Hitachi Virtual Storage Platform (VSP) Update and Directions

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Hitachi Data Systems

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Session Number 12681

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AGENDA

- Virtual Storage Platform – Quick Technology Update

Storage Virtualization in the Mainframe Environment

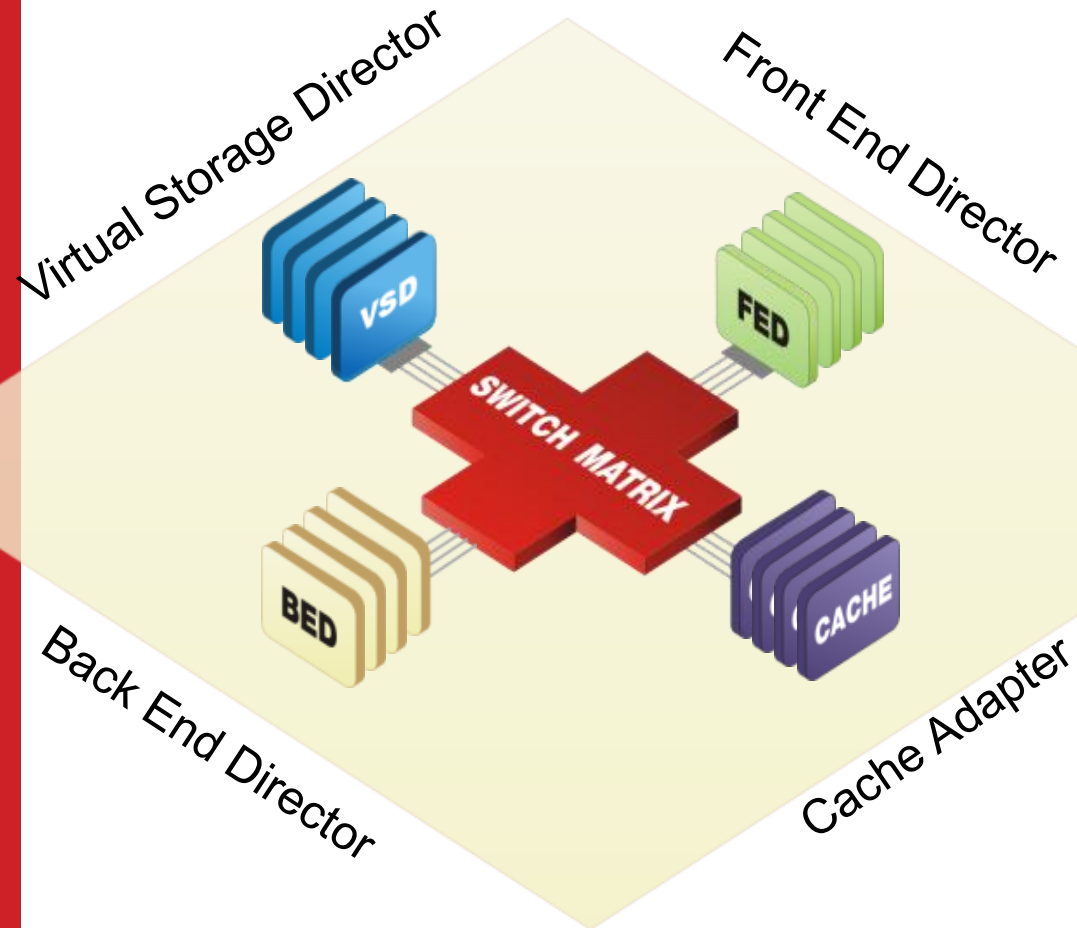Dynamic Provisioning – Mainframe Environment

Dynamic Tiering – Mainframe Environment

Virtual Storage Platform (VSP) – Other NEW Features

Summary

Virtual Storage Platform - Architecture

- **5th generation multi-dimentional internal crossbar switch**

- **Native 6G SAS backend**

- **192 x FC, 96 x FICON / FCoE**

- **Independent Scale up, scale out, scale deep growth path**

- **1TB Global Cache**

- **3rd generation imbedded virtualization (Open Systems and Mainframe)**

- **Granular non-disruptive upgrade paths**

- **100% non-disruptive maintenance**

Virtual Storage Director

Front End Director

Back End Director

Cache Adapter

VSD

FED

BED

CACHE

SWITCH MATRIX

Virtual Storage Platform

Capacity

2.5 PB of Internal Storage

255 PB of virtualized heterogeneous storage

1280 3.5" drives or 2048 2.5" drives or a combination of both sizes

65,536 logical devices (LDEV)

