncsort work files
- Transaction log files
- SMF data files

# Evolution of Mainframe Tape



## *Magnetic Reel*

- Batch systems
- Manual tape mounting



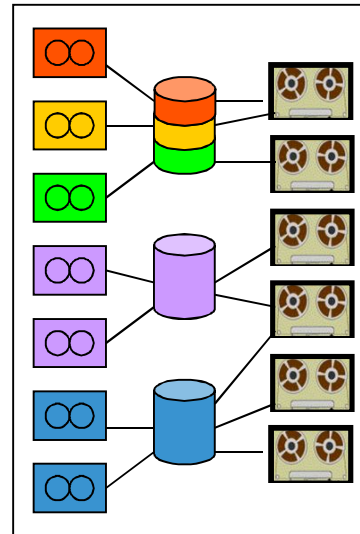
## *Tape Library with Cartridges*

- Automated Robotics
- Cheap, reusable



## *Virtual Tape Systems*

- Software emulated tape drives
- Disk Cache to Tape



## *Disk Library for mainframe*

- Appliance based tape drive emulation
- Tape on Disk



# One of the reason – why disk instead of tape...



Before  
(17 floor tiles)



After  
(1 floor tile)



# And Another Example...



Before

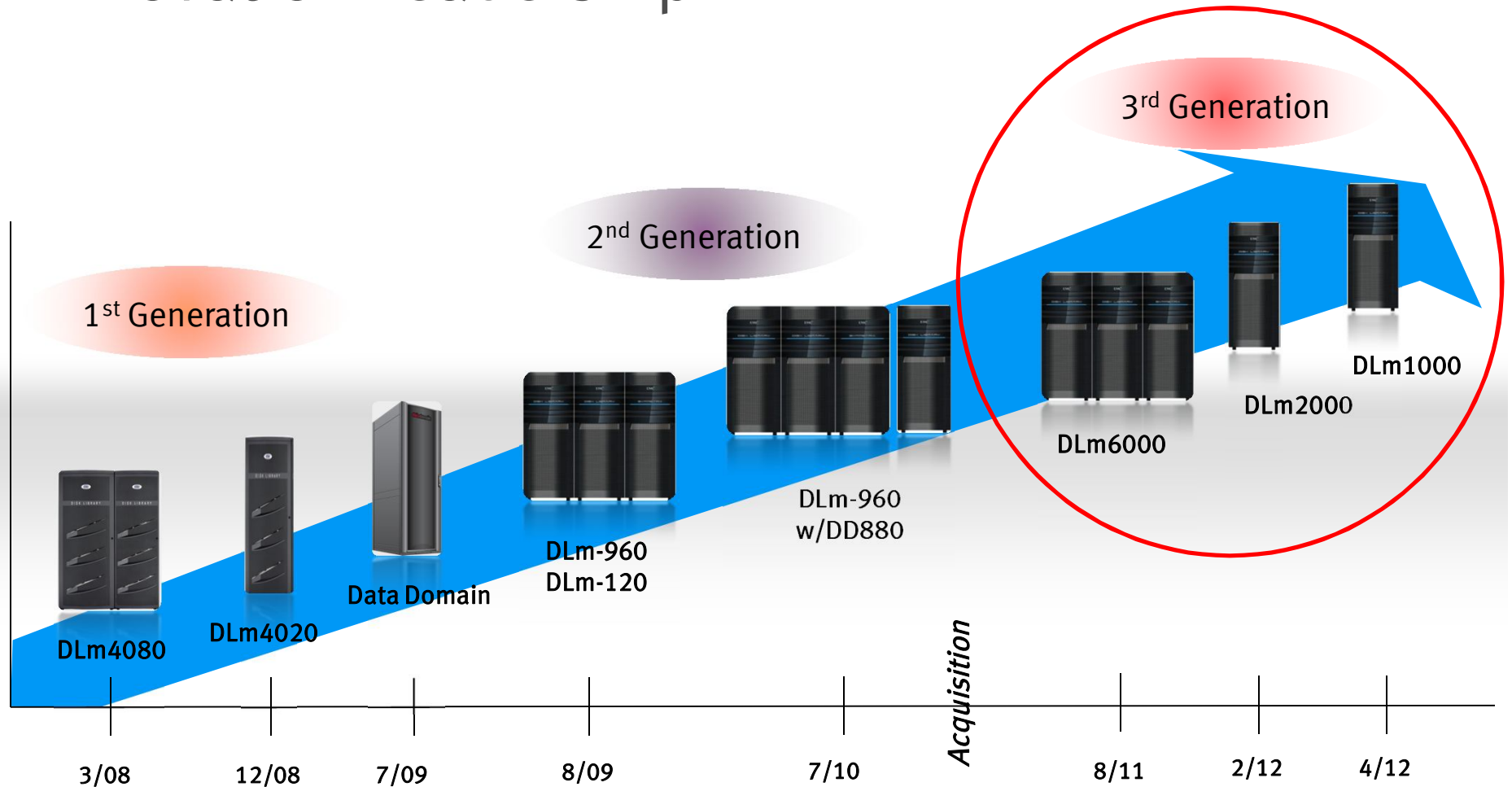


After



# EMC Mainframe Tape Solutions

## Innovation Leadership



# EMC's Mainframe Virtual Tape Solutions



EMC DLM6000



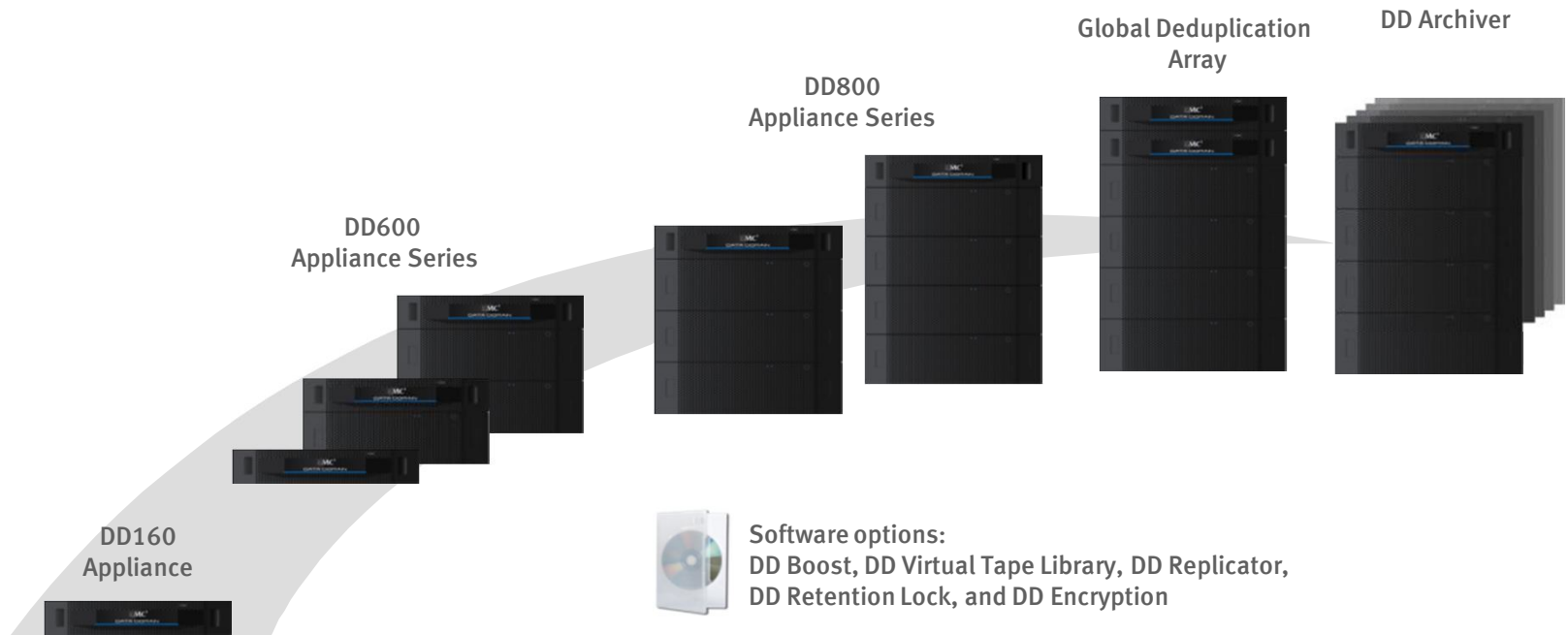
EMC DLM2000



DLM1000  
and DD  
storage

Data Domain can be shared with  
Open Systems backup

# Industry's Most Scalable Inline Deduplication Systems



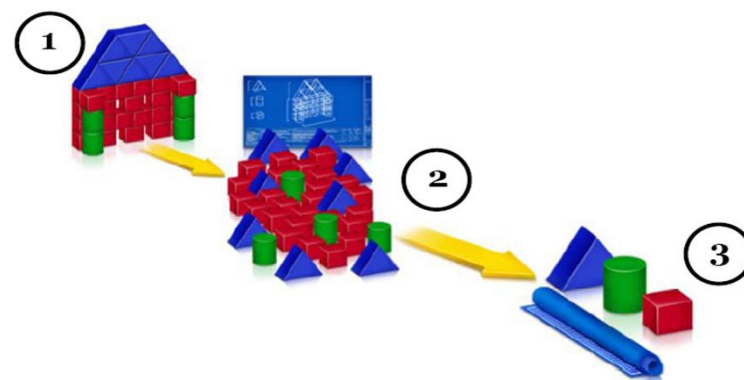
|                         | DD160         | DD620        | DD640         | DD670         | DD860        | DD890        | Global Deduplication Array | DD Archiver  |
|-------------------------|---------------|--------------|---------------|---------------|--------------|--------------|----------------------------|--------------|
| <b>Speed (DD Boost)</b> | 1.1 TB/hr     | 2.4 TB/hr    | 3.4 TB/hr     | 5.4 TB/hr     | 9.8 TB/hr    | 14.7 TB/hr   | 26.3 TB/hr                 | 9.8 TB/hr    |
| <b>Speed (other)</b>    | 667 GB/hr     | 1.1 TB/hr    | 2.3 TB/hr     | 3.6 TB/hr     | 5.1 TB/hr    | 8.1 TB/hr    | 10.7 TB/hr                 | 4.3 TB/hr    |
| <b>Logical capacity</b> | 40–195 TB     | 83–415 TB    | 0.32–1.6 PB   | 0.6–2.7 PB    | 1.4–7.1 PB   | 2.9–14.2 PB  | 5.7–28.5 PB                | 5.7–28.5 PB  |
| <b>Usable capacity</b>  | Up to 3.98 TB | Up to 8.3 TB | Up to 32.2 TB | Up to 55.9 TB | Up to 142 TB | Up to 285 TB | Up to 570 TB               | Up to 570 TB |

# Disk Library for Mainframe Products Comparison

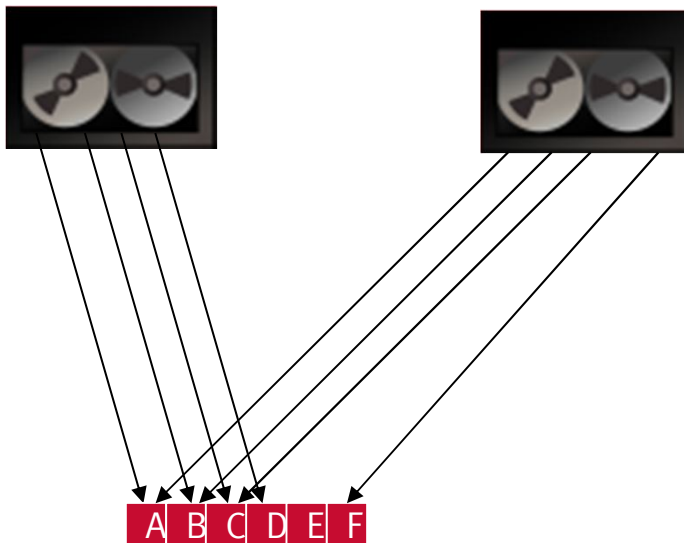
