DM - What's new from Dell Technologies: PowerMax and DLm updates

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Dell EMC

November 7, 2019
Session DM

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DELL EMC PowerMax & VMAX All Flash Update for IBM Z

Robin Fromm – Global CTO Mainframe Solutions

DELL EMC

PowerMax/VMAX Unique Features

- Large Global Cache
  - Advanced Algorithms
  - Partitioning
  - FlashBoost Improving Response Time for Read Miss IO
- SRDF Is Single Program Product With 4 Operational Modes
  - SRDF Is A Mirror Enabling IO TO Serviced Through Replication Link Avoiding DASD Swap Or Site Failover Due To Local Device Or Raid Failure
  - Sync, Async, Adaptive & Active Active (FBA)
  - Dynamically Change Operation Modes
  - Async Automatically Pages To SRP To Ensure Stability
  - Dynamic Volume Expansion With Active Replication
- Virtual Storage Provisioning And Extreme Space Efficiency
  - Single Track Allocation 56K CKD, 128K FBA
  - 2:1 Or Better Data Compression For FBA Data
- TimeFinder SnapVX
  - Target Less Snapshots Requiring No Addresses
  - Flashcopy Compatibility
  - 256 Consistent PIT Copy Of A Volume
  - One Full Copy Of Storage Can Yield 256 Active Usable Copies Of Data
- Extreme Space Efficiency Enables New Cost Effective Possibilities
  - Parallel Application Development And Testing (DevOPS)
  - Multiple Data Recovery Points From Data Corruption Or Destruction Events

VMAX 950F All Flash

- 1-8 Engines
- 56Gb/s Infiniband Engine Interconnect
- 72 Intel Broadwell 2.8GHz Cores/Engine
- Up to 256 16Gb/s FICON ports
- Up to 16TB cache (1TB, 2TB DDR4)

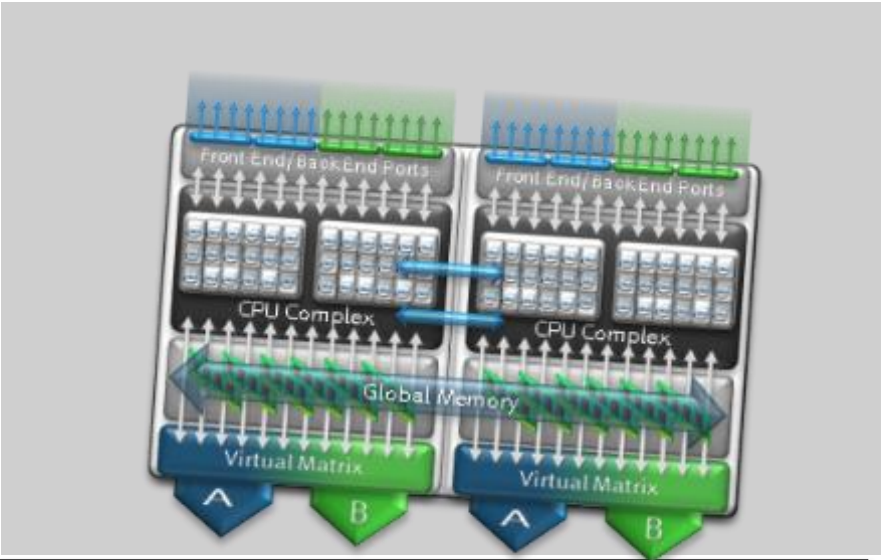
- *120-drive DAE (1920 max)*
- *Up to 1.7PBu*

PowerMax 8000

- 1-8 Engines
- 56Gb/s Infiniband Engine Interconnect
- 72 Intel Broadwell 2.8GHz Cores/Engine
- Up to 256 16Gb/s FICON ports
- Up to 16TB cache (1TB, 2TB DDR4)

- *NVMe Drives: Storage Class Memory & NAND flash*
- *24-drive DAE (288 max)*
- *Up to 1.7PBu*

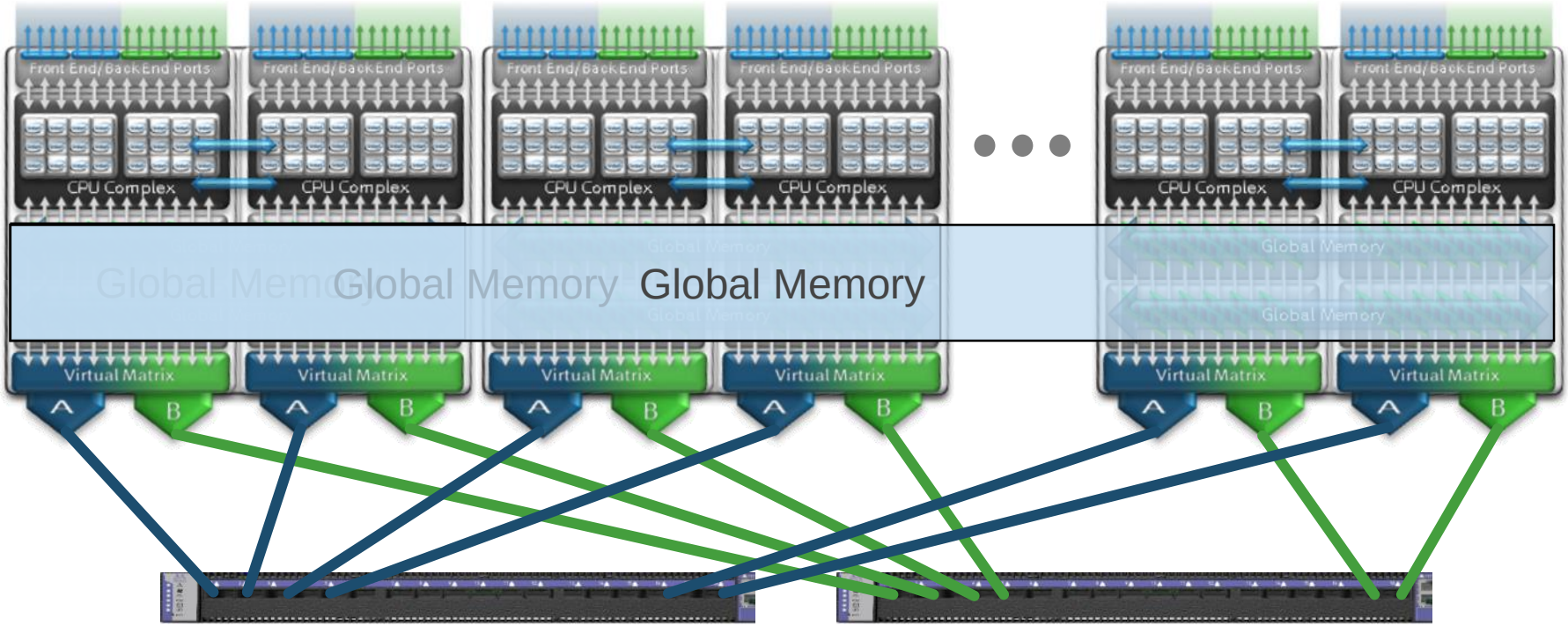
VMAX 950F & PowerMax 8000 All Flash Engines



Broadwell 18 Core CPU 2.8GHz
72 CPU Cores per Engine / 576 per System
Up to 2 TB Cache per Engine / 16 TB per System
Up to 32 FICON Ports per Engine / 256 per System

Virtual Matrix enables global memory

Data cache and metadata striped across all directors



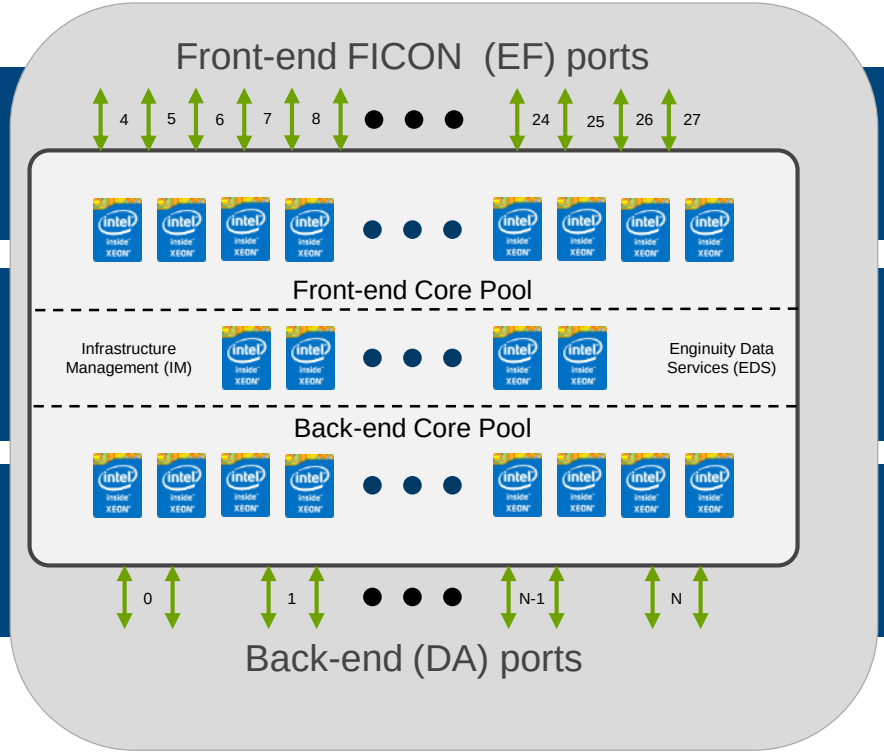
Architected for All Flash

zBricks & zPowerBricks (engine + capacity pack) optimized for multi-core CPUs

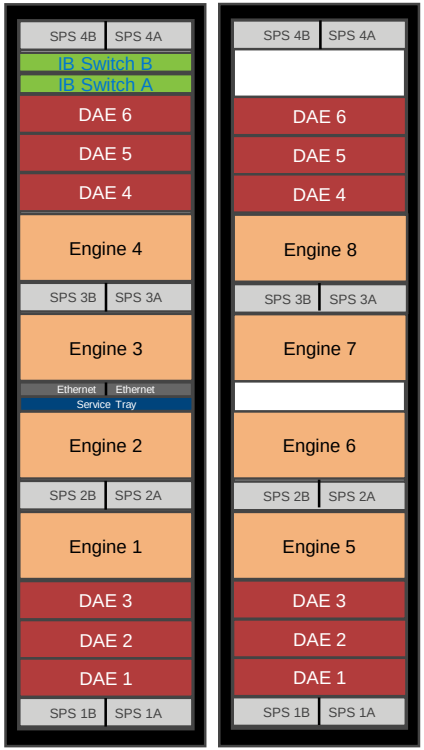
Massive increase in per-port performance