Drive Types

High Performance SSD flash drives

SAS drives 15K (2.5")

SAS drives 10K (2.5")

SAS drives (3.5") - Nearline

## Connectivity (ports)

192 Fibre Channel

192 FICON

96 FCoE

# Encryption Support Updates

- **All Virtual Storage Platforms are encryption capable**
  - Every BED has an encryption capability built in
  - Needs to be enabled by software license key
- **New encryption mode of operations**
  - XTS-AES 256 bit encryption
- **Expanded key support**
  - 32 keys per array
  - Encryption as access control

RAID Group 1   RAID Group 2   RAID Group 3

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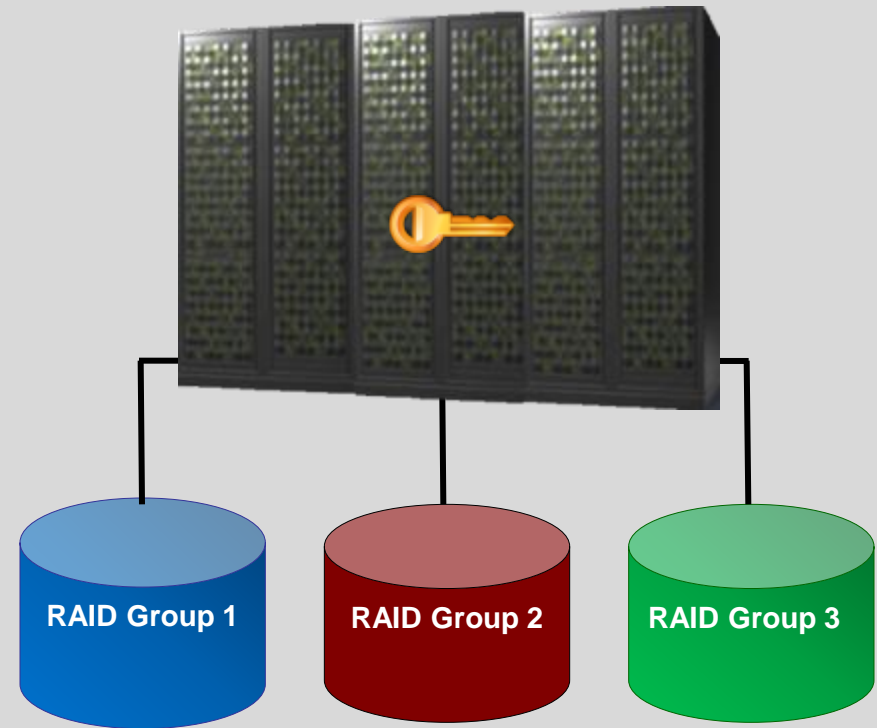
Hitachi Virtual Storage Platform Rack Structure
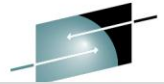
**The maximum number of racks is 6:
2 control chassis and 16 drive chassis**