|                               | DLm1000        | DLm2000        | DLm6000      |
|-------------------------------|----------------|----------------|--------------|
| Number of VTEs                | 1              | 1 or 2         | 2–6          |
| Connectivity                  | FICON          | FICON          | FICON        |
| Number of channels to host    | 1 or 2         | 2 or 4         | 4–12         |
| Number of virtual tape drives | 32 or 128      | Up to 512      | Up to 1,536  |
| Maximum capacity (usable)     | 5.7 PB         | 13 TB–143 TB   | 40 TB–5.7 PB |
| Performance                   | Up to 340 MB/s | Up to 680 MB/s | Up to 2 GB/s |
| Number of cabinets            | 0              | 1              | 2–7          |
| Deduplication storage         | ✓              | ✗              | ✓            |
| Replication                   | ✓              | ✓              | ✓            |
| Hardware compression          | ✓              | ✓              | ✓            |
| WORM tape                     | ✗              | ✓              | ✓            |
| Guaranteed replication        | ✗              | ✓              | ✓            |
| RSA key management            | ✗              | ✗              | ✓            |

# Data de-duplication

- Data de-duplication (often called "**intelligent compression**") is a method of reducing storage needs by eliminating redundant data.
- Only one unique instance of the data is actually retained on **storage media**.
- Redundant data is replaced with a pointer to the unique data copy.
- The difference between the classic compression and de-duplication is that compression reduces duplicate data only within specific parts of individual file, while de-duplication eliminates the redundant segments among many files/objects.



# Dedup Benefits

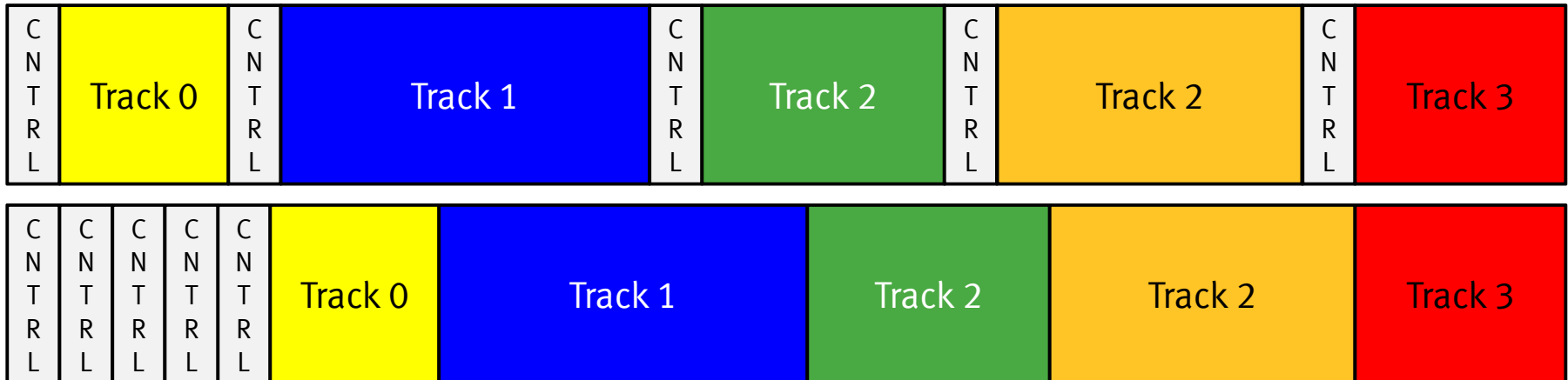


- Store more on Less
- Use less energy
- Use less physical space
- Replicate faster, easier (lower bandwidth needs)
- Have a guarantee of restore through the integrity checker of each element on regular basis