Balanced performance across CPU resources

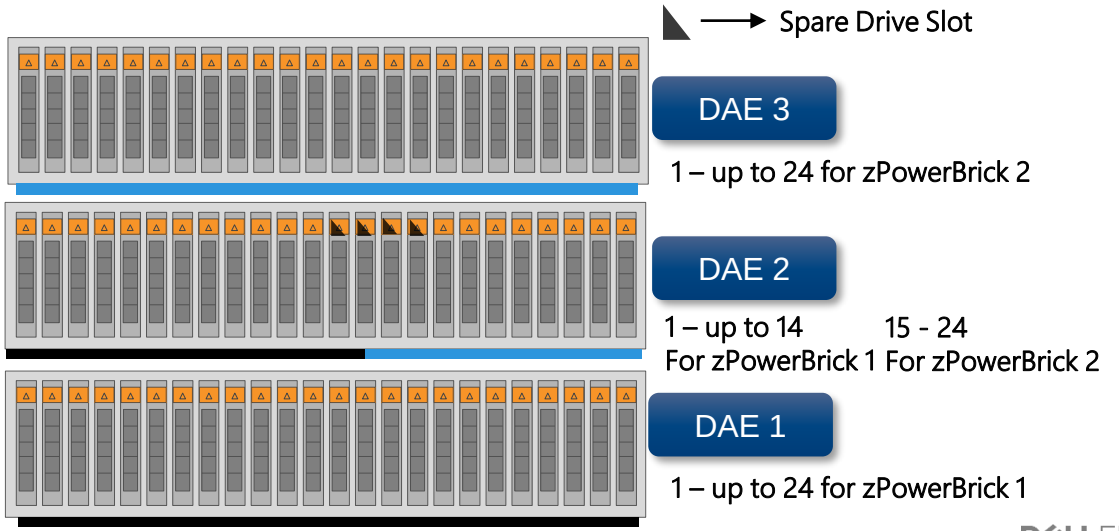
Optimized for flash performance



PowerMax 8000 System Configuration Details

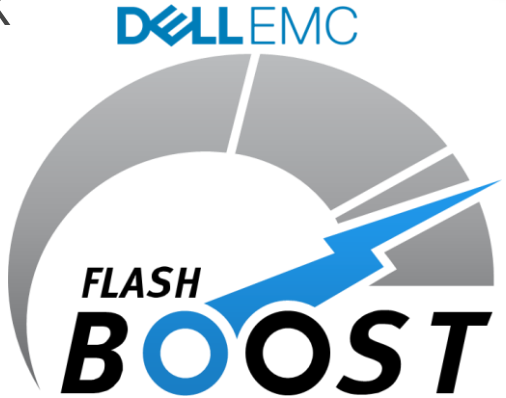


- Each engine starts with 2 DAEs
- Infiniband switch gets added with 2nd engine
- Each additional engine adds 3rd DAE
  - Each additional even numbered engine gets a 3rd DAE which is shared with the previous odd numbered engine



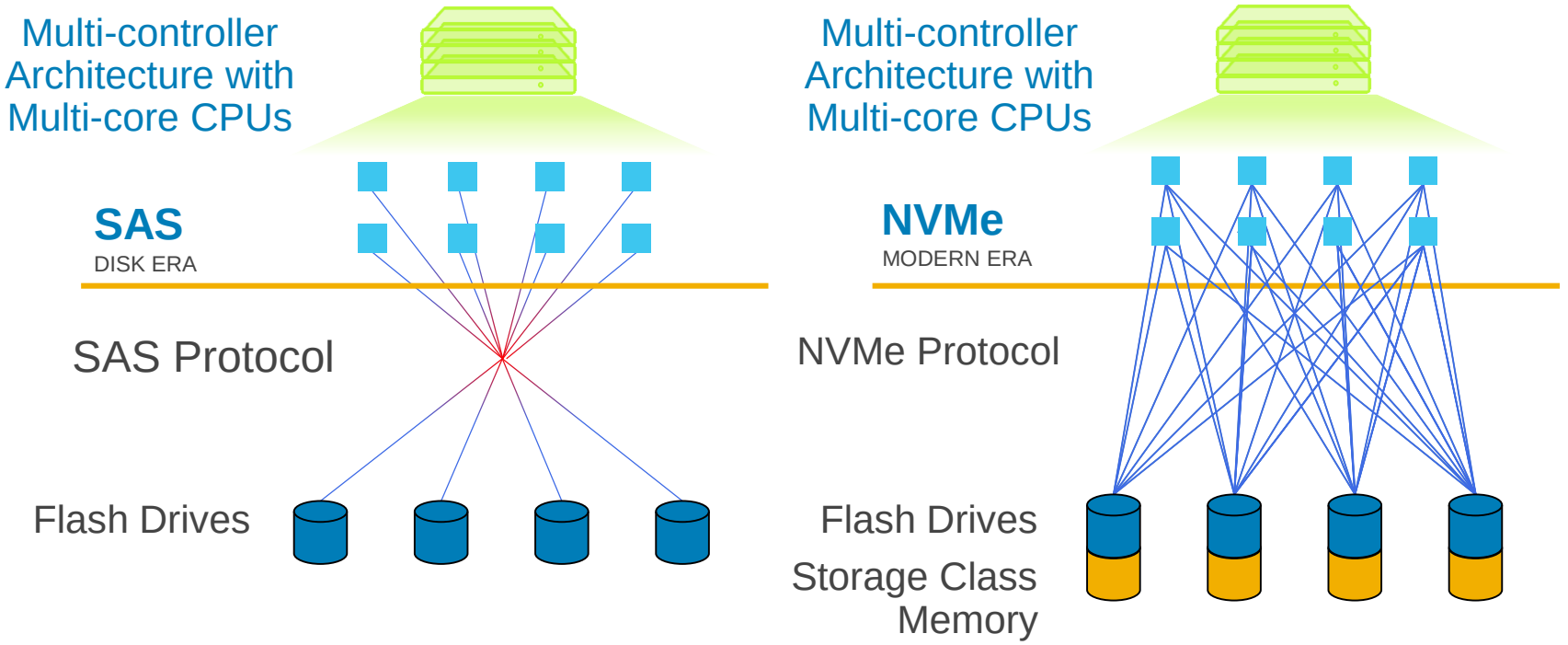
New! FLASHBOOST™ for Mainframe

- Performance feature introduced with VMAX non-mainframe now reintroduced in PowerMax & VMAX All Flash
- Delivers performance acceleration for high demand read intensive workloads
  - VMAX will bypass its internal cache on read miss workloads
  - Cache loading overhead happens asynchronously
  - Performance improvements ~2X on Read Miss
  - Significant savings for All Flash disk response profile