Controller 1
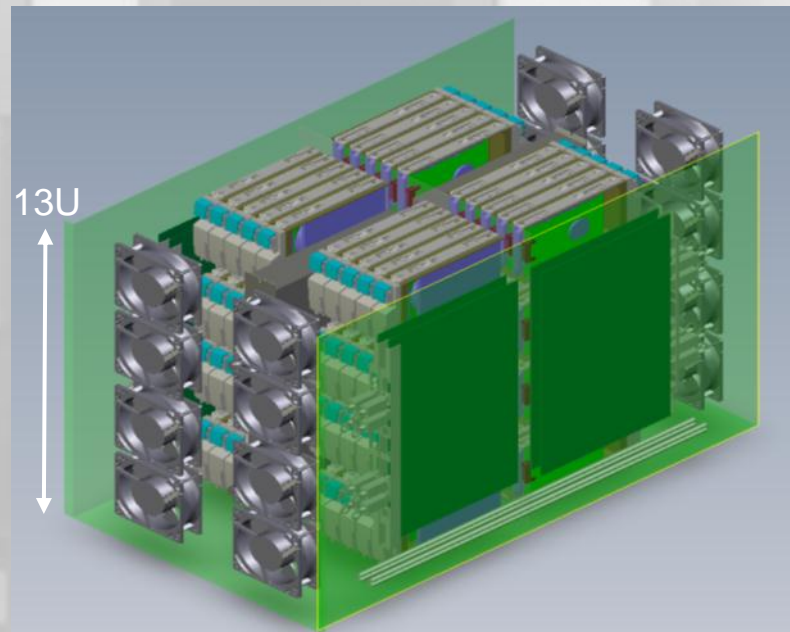
Controller 0
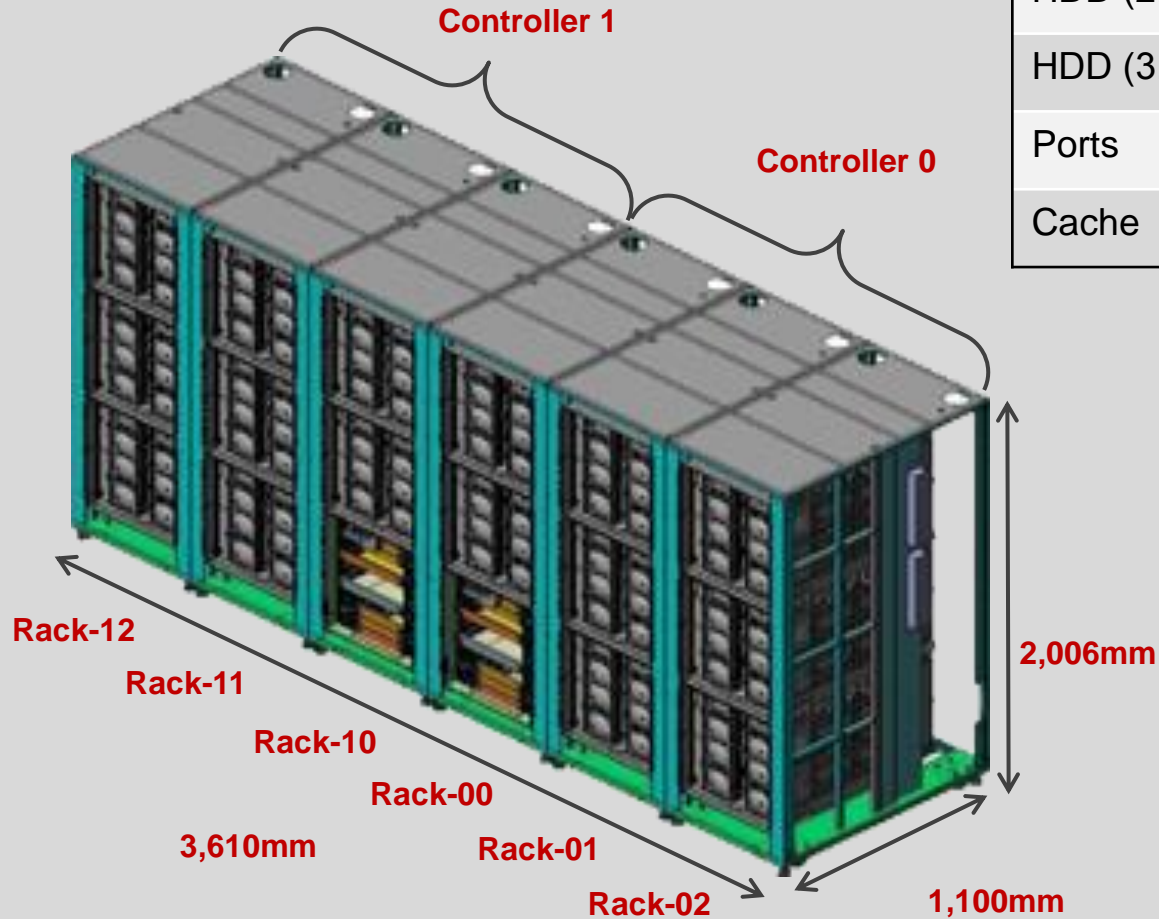
	1 control chassis	2 control chassis
HDD (2.5")	0 - 1,024	0 - 2,048
HDD (3.5")	0 - 640	0 - 1,280
Ports	16 - 96*	16 - 192*
Cache	Up to 512GB**	Up to 1,024GB**