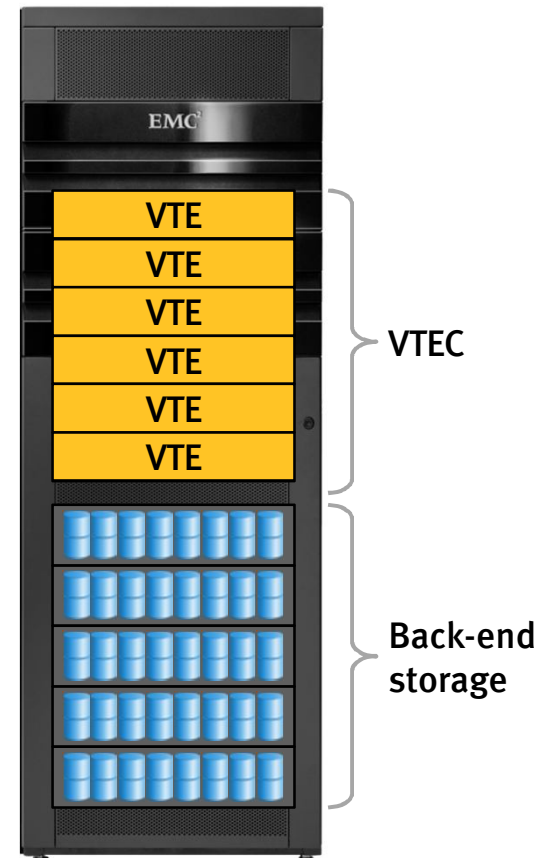
# AMDD - Assisted Mainframe Data De-Dupe

- ✓ Virtuent as a list of supported application (e.g. FDR, DSS)
- ✓ When a VOLSER arrives in the VTE, the first few blocks of data are analyzed
- ✓ If the data is NOT from one of the AMDD supported applications it will be processed as it is, without using AMDD. The data is written to the back-end storage.
- ✓ If the data is from one of the AMDD supported applications, then the data will be pre-processed by AMDD.
- ✓ Once re-organized, the data is forwarded to the back-end storage, as normal.



# DLm 2000/6000 features

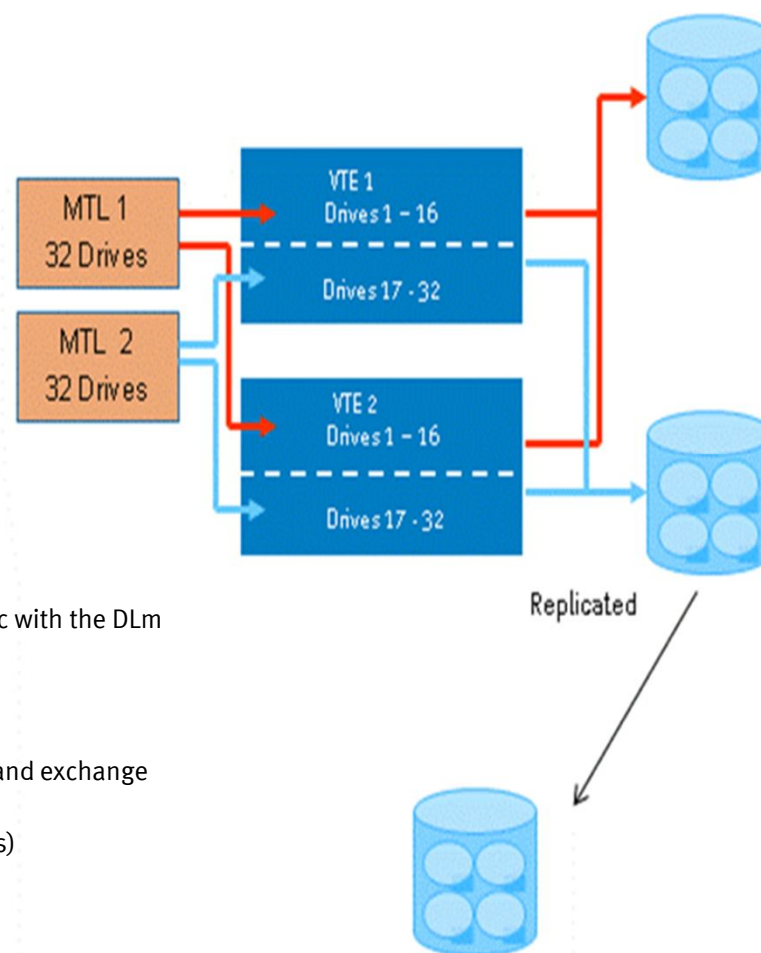
- Ideal for backup, archive, batch & HSM
- True IBM tape emulation
  - 3480, 3490, 3590
- Virtual cartridge size up to 16 TB
- Disk consumption is based on data written
- Unlimited number of tape volumes
- Data path: No single point of failure
- High performance
- Hardware compression
- “WORM” tape support (SEC Rule 17a-4f)
- Guaranteed replication
- RSA Encryption (DLm6000 only)
- Disaster recovery vaulting and testing
- Management reporting
- ESRS Support



EMC Disk Library  
for mainframe

# DLM Mainframe Configuration

- DLM Appears to Mainframe Simply as a Collection of Tape Drives (3480, 3490, 3590)
  - No Library Management or Allocation Modifications to the OS are Required
  - Each tape VOLSER is kept on disk as a file
  - Multiple Virtual Libraries can be Configured
  - Up to 64 LPARs May Attach to Each Tape Drive
- 
- EMC Provides Small Utilities to Help Manage the DLM
    - A Scratch Utility (keep your tape management system scratch status in sync with the DLM scratch status)
    - A Utility to Send Commands to DLM
    - A utility allowing you to define scratch volumes to an MTL
    - A program that runs as a started task in z/OS to allow message and command exchange between the z/OS operator console and the DLM controller(s)
    - A utility that provides statistics reports on the usage of the DLM controller(s)



# Configuring Virtual Tapes in Mainframe OS

## Virtuent Supports Three Alternatives for Device Configuration

### 1. Manual Tape Library (MTL) - Preferred

- ✓ Devices are defined as 3490 / 3590
- ✓ Devices are defined as part of a library
- ✓ A new SMS Storage Group is Defined for the MTL
- ✓ Volumes must be entered into the TCDB
- ✓ SMS ACS routines are Updated to Allocate the Storage Group

### 2. As real 3480, 3490, or 3590 Devices

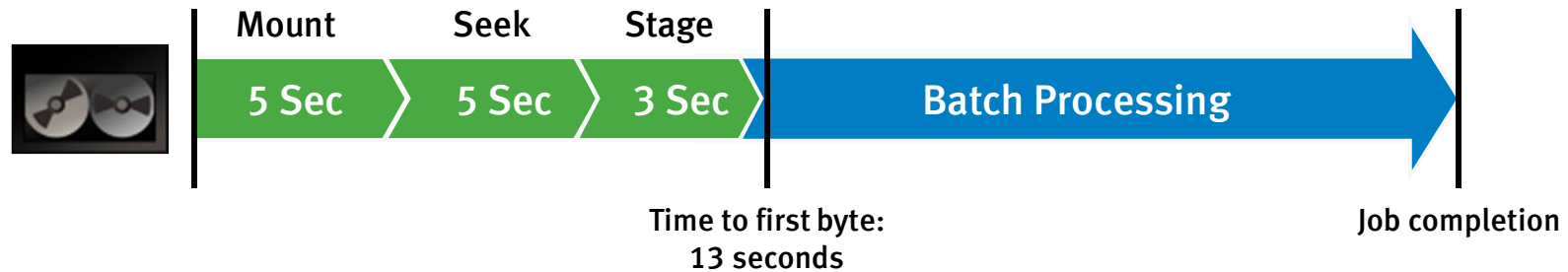
- ✓ Usable when real devices are not present
- ✓ May require modification to standard Esoterics