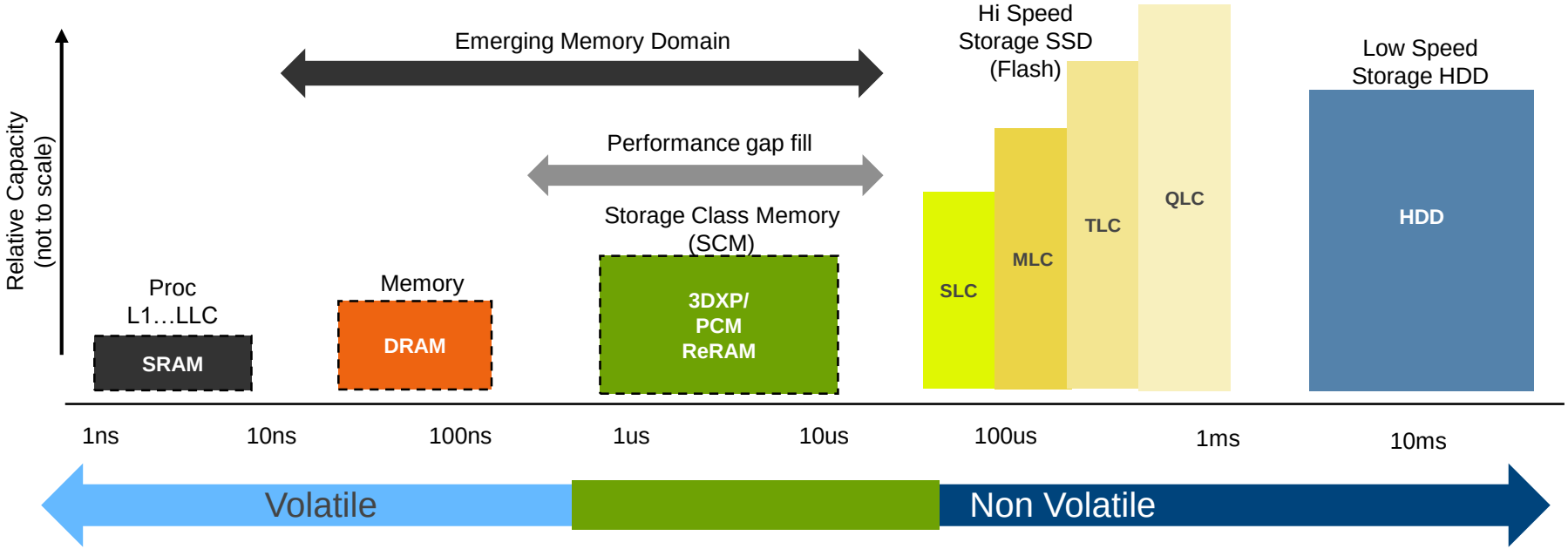


NVMe unlocks the power of next generation media

- Maximizing the performance of multi-controller architectures

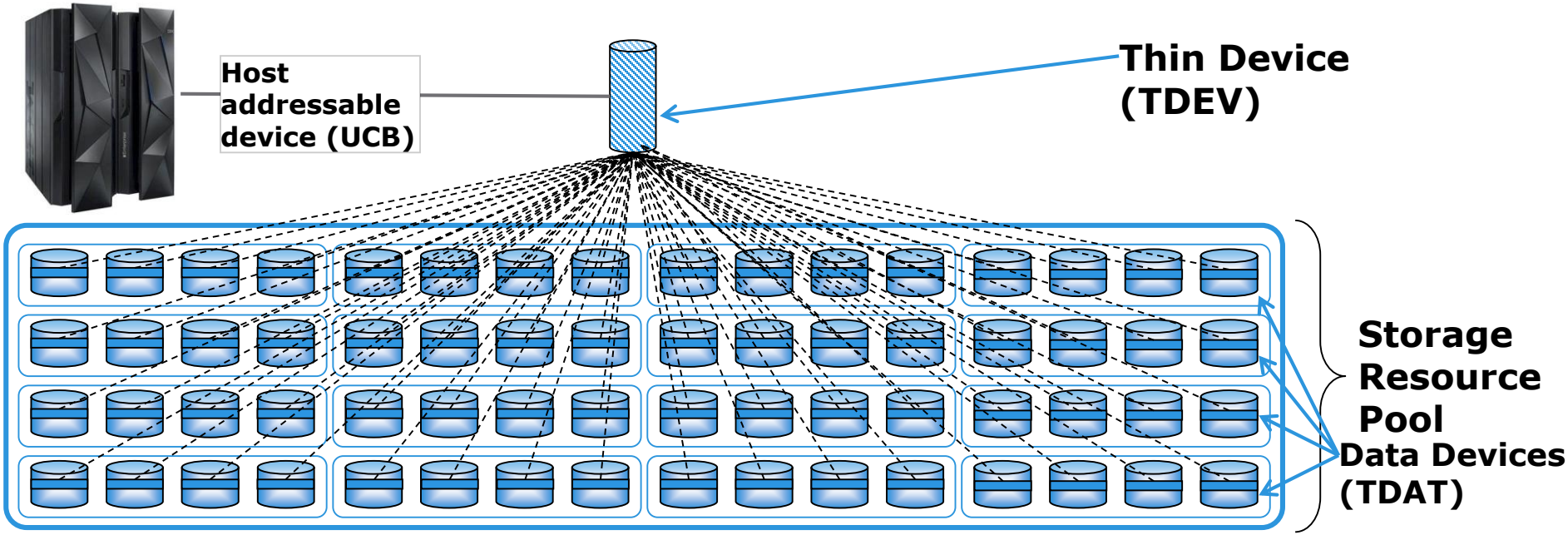


Storage Class Memory: Filling the latency gap



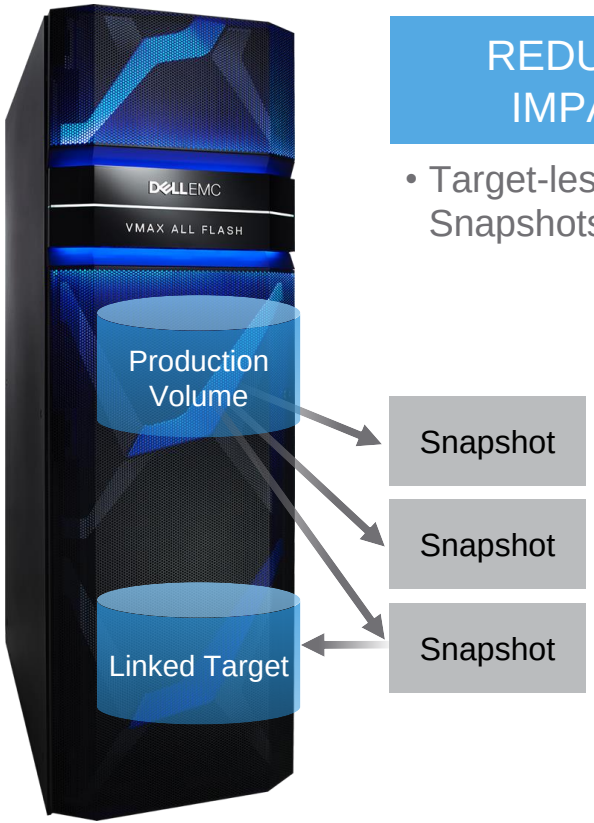
Virtual (thin) Provisioning Concept

- Storage capacity is structured in common data pools
- Thin devices are logical volumes that are provisioned to hosts
- Workload is spread across many disks



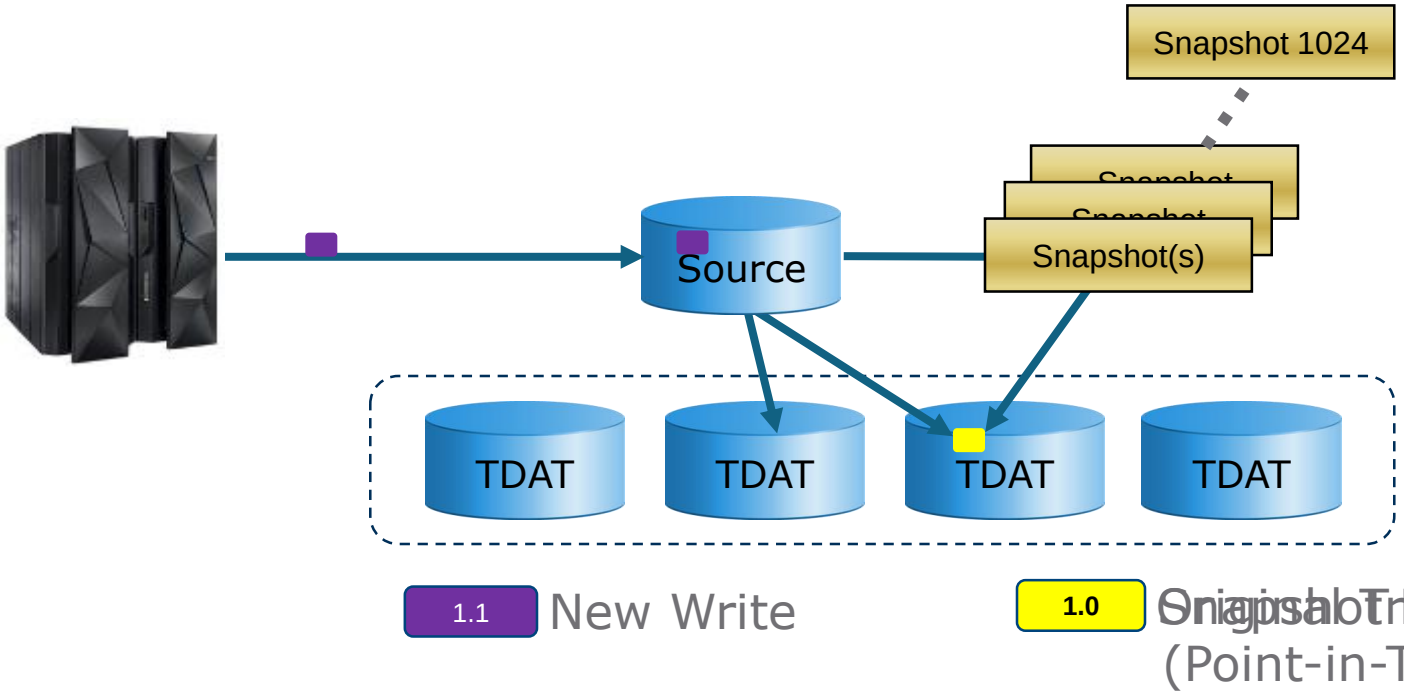
Incorporate snaps for data copies

New TimeFinder SnapVX™

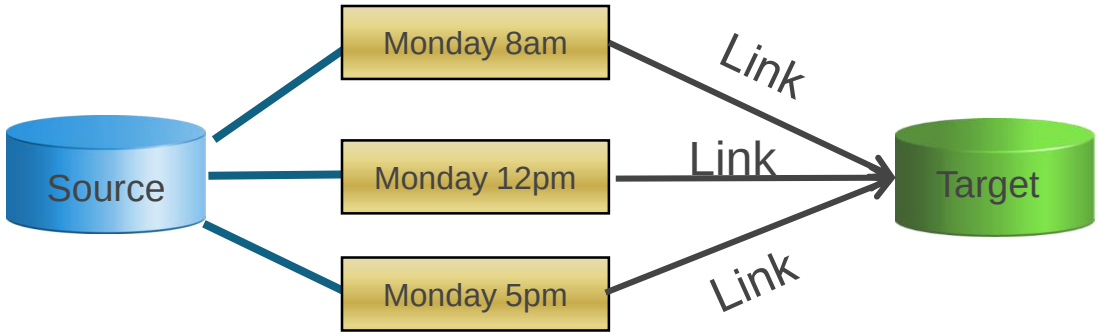


REDUCED IMPACT	INCREASED AGILITY	EASE OF USE
• Target-less Snapshots	• Up to 256 Snapshots per source • zDP enables up to 1024 Snapshots per source • Up to 1024 Linked Targets (snaps and/or clones) per source	• User-defined name/version number • Automatic expiration if desired • Secure Snapshots

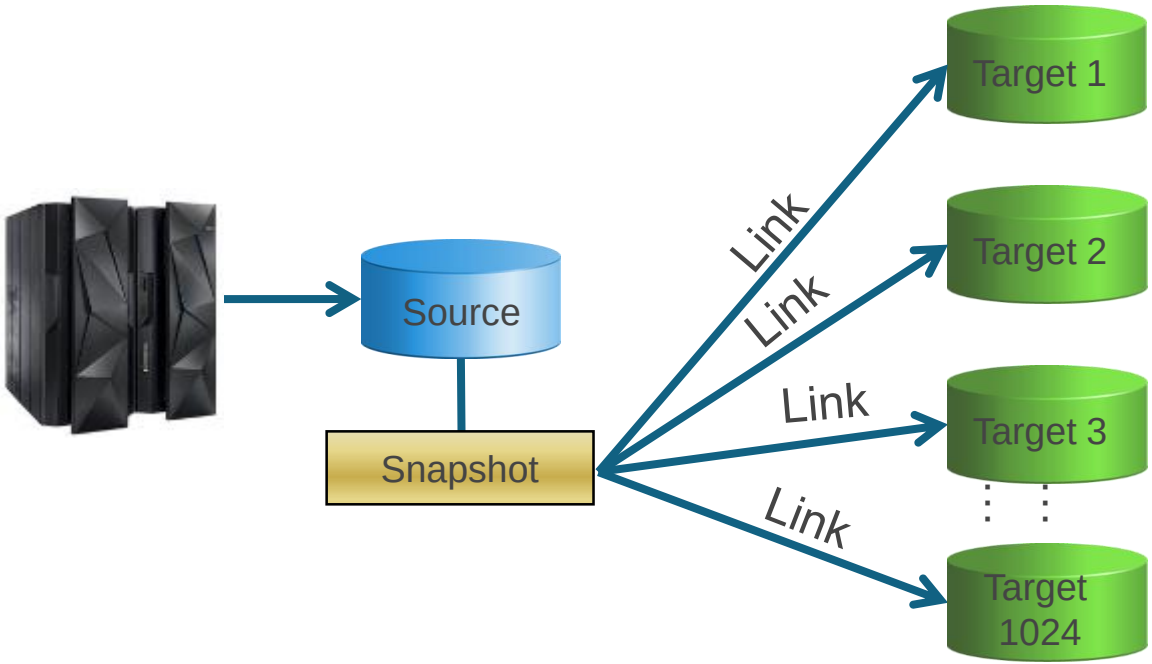
SNAPVX SPACE EFFICIENCY
REDIRECT-ON-WRITE AND SNAPSHOT DELTAS



SNAPVX Link Command



SNAPVX Link Command



zDP

Data Protector for z Systems

What is zDP?