* All channel configuration, **v02

Rack-12

Rack-11

Rack-10

Rack-00

Rack-01

Rack-02

3,610mm

1,100mm

2,006mm

VSP: Flexible Building Block

- **Hitachi 19" rack**
  - Front to back cooling
  - Up to 6 racks

- **Dense packaging**
  - 13u x 19 inch
  - 80 x 3.5in drives
  - 128 x 2.5in drives
  - SSD and SAS

- **Power and cooling**
  - 48% less power than equivalent capacity Universal Storage Platform® V


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Comparison: Universal Storage Platform V Fibre Channel Loops vs. Virtual Storage Platform SAS
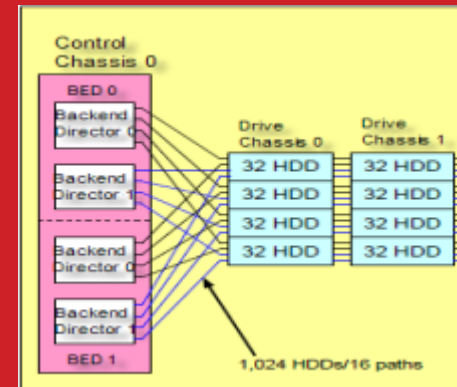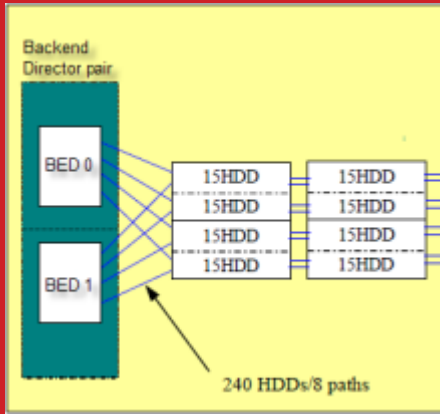
- **Universal Storage Platform V with 64 Fibre Channel (FC) loops 4 FC loops per controller**
  - 4 FC loops per back end director
    - Half duplex arbitrated loops
    - 32 FC loops pair at 4 Gb/s

- **Virtual Storage Platform with 64 SAS links**
  - 8 SAS paths per back end director blade
    - 32 full duplex links per control chassis
    - 64 SAS links at 6 Gb/s
  - Chassis are connected point-to-point
   - Intermix of Flash, SAS and NL SAS
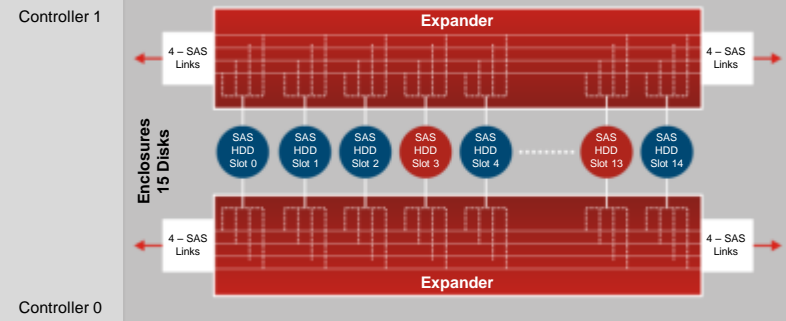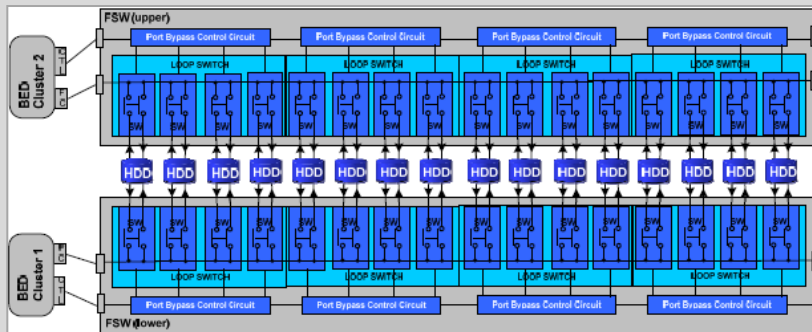
Drive Types and Capacities

- Current Drive Technology:
    - 2.5" 10K 300GB, 600GB, and 900GB SAS
    - 2.5" 15K 146GB, and 300GB SAS
    - 2.5" Flash MLC 200GB and 400GB, SAS
    - 3.5" Flash MLC 400GB SAS
    - 3.5" 2TB and 3TB Nearline SAS / 7200 RPM