### 3. Bus-Tech User Information Module (UIM)

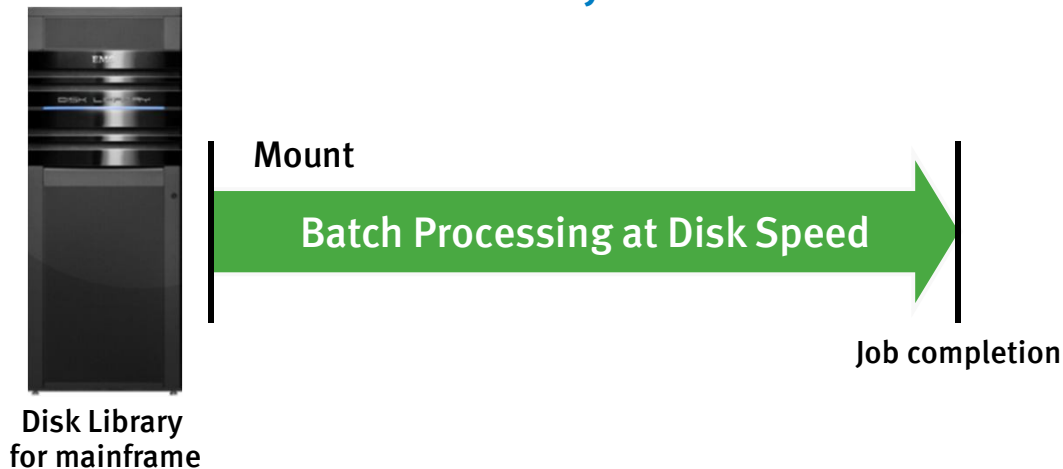
- ✓ Makes devices unique device type (v3480, v3481) requiring specific allocation.
- ✓ Easiest to implement
- ✓ Works good for some applications (Mobius ViewDirect)
- ✓ Does not work with some IBM software (HSM and OAM)

# DLM Performance vs. Tape

## Physical Tape



## Disk Library for Mainframe

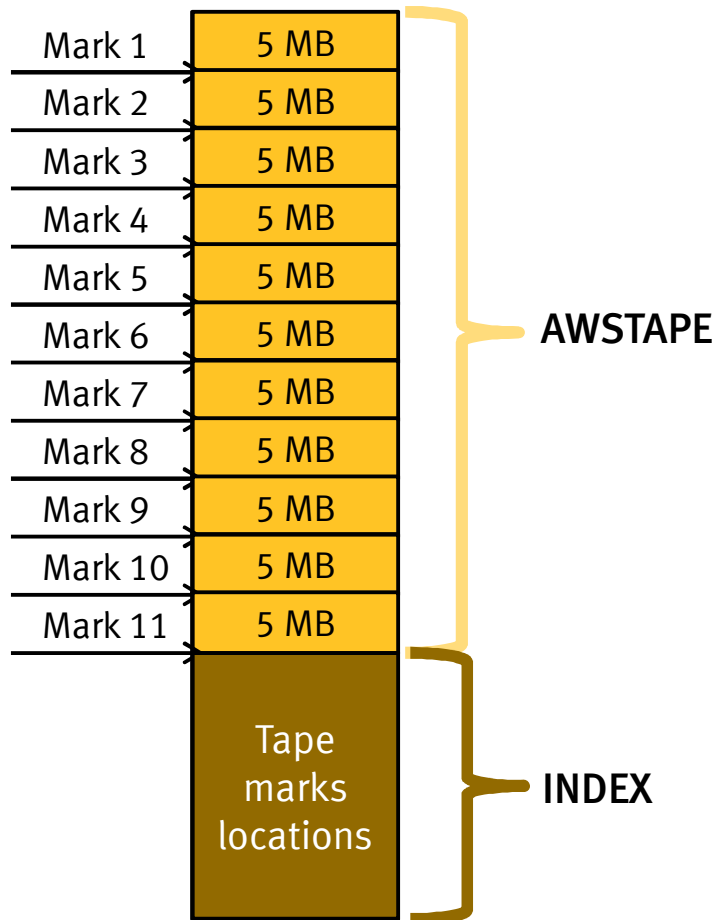


### Provides...

- Faster time to first byte
  - One second mount time on average
- Faster batch processing

# Improved Response Time

## File name = Tape VOLSER

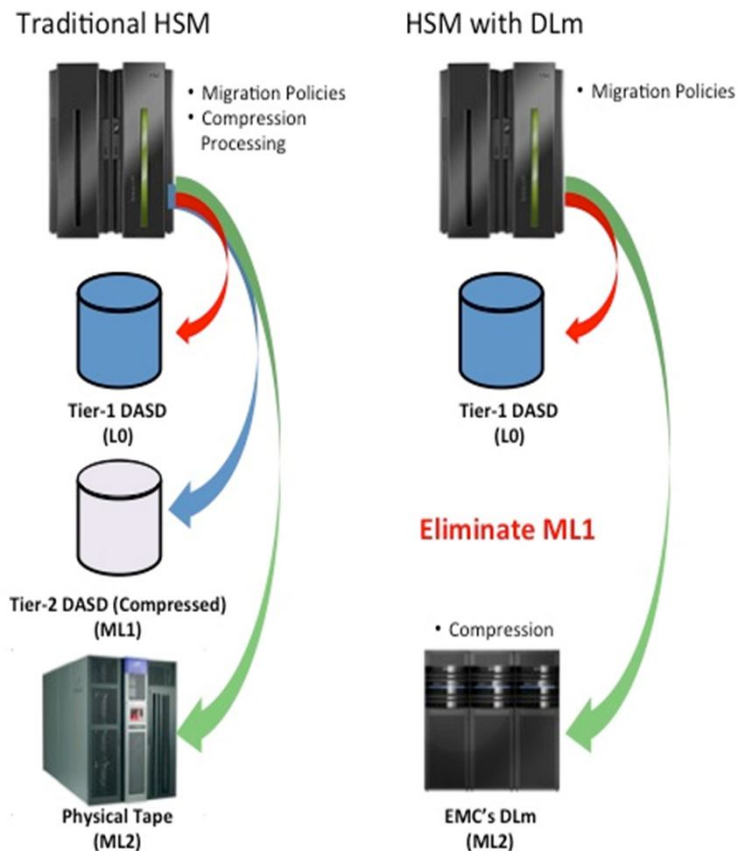


- When Disk Library for mainframe writes to tape, it builds an index for fast locate
  - Index is stored at the end of the volume's disk file
  - Contains a pointer to:
    - Each tape mark location
    - Each 5 MB block boundary
  - On read, the VTE can go directly to any tape mark
- Fast locate mechanism provides additional performance benefits
  - Response times drop from 15–40 seconds on physical tapes, to less than one second on average
  - Improves service level agreements