A z/OS based solution that automates SnapVX snapshot creation/deletion

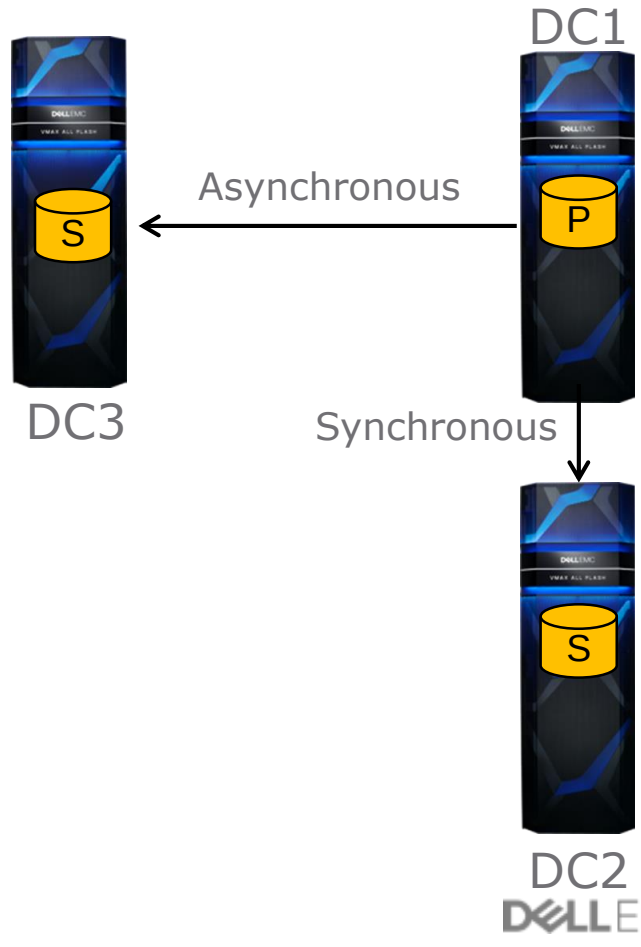
Enables rapid recovery from a spectrum of risks to data:

- Processing error
- Human error
- Malicious intent

Think: ‘Time Machine for the mainframe’

Replication solutions focus the physical:
“availability with data integrity”

- Planned and Unplanned outage events
- Multiple copies
- EVERYTHING gets physically replicated
  - Even the logical corruptions!



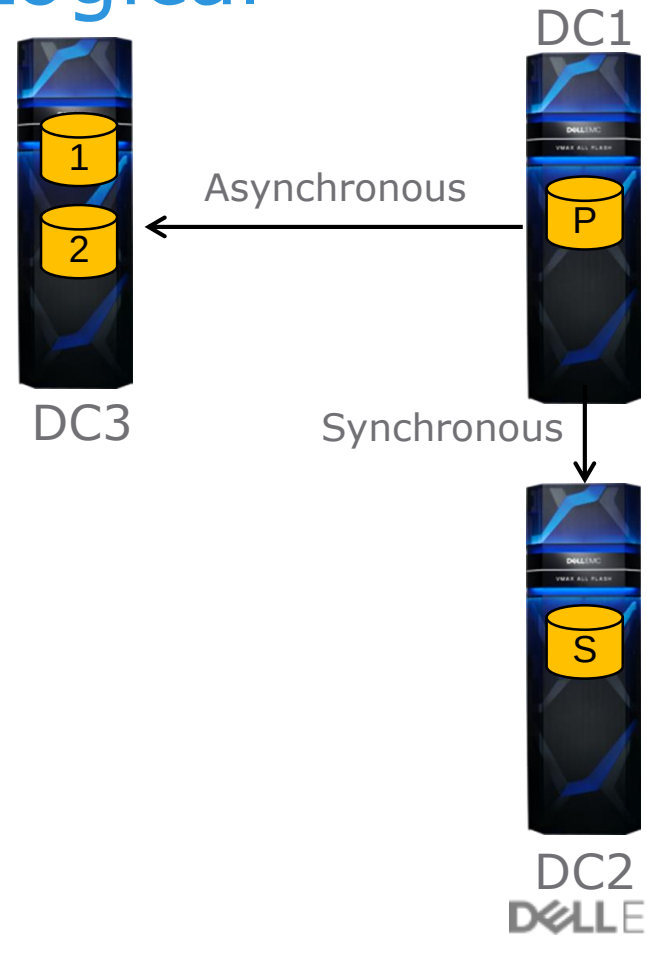
Why zDP? – Physical vs Logical

Replication solutions focus the physical:
"availability with data integrity"

- Planned and Unplanned outage events
- Multiple copies
- EVERYTHING gets physically replicated
  - Even the logical corruptions!

Today– 1 additional full PIT copy

- Copy 1: near real time
- Copy 2: new PIT created every 24 hrs
- 24 hours to find corruption
- Up to 24 hours of data loss



zDP focuses on:
“recovery from loss of data integrity”

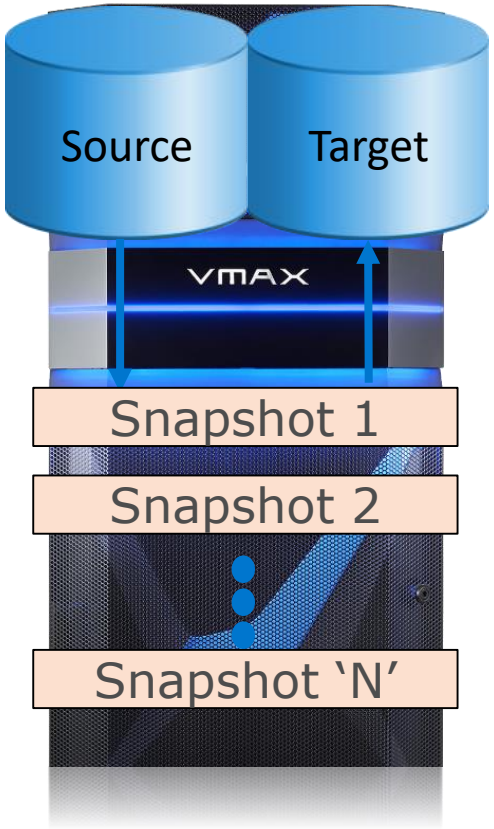
- Continual point in time copy creation
- Automated
- Selectable recovery points
- Granularity of minutes

Brings Point in Time recovery capability to database and non-database systems

Provides applications with recovery capability when not ‘designed-in’

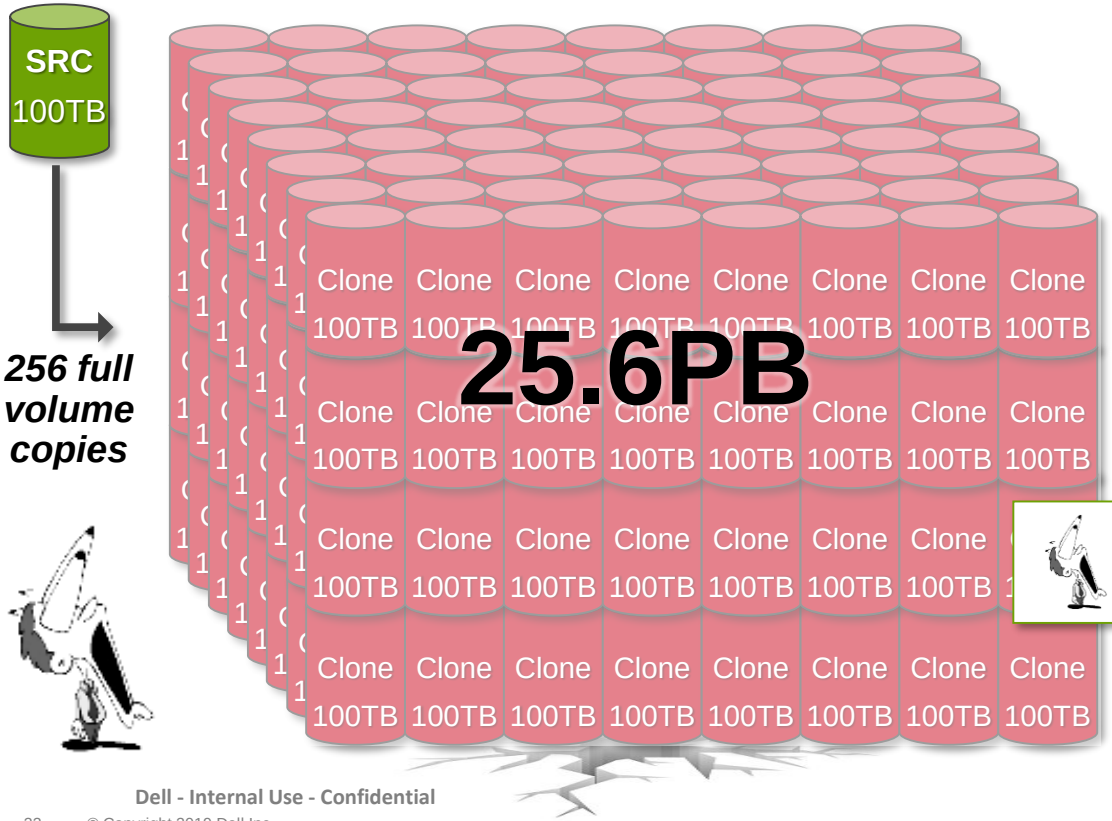
Provides cross-application recovery point

Supports both FBA and CKD data

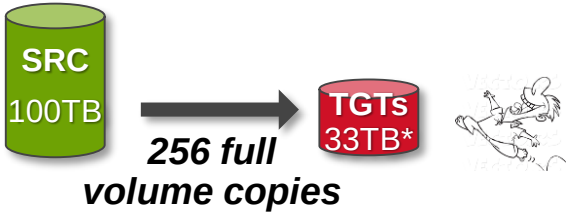


Which local replication solution would you choose?