NEW

- New Drive Technology:
    - Hitachi Accelerated Flash storage (HAFs) 1.6TB
        - More about this later!
    - 3.5" Higher Capacity Nearline SAS / 7200 RPM

    - 3.5" SATA Drives are EOL.
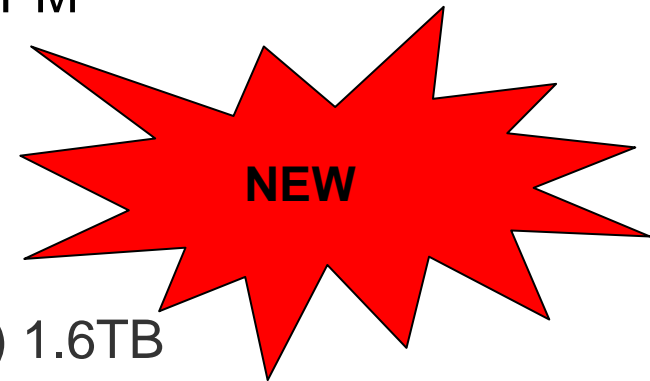
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Virtual Storage Platform – Quick Technology Update
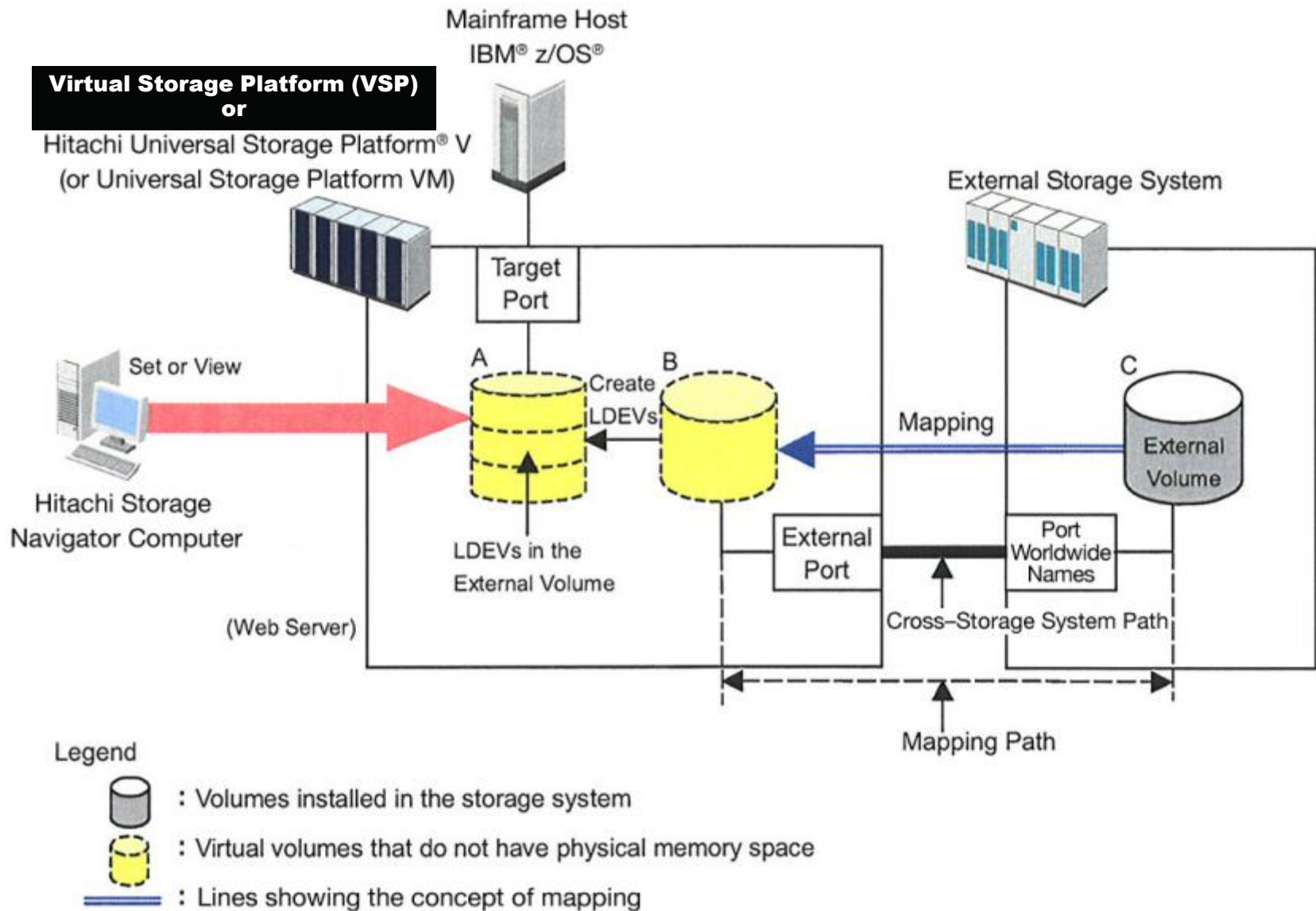
■ Storage Virtualization in the Mainframe Environment