## Tape image on disk



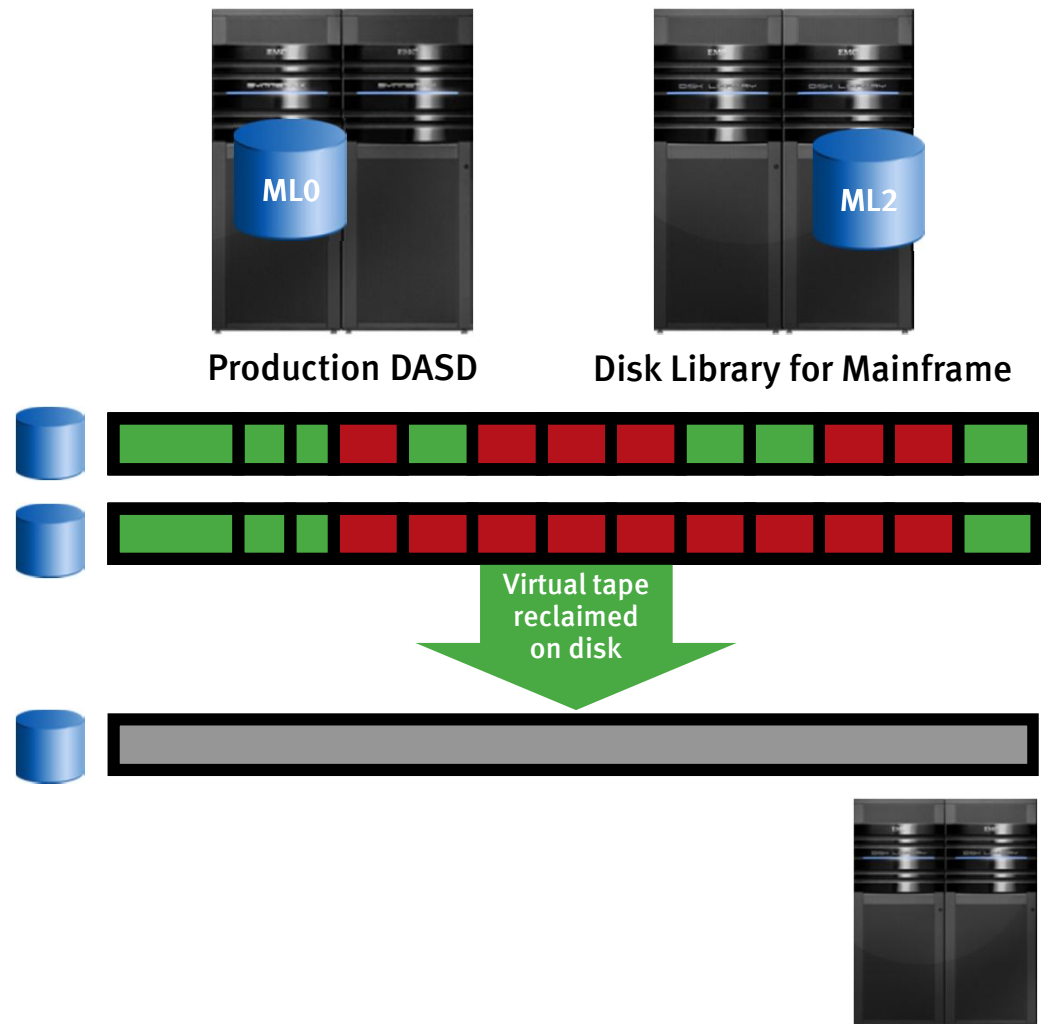
# Why Tape-On-Disk As The Next Wave?



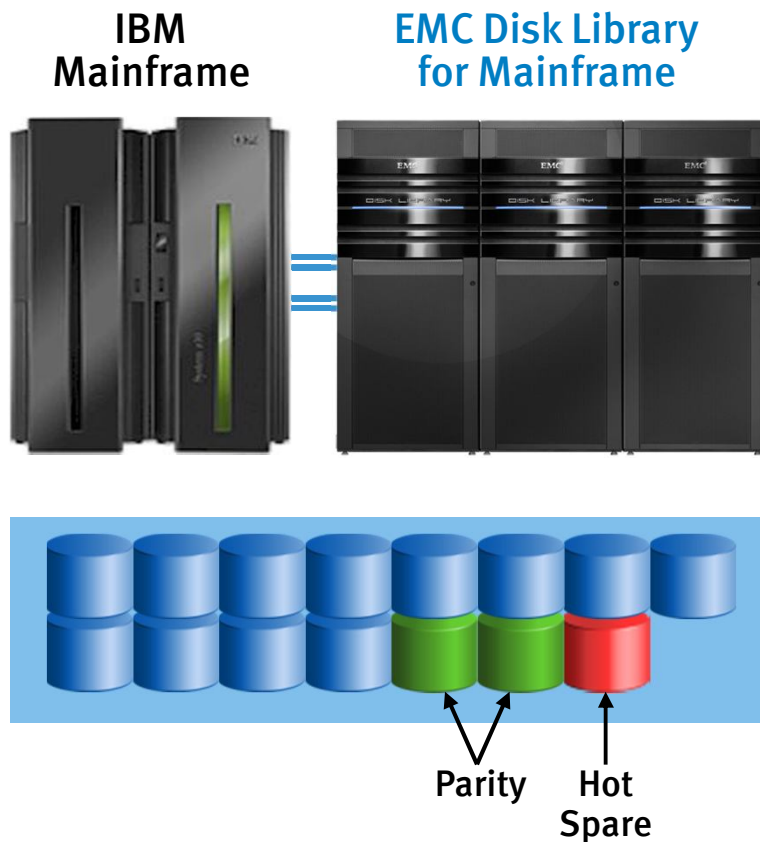
- Better performance
- Business continuity
- Higher availability
- Disaster recovery

# Reduce HSM CPU Cycles

- Reduce/eliminate DFHSM ML1
  - Move directly from L0 to ML2
  - Save the mainframe CPU compression cycles
  - ML2 information is still kept on disk on the DLM
  - Recalls at disk speed
- DFHSM recycle time optimized
  - DFHSM will continue to perform tape recycling
    - Recycling at disk speed
    - User settable virtual cartridge size
    - No contention for tape drives
  - Hours of savings potential