NON-SNAPVX SOLUTION



SNAPVX SOLUTION

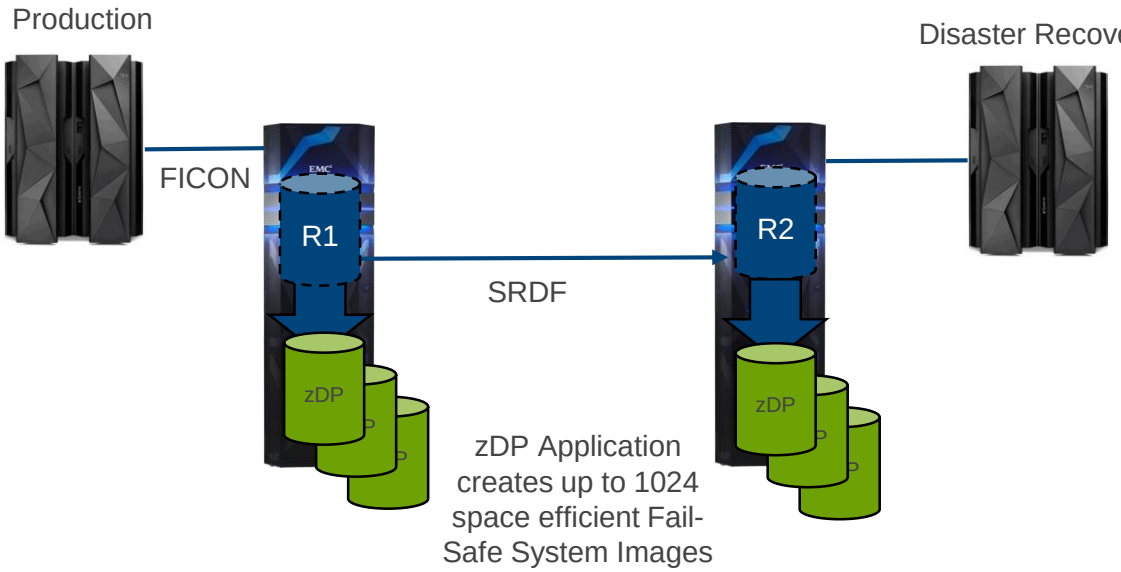


* Based on the following observed avgs
- Snaps every 10 mins
- Observed change rate

99.9%

LESS COPY SPACE USED WITH SNAPVX!!

Data Protector for zSystems – Automate Data Integrity Protection



- RACF to restrict user access
- Open & Mainframe (VMAX)
- SnapVX Copies for restore points
- SnapVX Sessions are Immutable
- Secure Retention time to Live can be set

Quick Recovery

RPO = Adjustable*

RTO = Minutes**

* 5 minute minimum
** Depends on # of Volumes, Data etc.

- Data Integrity Protection from human or processing errors and malicious actors
- Co-exist with and enhance existing BC/DR Solution
- zDP application creates multiple space efficient Fail-Safe System Images
- zDP can be run from either PROD or DR
- Un-addressable SnapVX PIT Sessions allow multiple restore points
- Management CEC can be used to periodically validate data

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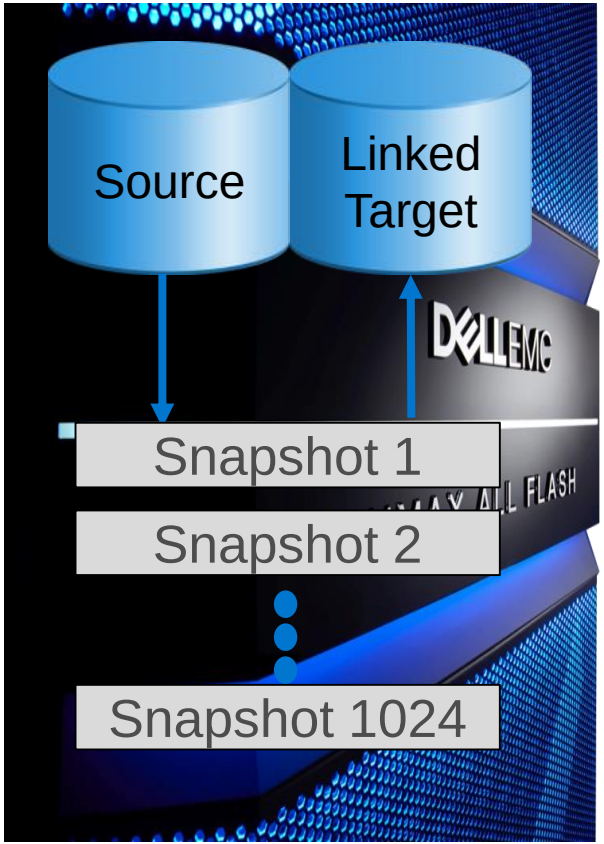
zDP summary



- Host automation solution
  - Frequent creation/deletion of snapshots
  - Benefit: Fast recovery from logical corruption
- Features at-a-glance
  - Up to 288X more recovery capability compared to a daily snapshot
  - Keep up to 256 versions of each volume
  - Select snapshots to LINK by timestamp
  - Automatic ‘roll-off’ of aged snapshots
  - Space estimation and monitoring
  - Consistent scale (32,000 volumes)

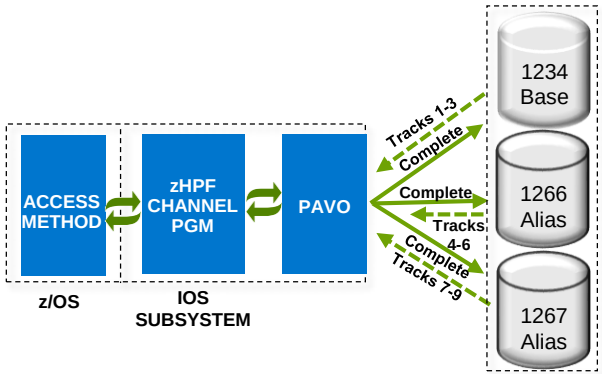
zHPF Optimizers for z/OS

Intercept zHPF I/O and transform it to:

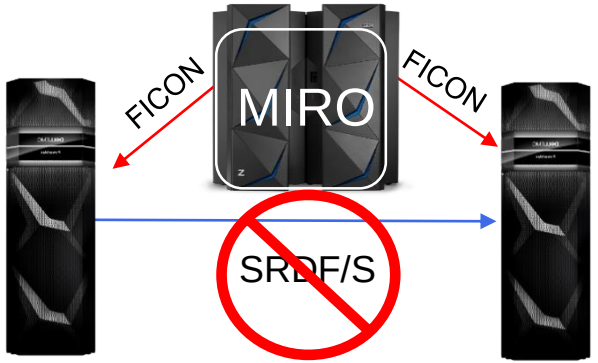
- Create multiple I/O requests
- Execute them parallel
- Reduce latency

PAV OPTIMIZER

UP TO **70%** **FASTER** RESPONSE TIME



MIRROR OPTIMIZER



Cuts replicated I/O response time in half

For any zHPF performance sensitive data

VMAX and PowerMax IBM Z synergy

- **Multi-Incremental FlashCopy**
- **SuperPAV**
- **PPRC Event Aggregation**
- **Storage Controller Health Messages**

- Enhanced zHPF support
  - List Prefetch
  - Format Writes
  - Bi-Directional transfers
  - BSAM/QSAM support
  - zHPF Extended Distance II
- Query Host Access (ICKDSF VERIFY OFFLINE)

- FICON Enhancements:
  - FICON Dynamic Routing
  - 32K devices per FICON channel
  - Forward Error Correction Codes
  - Read Diagnostics Parameters
- zHyperWrite
- zFBA support
- PPRC SoftFence
- Non-disruptive state save
- 1 TB EAV
- Dynamic Volume Expansion
- D@RE external key manager support - IBM SKLM (Secure key Lifecycle Manager) & Gemalto

Disk Library for mainframe DLm8500 release 5.1

Robin Fromm – Global Field CTO Mainframe Solutions

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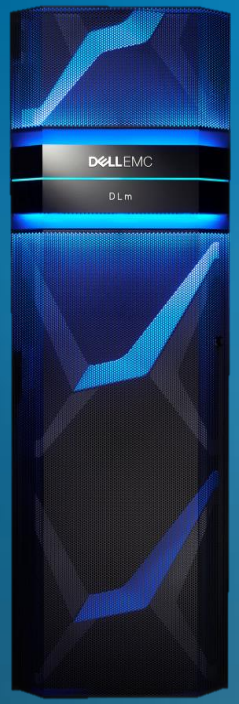
DLm8500 – What Matters - Unique Features

- Continuous Availability In A Single System
- Ability to Read/Write Test %100 of Data Without Disrupting Disaster Recovery
- Superior and Consistent Performance Over The Life Of The System (3X Competitive Offerings) Up to 12 GB/Sec!
- Deduplication Enables Extreme Space Efficiency (8:1 or more reduction
- Leverage Cloud Object Storage (ECS) For Long Term Retention Of Data

What is Disk Library for mainframe?

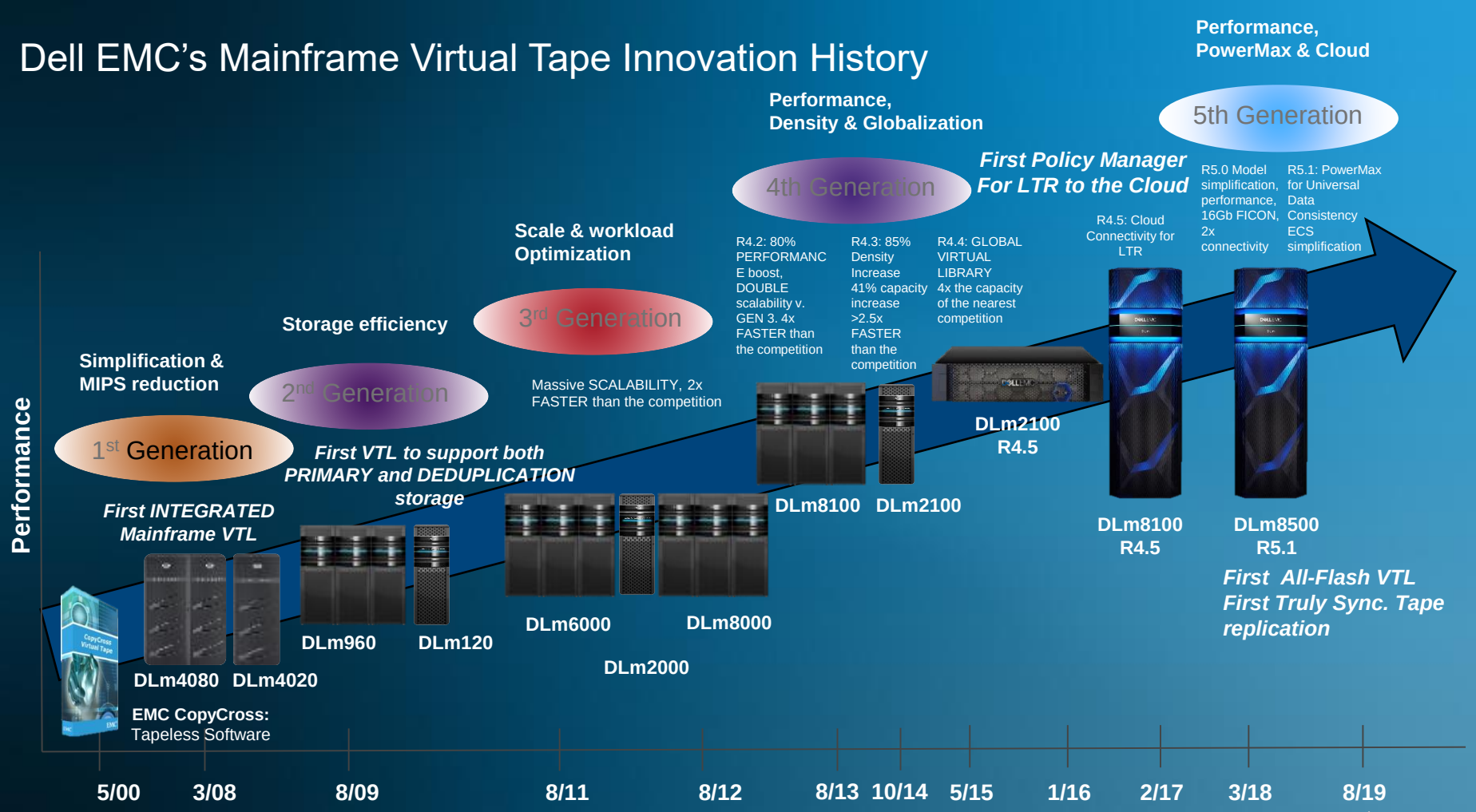
- “Virtual” mainframe tape (tape on disk) for all tape use cases
- The first “all flash” virtual tape storage with powermax offering universal data consistency[tm] and truly synchronous tape (SRDF/S)
- IBM tape emulation, but significantly faster for IBM & unisys mainframes – 3480, 3490, 3590
- Up to 4096 virtual tape drives
- Transparent – looks just like IBM tape
- SAS, Flash & Cloud Object Storage Options
- Dell EMC invented 100% tape on disk
  - QA/tested by dell EMC
  - Developed & manufactured by dell EMC
  - Maintained by dell EMC
  - Professional services by dell EMC