Dynamic Provisioning – Mainframe Environment

Dynamic Tiering – Mainframe Environment

Virtual Storage Platform (VSP) – Other NEW Features

Summary

Mainframe Host
IBM® z/OS®

Virtual Storage Platform (VSP)
or
Hitachi Universal Storage Platform® V
(or Universal Storage Platform VM)

External Storage System

Set or View

Hitachi Storage
Navigator Computer

Target
Port

A   B   C

Create
LDEVs

Mapping

External
Volume

LDEVs in the
External Volume

External
Port

Port
Worldwide
Names

(Web Server)

Cross–Storage System Path

Mapping Path

Legend

: Volumes installed in the storage system

: Virtual volumes that do not have physical memory space

: Lines showing the concept of mapping

Storage Virtualization for Mainframe

- Constantly adding new devices to the Virtualization Support Matrix.

- EMC VMAX and VNX

- IBM DS8000 Series – all models

- HP all models

- Industry Standard UVM Profile
  - No testing required
  - Plug and Play concept
    - Quick test for adherence to SCSI standards

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Virtual Storage Platform – Quick Technology Update

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Dynamic Tiering – Mainframe Environment

Virtual Storage Platform (VSP) – Other NEW Features

Summary

Hitachi Dynamic Provisioning (HDP) for Mainframe

- Provides fully compatible support for IBM features:
  - EAV
  - DVE
  - FlashCopy SE

- Dynamic Provisioning
  - Up to 128 unique pools (OPEN and Mainframe)
  - Space Savings or "Thin Provisioning" characteristics
  - Ultra Wide-Striping
    - Physical pools comprised of multiple array groups
    - 38MB pages striped across all storage in a pool
    - Improved performance – especially for sequential workloads

Hitachi Dynamic Provisioning (HDP) for the Mainframe

- So, just what is a page?
  - For the VSP, there are two page sizes
    - OPEN – 42MB
    - Mainframe – 38MB
  - They are different to fit the best use of storage space for the underlying OS structures they support
  - For Mainframe, 38MB fits the 3390 architecture with minimal wasted space
- Each storage supplier has a different implementation
  - Some are in MB
  - Some are sub-LUN
  - Some are partial volumes
  - Some are Chunks / Chunklets
- Each is designed to best fit their architecture

HDP Mainframe — Basic Concepts

Key Functionalities

- Thin Provisioning
  - Pool Rebalance
  - Pool Volume Reduction
  - Space Reclaim

- Support Mainframe Features
  - PAV, HyperPAV
  - z/HPF

- Support Replication Products
  - TrueCopy and HUR
  - ShadowImage and FlashCopy V2

- Support New Features
  - EAV and DVE
  - FlashCopy SE
  - Hitachi Dynamic Tiering

With HDP for Mainframe

- Optimize storage performance by spreading the I/O across all available physical disk drives

HDP Volume (Virtual 3390)