# No Single Point of Failure

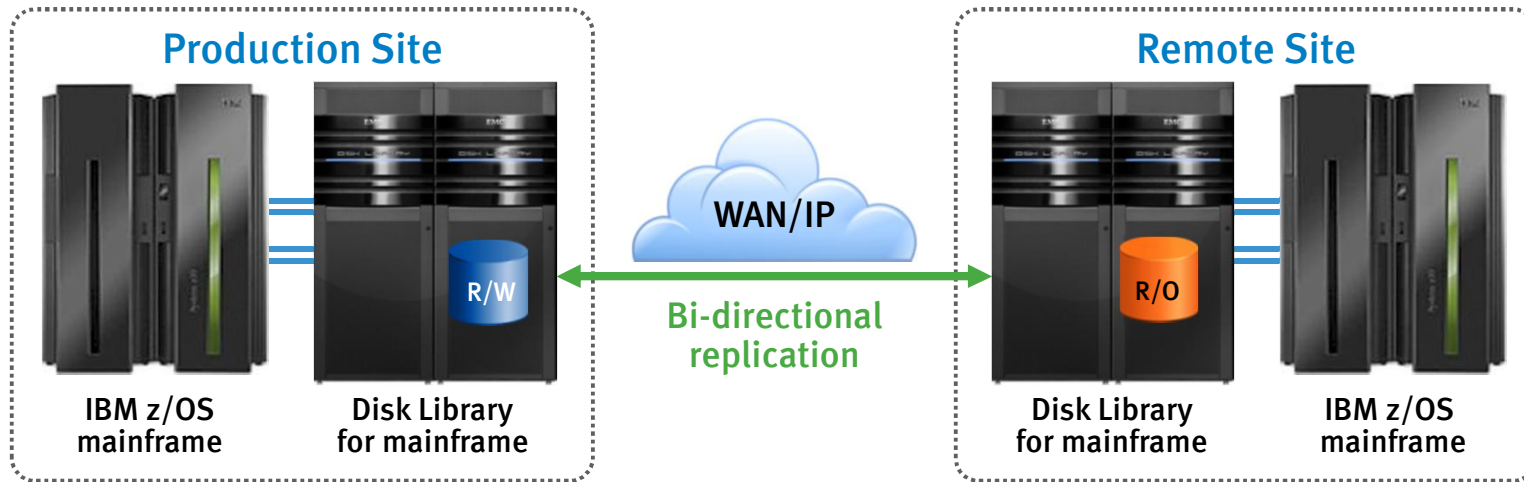


Any VTE can access any tape volume in the library

- All VTEs can see all tape volumes
- If a VTE fails...
  - Job will fail with tape error (same as with regular tapes)
  - Tape volumes are still available via alternate VTE
  - VTE does not contain metadata
- Disk drives are RAID 6 protected
  - 12 + 2 protection—the best protection
  - Hot spare drive in each disk tray (DAE)

# Disaster Recovery Testing

Two ways to conduct disaster recovery testing from copy of production data



## Read-only mounts

- Disk arrays allow instant “read-only” copies
- Confirm that tapes can be mounted and all required data can be accessed
- No incremental storage capacity required

## Snapshots

- Disk arrays allow creation of “read-write” snapshot
- Confirm operation at the disaster recovery site
- Some incremental storage capacity required

**Remote replication is uninterrupted during testing**

# Virtuent 7

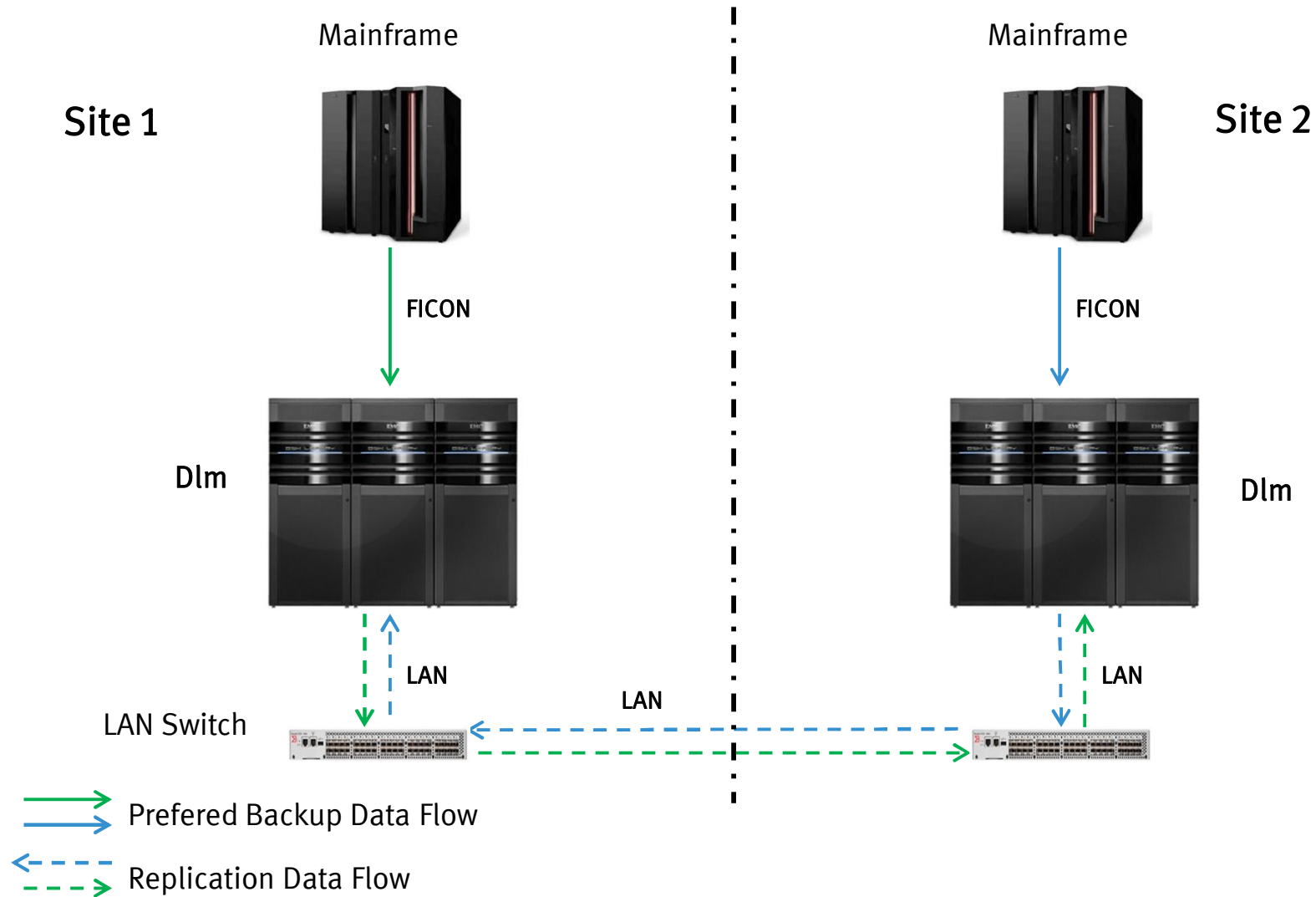
## DLM Console – Messages Tab

- Provides access for changing error message handling

The screenshot shows the 'Virtuent Configuration' web interface for configuration 'ChuckOldFS'. The 'Messages' tab is active, displaying a table of error messages. The table has columns for Code, Message, SNMP, Vendor Email, Customer Email, and Mainframe. A 'toggle all' link is located above the table.