Single-cabinet configuration

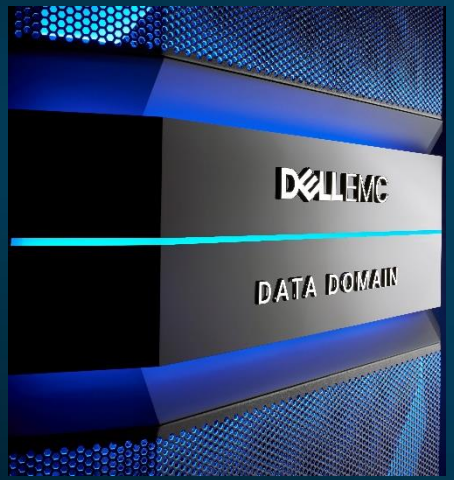
Multi-cabinet configuration

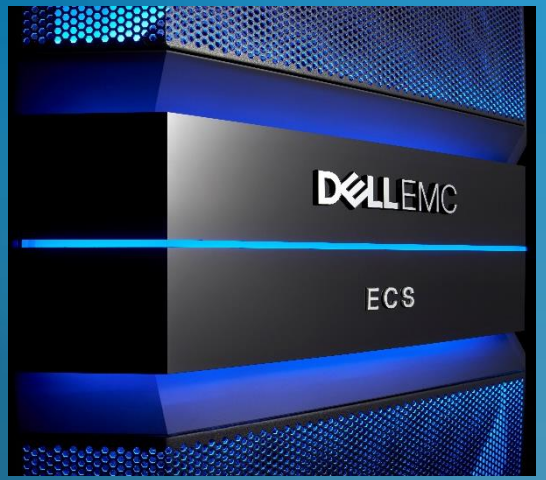
Dell EMC's Mainframe Virtual Tape Innovation History



DLm Starts With Dell EMC's Industry Leading Storage & Cloud Offerings

And allows you to leverage them all





New DLm8500 Release 5.1

Enhances DLm8500 release 5.0

Single-frame Solution

- 1-2 VTEs
- Up to 1024 Virtual Tape Drives
- Up to 3 GB/Sec Bandwidth
- 1-2 1Gb management switch
- 1-2 10Gb Data switch
- Deduplication Storage Options
- DD6300
- DD6800 (HA optional)
- DD9300 (HA optional)
- DD9800 (HA optional)
- Storage sharing with IBMi (iSeries), open systems
- Long-term tape retention cloud (ECS)

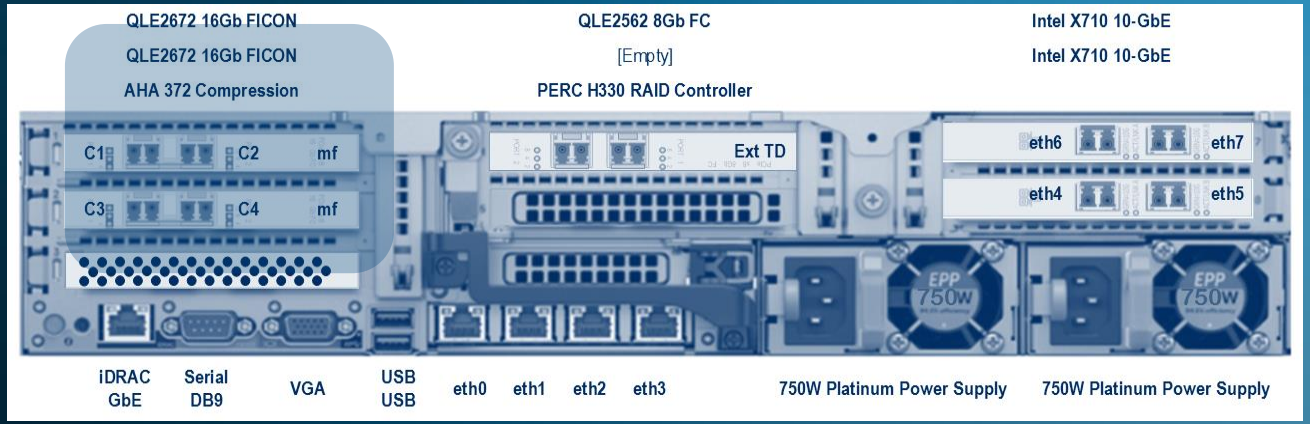
Multi-frame Scale out Solution

- 1-8 VTEs
- Up to 4096 Virtual Tape Drives
- Up to 12 GB/Sec Bandwidth
- 2 1Gb management switch
- 2 10Gb Data switch
- Deduplication Storage Options
- DD6800-HA
- DD9300-HA
- DD9800-HA
- Long-term tape retention cloud (ECS)
- PowerMax8000 high performance DASD

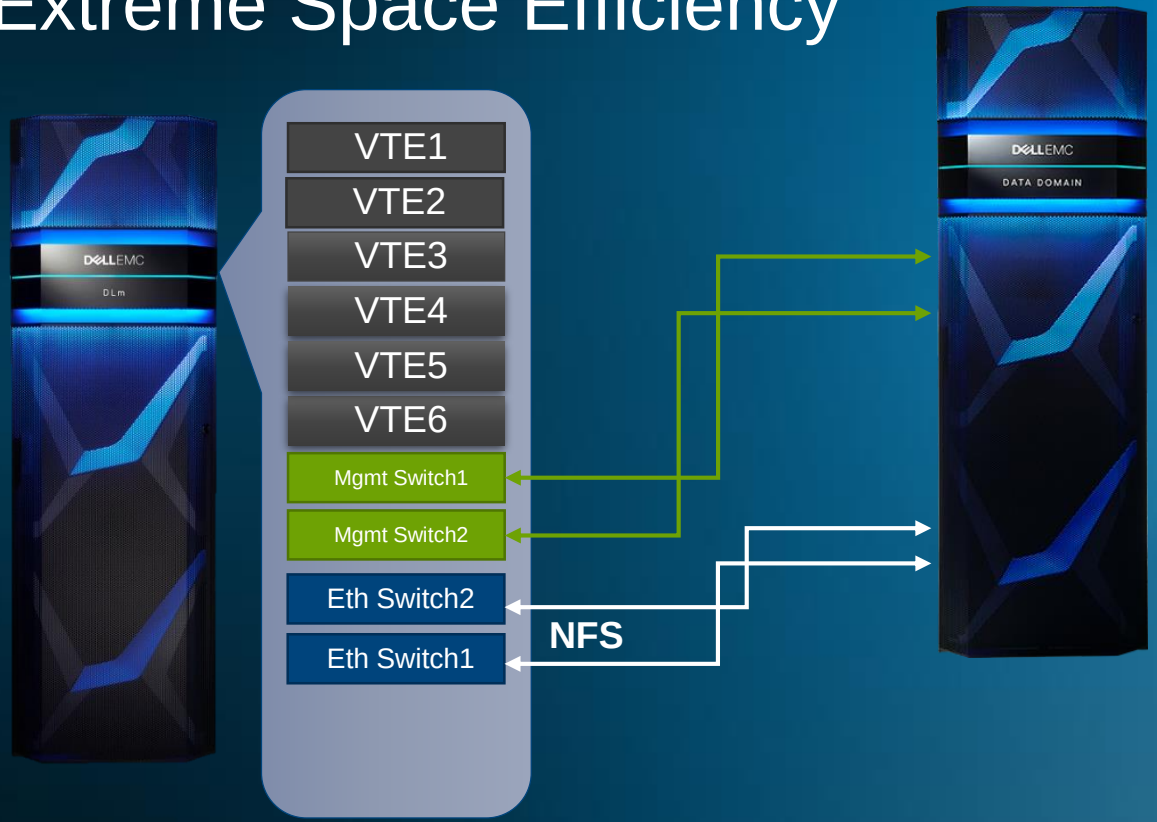
DLm 5.1 “under the covers”

DLm8500 Virtual Tape Engine – 2x All Around

- 16Gb FICON ports into each VTE - Up to 32 per DLm Array – twice that of Gen 4
  - 4 port Virtual Tape Engine using Dell Servers
  - Up to 512 Virtual Tape Drives per VTE – twice that of Gen 4 VTEs
  - 1,500MB/Sec Performance Rating – twice the performance of Gen 4 VTEs
- New and faster Dell server for the DLm VTE Appliance

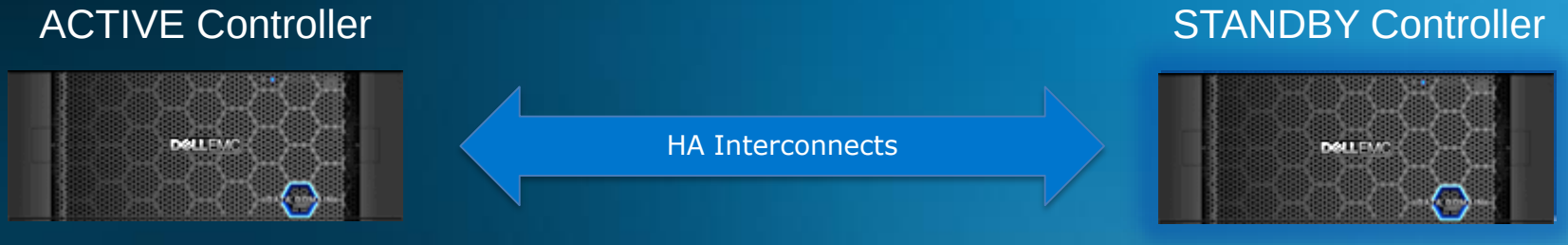


Data Domain Connectivity for High Performance Extreme Space Efficiency



- Data Domain
- High Availability Option
- Inline Deduplication 8:1 or More data reduction
- @DARE Encryption Option