HDP Pool

DP Pool Vols — LDEV LDEV LDEV LDEV LDEV LDEV LDEV

PDEVs — PDEV PDEV PDEV PDEV ■ ■ ■ ■ PDEV PDEV PDEV PDEV
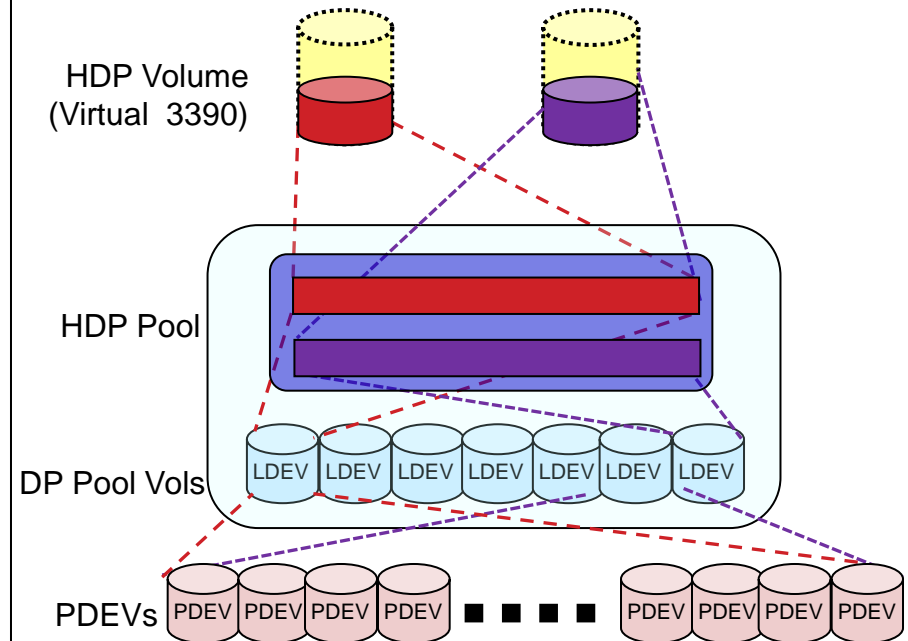
- Spreading data across more physical volumes reduces the I/Os per volume and improves performance

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✓ - Dynamic Tiering – Mainframe Environment

Virtual Storage Platform (VSP) – Other NEW Features

Summary

Hitachi Dynamic Tiering for Mainframe

- **Dynamic Tiering**
    - **Open Systems available since September 2010**
    - **Mainframe available since January, 2012**
    - **Automated performance management**
    - **Cost effective use of storage tiers**
    - **Internal and external (virtualized) storage**
    - **Managed in pages (42MB for OPEN, 38MB for Mainframe)**

- **Cost savings through:**
    - **Improved storage utilization**
    - **Reduced storage requirements for Tier 1**
    - **Less time spent on performance management**
    - **Re-deploy personnel**
    - **Integration with SMS**

Virtual Storage Platform: Page Level Tiering

- Different tiers of storage are in one pool of pages – up to 128 pools

- Automatically detects and assigns Tiers based on media type

- Dynamically:
    - add or remove Tiers
    - expand or shrink Tiers
    - expand 3390A volumes
    - move 3390A volumes between pools

- Dynamic Tiering Policies at volume level:
    - Default - All
    - Level 1 - Tier 1 only
    - Level 2 - Tier 1 and Tier 2 only
    - Level 3 - Tier 2 only
    - Level 4 - Tier 2 and Tier 3 only
    - Level 5 - Tier 3 only