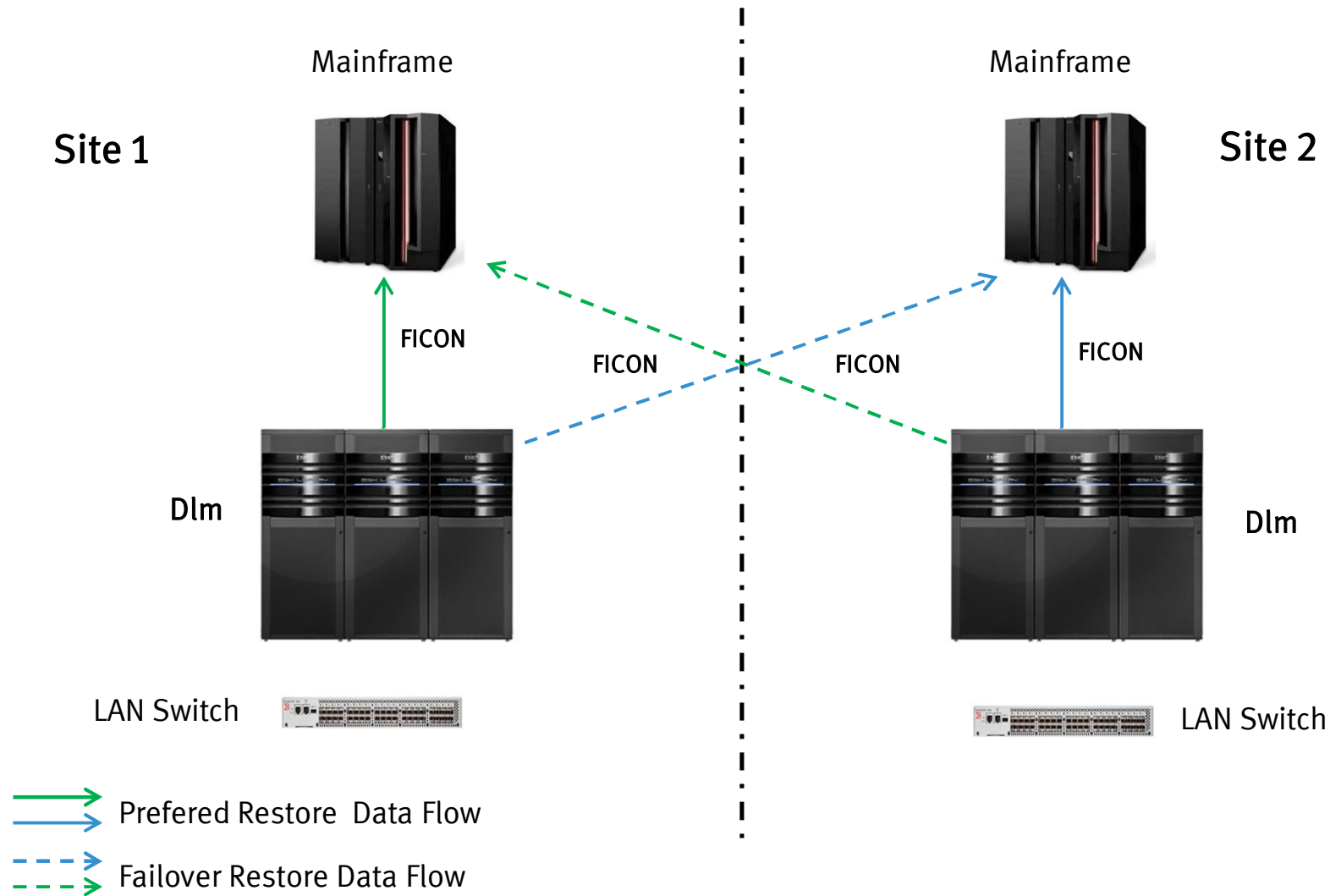
| Code | Message  | SNMP                                | Vendor Email                        | Customer Email                      | Mainframe                           |
|------|--|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
|      |  | toggle all:                         | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 014E | Unknown hardware compression card, id=0xXXXX                                   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 015E | Hardware compression driver error  | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 016E | Device <devicename> Error opening hardware compression driver: <error message> | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 018E | Error creating <processname> Thread: <error message>                           | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 019E | Error allocating memory for <name>: <error message>                            | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 020E | Cannot verify <feature> license: <error message>                               | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 021E | <parameter=value> incompatible with <license> license                          | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 022E | Unable to find userid 'vtape'  | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 023E | Unable to switch to user and group 'vtape'                                     | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 024E | Program not started with effective userid 'root'                               | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 025E | Invalid license combination, <license1>+<license2>.                            | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 026E | Pid file <filename> must be full path name. Use -? for Help                    | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 027E | Failed to fork daemon: <error message>   | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 028E | Internal Error calling setsid: <error message>                                 | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 029E | Internal Error changing working directory to '/': <error message>              | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 031E | Cannot create PDI file <filename>: <error message>                             | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| 032F | Trace task error reading pipe errno=0x<xx> (<nnn>)                             | <input checked="" type="checkbox"/> | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |

# Mainframe Integration with DIm – Backup



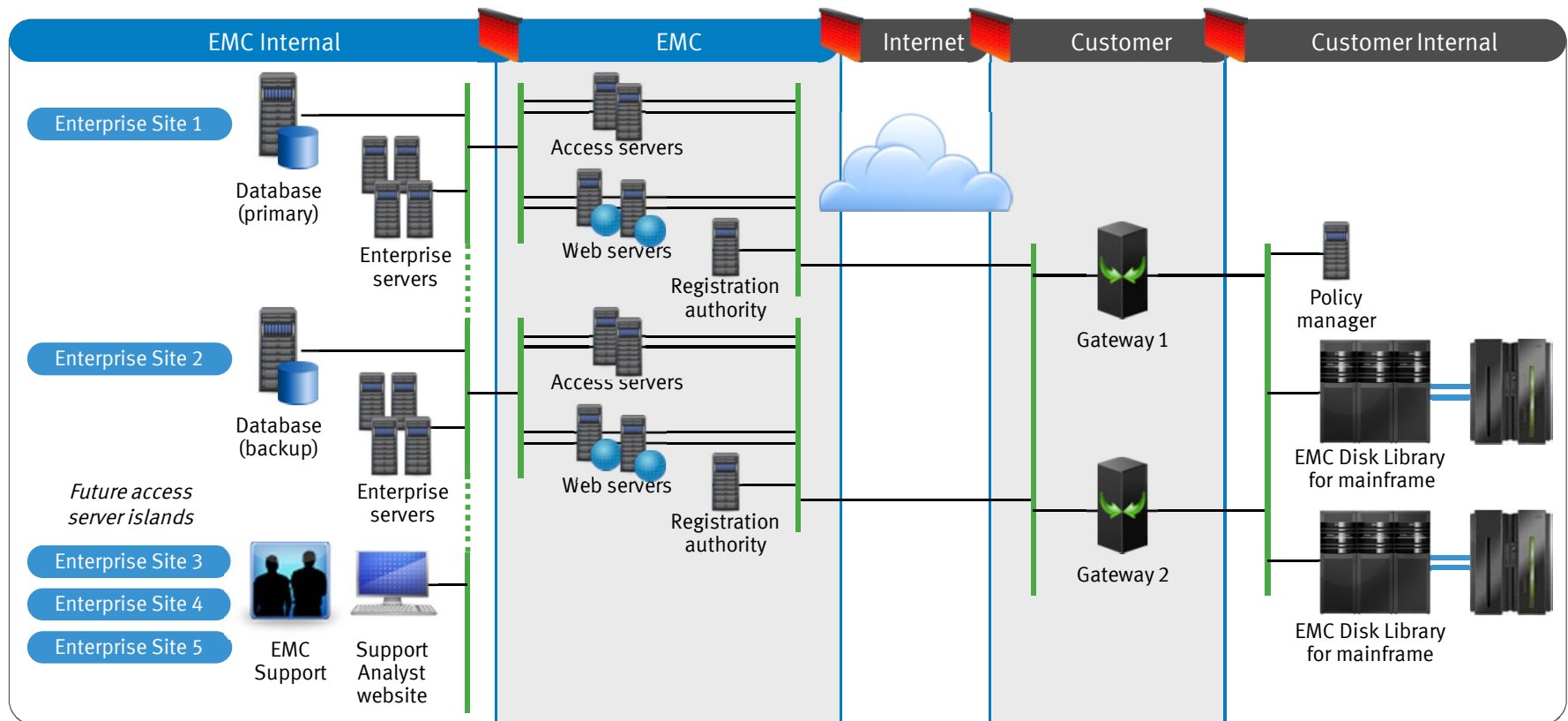


# Mainframe Integration with DIm – Restore



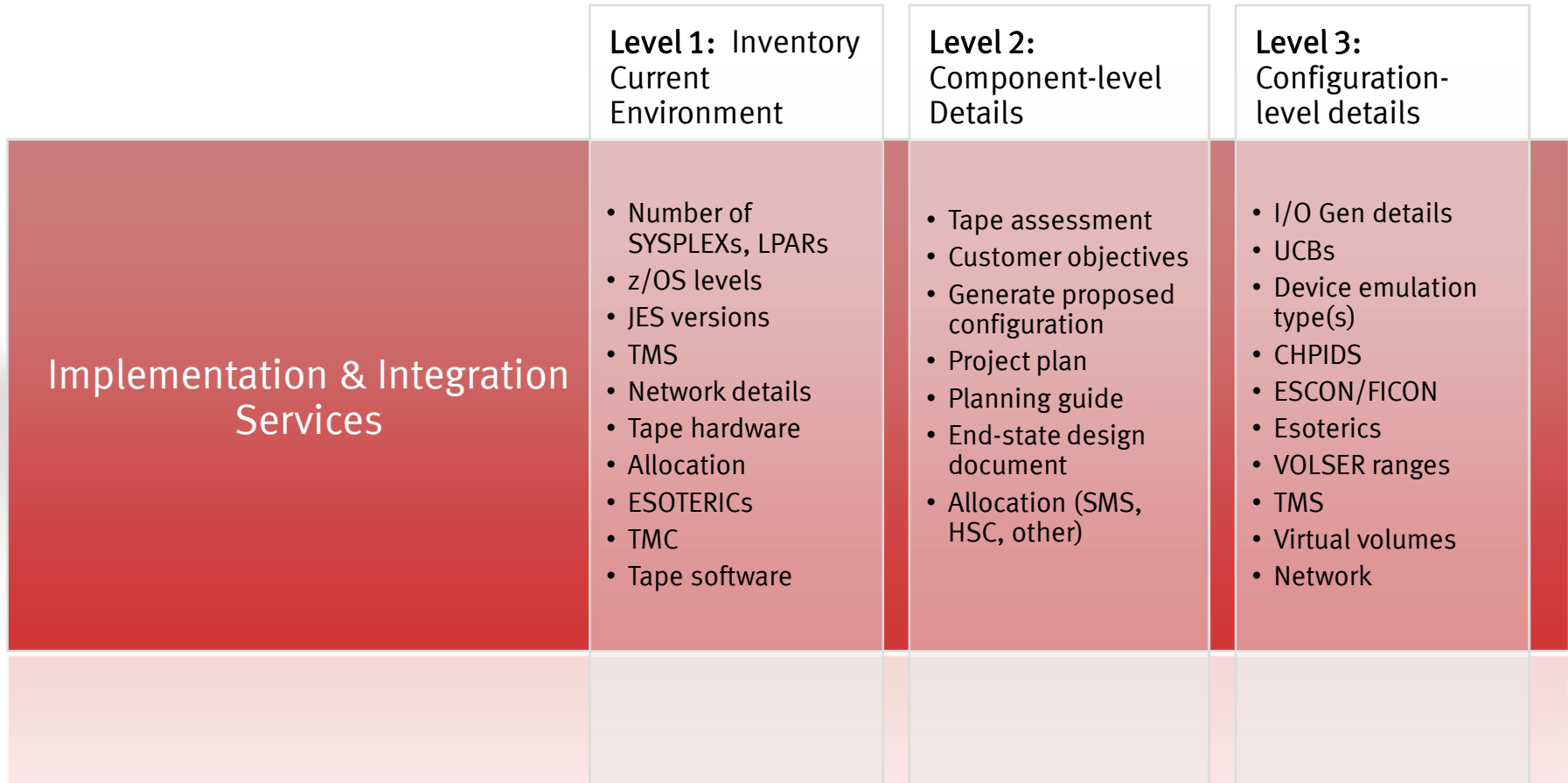
# Disk Library for Mainframe Support

## EMC Secure Remote Services and ConnectEMC



# Services: DLm Success Factor

## 3-Level Architecture



# Services: Migrating to DLm

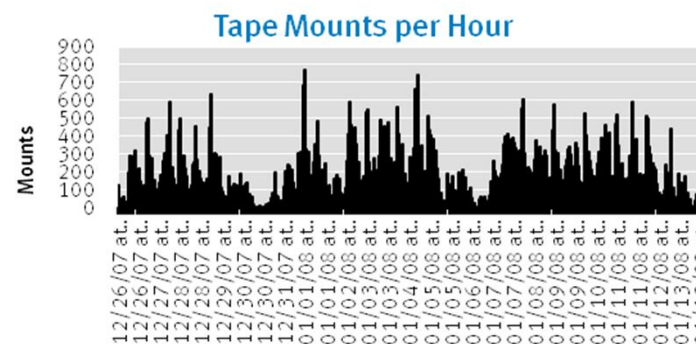
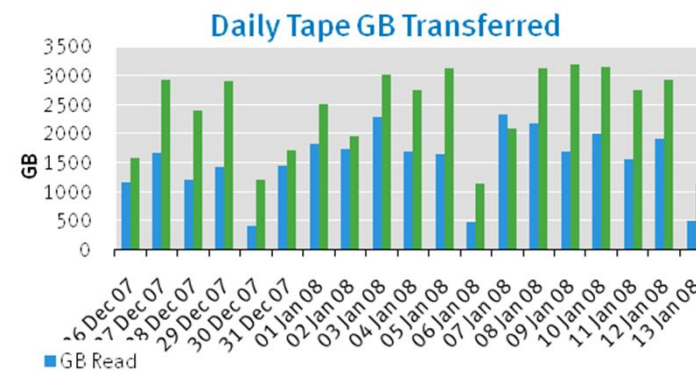
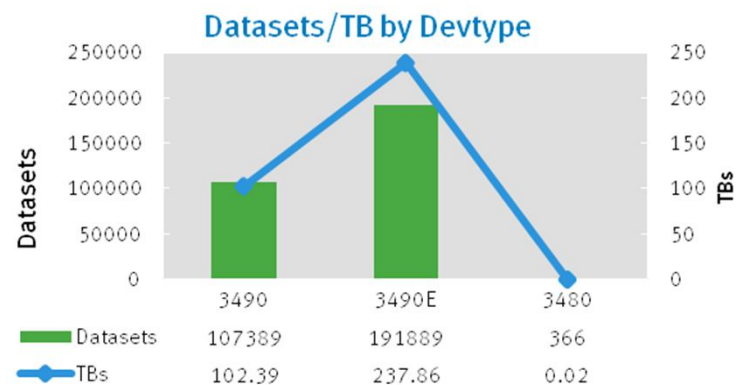
## Going from STK or IBM to EMC's DLm

- Migrating data from STK/IBM to EMC's DLm
- Develop migration plan
- Implement services



# Tape Assessment

- A comprehensive analysis of the current tape environment; data sources include:
  - HSM MCDS data
  - HSM FSR data
  - HSM list TOC data
  - HSM control parameters
  - System log data
  - Tape device configuration
  - Tape library management system catalog data (TLMS, CA1-TMS, RMM or ZARA)
  - SMF data—record types 14, 15, 21, 30, 40
- Report of the summary of findings:
  - HSM Capacity Analysis
  - HSM Activity Analysis
  - HSM Tape Use
  - HSM Control Parameters Analysis
  - Tape Mount and Transport Activity
  - Tape Library Analysis
  - Tape Bandwidth Analysis



# Needs addressed by EMC DLm

- ✓ TCO Reduction
- ✓ DR Strategy improved & simplify
  - ✓ Reduced RTO & RPO
  - ✓ Real read/Write DR testing of 100% of data
- ✓ Tape processing Improvements
  - ✓ Reliability
  - ✓ Speed
  - ✓ Consistency
- ✓ Batch Windows Reduction
- ✓ Eliminate Risks with Physical Tape
- ✓ Reduce Mainframe MIPS (avoiding compression)
- ✓ Reduce Floor Space
- ✓ Reduce energy consumption



# EMC<sup>2</sup><sup>®</sup>

where information lives<sup>®</sup>

^  
Mainframe