Data Domain High Availability



- High availability of backup, archive, and recovery data on Data Domain ensures operational continuity to minimize downtime for users and processes.
- HA configurations are supported on DD6800, DD9300, DD9800 and the legacy DD9500
  - Delivering business continuity for both Large and Midsized Enterprises

Details of DLm 5.1 enhancements

PowerMax 8000 attachment

- Block Storage (supports mainframe and open environments)
- Universal Data Consistency™ (between PowerMax & DLm)
- Synchronous or asynchronous tape protection (SRDF/S, SRDF/A)

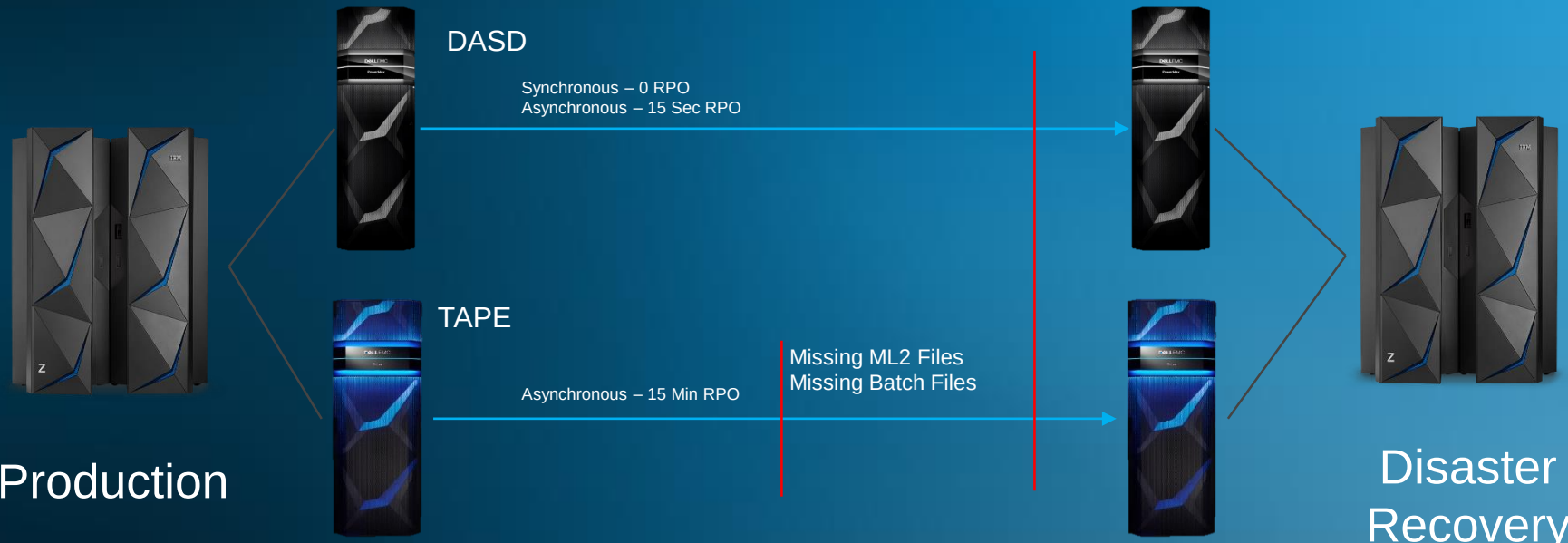
New Cloud capability and simplification

- Ability to move data on demand to the cloud tier
- Single, simple, “restore” command

Additional Enhancements

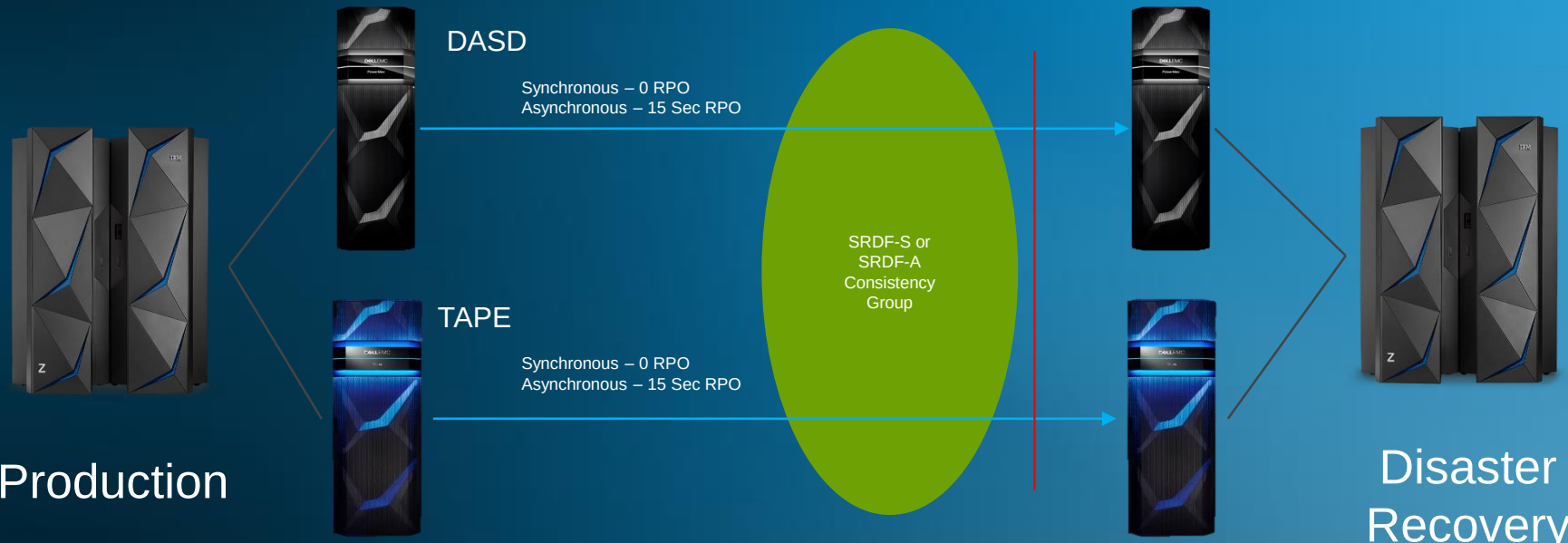
- SNMP V3 network security
- Additional installation options
  - Customer supplied rack
  - 3-Phase power available

DASD and Tape Data Consistency Issue



- Missing Data
- DASD Files And System Catalogs Are Ahead Of TAPE Files

DASD and Tape Data Consistency Issue - Solved!



- DASD Files, Tape Files And System Catalogs Are Synchronized
- No Missing Tape Data
- No Performance Impact

Why use PowerMax 8000 with DLm?

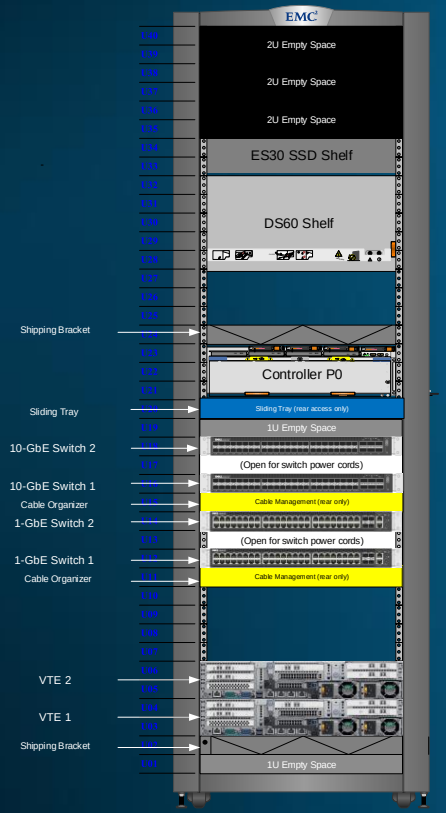
- When Universal Data Consistency™ is needed to provide data consistency between PowerMax 8000 primary storage (DASD) & DLm (TAPE) on PowerMax for applications that demand it:

- Examples:
  - DFHSM ML2 Migration – DASD File is scratched and catalogs are updated before the TAPE file is replicated resulting is missing ML2 data at the DR location

  - Batch TAPE Files – Jobs or Job Steps terminate and catalogs are updated before the TAPE file is replicated – resulting is missing TAPE data at DR location

- SRDF Synchronous and Asynchronous replication is supported

DLm8500 Single Rack DD Storage Solution



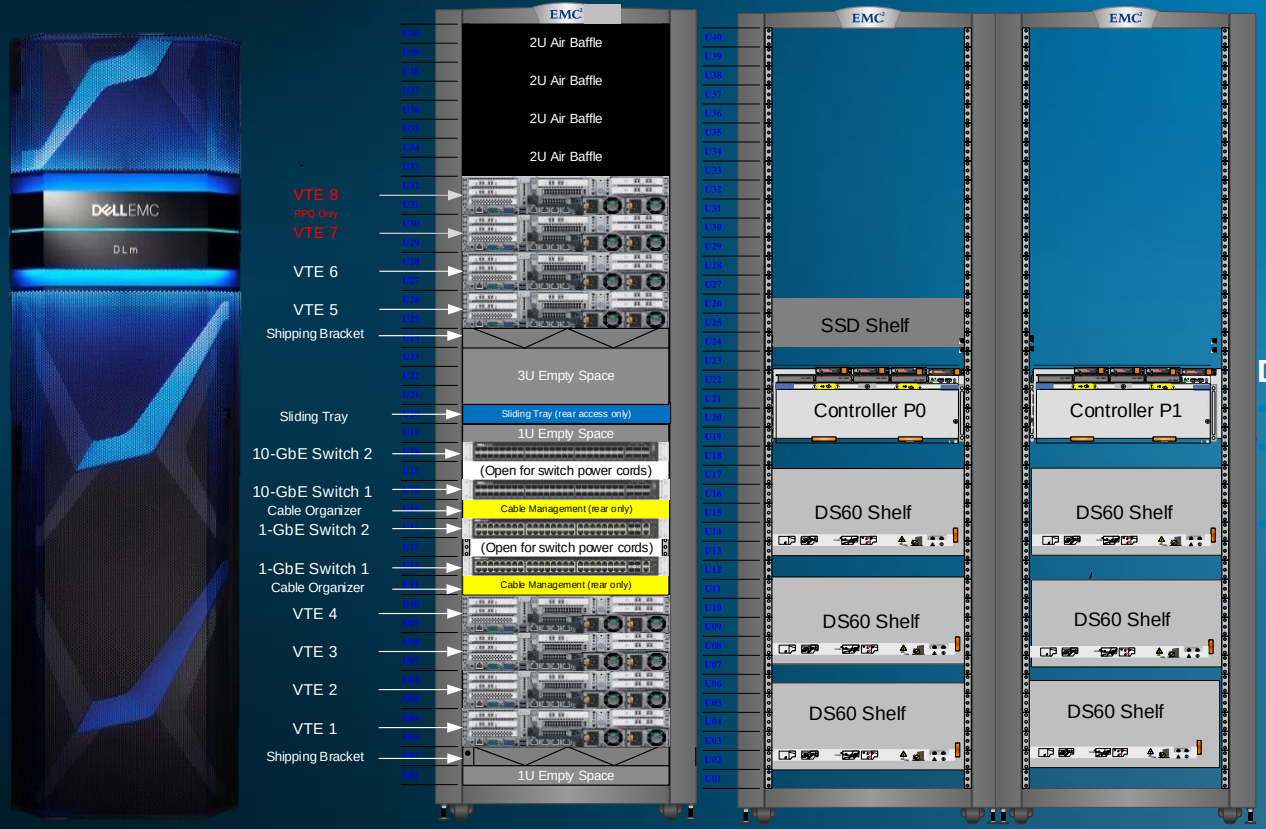
DLm8500

- 1 - 2 VTEs
  - Up to 4 FICONS per VTE
    Total 8 FICONs
  - Up to 4 FICON Licenses per VTE
  - 512 – 1024 Tape Drive Support
  - Up to 3 GB/Sec

DD6300/DD6800

- Minimum useable capacity: 34 TB
  - 272 TB @ 6:1 Deduplication
- Maximum useable capacity: 420 TB
  - 3200 TB @ 8:1 Deduplication

DLm 8500 / DD9800 Scale Out



DLm8500

- 1 - 6 VTEs
  - 1 – 24 FICON Channels
  - 512 – 3072 Tape Drive Support
  - ~750MBytes/sec single FICON
  - ~1200MBytes/sec 32 FICONs

DD6800/DD9300/DD9800

- High Availability Configuration
- DD6800 Minimum useable capacity: 94TB
  - 752TB @ 8:1 Deduplication
- DD9800 Maximum capacity: 1PB
  - 8000TB @ 8:1 Deduplication

Comprehensive PowerProtect DD Portfolio

	Virtual Edition	DD3300	DD6900	DD9400	DD9900
BACKUP INGEST (with DD Boost)	Up to 11.2TB/hr for 96TB	Up to 7.0TB/hr	Up to 33TB/hr	Up to 57TB/hr	Up to 94TB/hr
LOGICAL CAPACITY (with Cloud Tier)	Up to 14.8PB for 96TB	Up to 4.8PB	Up to 56.1PB	Up to 149.8PB	Up to 211PB
USABLE CAPACITY (with Cloud Tier)	Up to 288TB for 96TB	Up to 96TB	Up to 864TB	Up to 2.3PB	Up to 3.25PB

Logical capacity based on up to 50x deduplication (DD3300) and up to 65x deduplication (DD6900, DD9400, DD9900) based on additional hardware-assisted data compression of up to 30%. Actual capacity and throughput depends on application workload, deduplication and other settings.

Typical Disaster Recovery testing with DLm

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

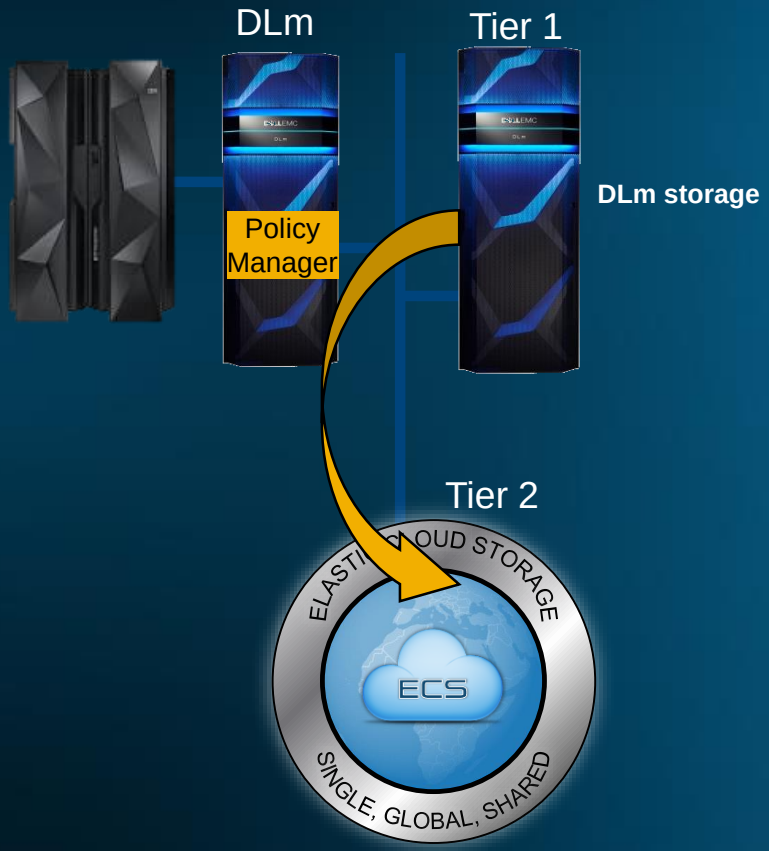
- Disk arrays allow creation of “read-write” snapshots
- Confirm operation at the disaster recovery site
- Some incremental storage capacity required

Remote replication is uninterrupted during testing

Replacing Physical tape:

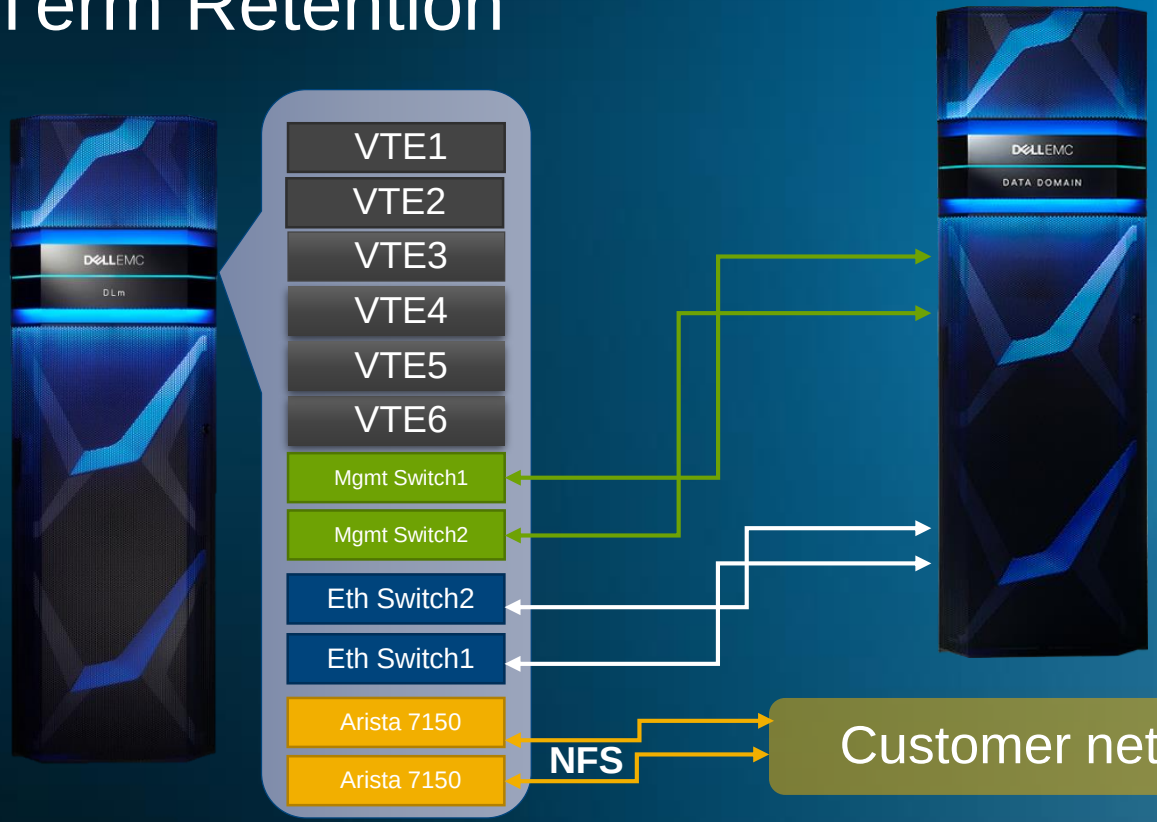
Cloud Object Storage and DLm5.1 Long-Term Retention

Benefits of DLm8500 + ECS For Long-Term Retention



1. **Reduce costs**
   - **Keep Only The "Working Set" Of Tape** Datasets On Primary Tier Of Storage
   - **Eliminate** Physical Tape Media
   - **Repurpose** all or a portion of an existing **ECS** environment
2. **"Simplify & Quantify" DR**
   - Knowing what's on ECS vs. DLm creates more accurate accountability
3. **Create a "Safety Valve"** To Accommodate Unexpected Increases In Tape Workload
4. **Create "political capital"** as mainframe participates in the organization's cloud strategy.

Elastic Cloud Storage Connectivity (Object) for Long Term Retention



- Optional for both Data Domain and PowerMax
- When making an NFS connection to a ECS storage system that is not directly connected to the DLm internal data network.

Customer network

GDDR Tape: DLm DR & Test Automation

- Planned and unplanned outages
- Leverages Dell EMC GDDR Technology
- Automates DLm DR Test Setup and Tear Down
- Automates Switch Over / Failover / Failback
- Supporting DLm w/ VNX Data Domain & PowerMax

Summary of DLm 5.1 and ongoing advantages

Universal Data Consistency between disk & tape + tape Synchronous Copy via PowerMax 8000 SRDF/S & ability to r/w test 100% of data with no DR interruption

Extreme storage efficiency through deduplication combined with Superior and consistent performance

Additional enhancements include SNMP V3 network security, the ability to use a customer-supplied rack and 3-Phase power, configurable at installation

Lower Tape TCO, eliminate physical tape with DLm + Elastic Cloud Storage with simplified and expanded capabilities

Continuous, High Availability in a single frame to lower costs, via unique virtual tape engines & deduplication storage

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- This session is DM