POOL A

TIER 1

Least Referen

TIER 2

Least Referen

TIER 3
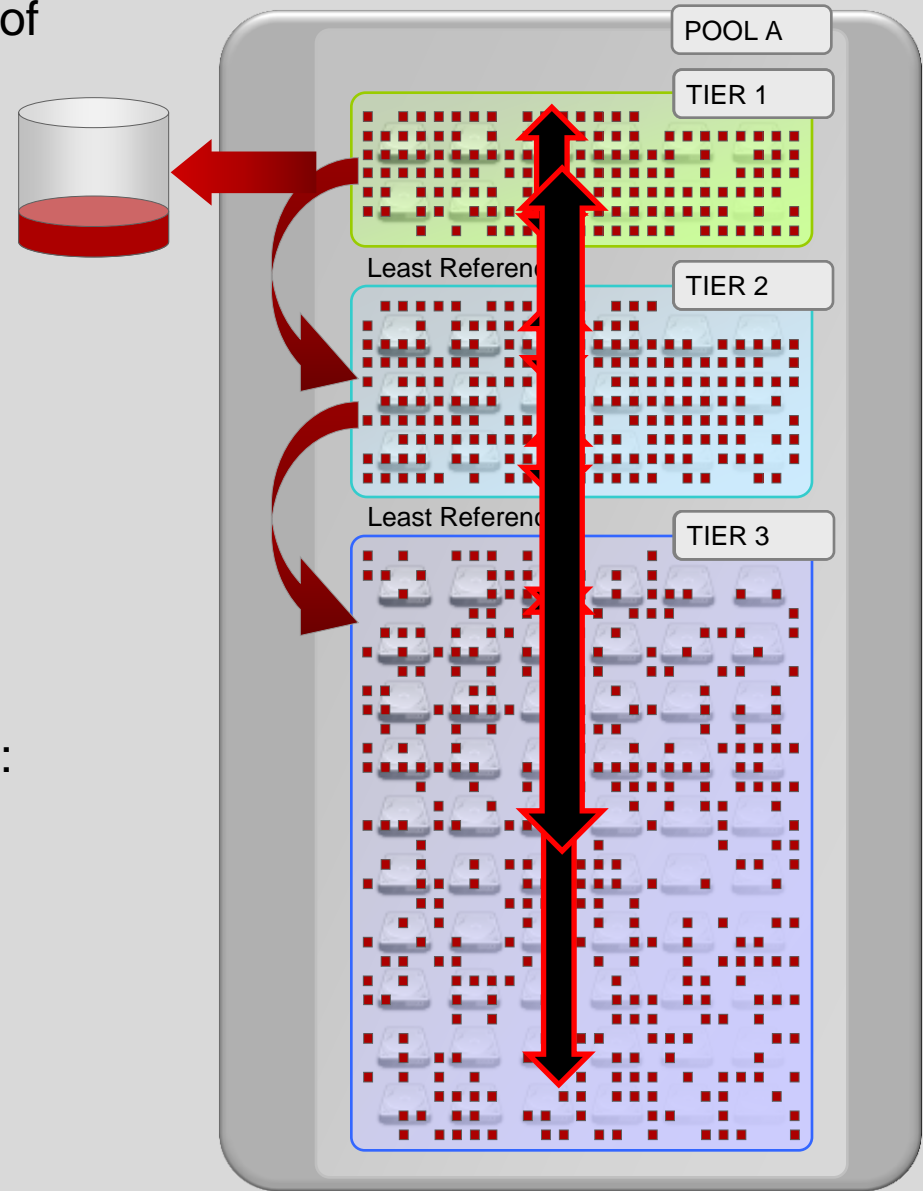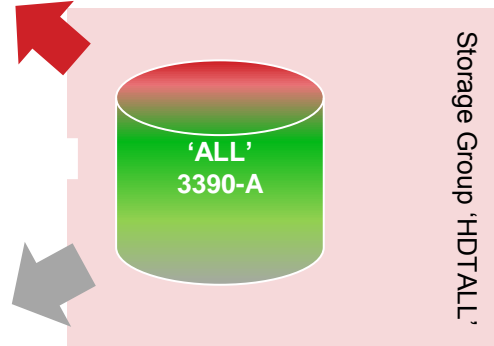
Virtual Storage Platform: Page Level Tiering

- Cycles

  - Customer defines strategy, it is executed automatically

  - 24 hour

    - defined part of 24 hour

    - ½, 1, 2, 4 or 8 hourly

    - All aligned to midnight

  - Weekly or longer

- Use Hitachi Tier Storage Manager (HTSM)

  - Set tiering policy schedules to match business cycles and requirements

  - Report on data mobility (promotions and demotions)

  - Dynamically change or adjust cycle, policies, tiers etc…

Media tier groupings supported by Hitachi VSP	Order of tiers
2.5" SSD (200GB) SLC or eMLC 2.5" SSD (400GB) SLC or eMLC Hitachi Flash Trays	1
2.5" SAS15Krpm (146GB) 2.5" SAS15Krpm (300GB)	2
2.5" SAS10Krpm (300GB) 2.5" SAS10Krpm (600GB) 2.5" SAS10Krpm (900GB)	3
3.5" SAS 7.2Krpm (2TB, 3TB)	4
3.5" SATA (2TB)	5
External	Lowest
External Multi Tier	Any Tier

Hitachi Dynamic Tiering with SMS Storage Groups and ACS Routines

Storage Group 'SSD'
Level1 3390-A

Storage Group 'SAS10'
Level3 3390-A

Storage Group 'SAS07'
Level5 3390-A

Pool
- Tier 1
- Tier 2
- Tier 3

Storage Group 'HDTALL'
'ALL' 3390-A
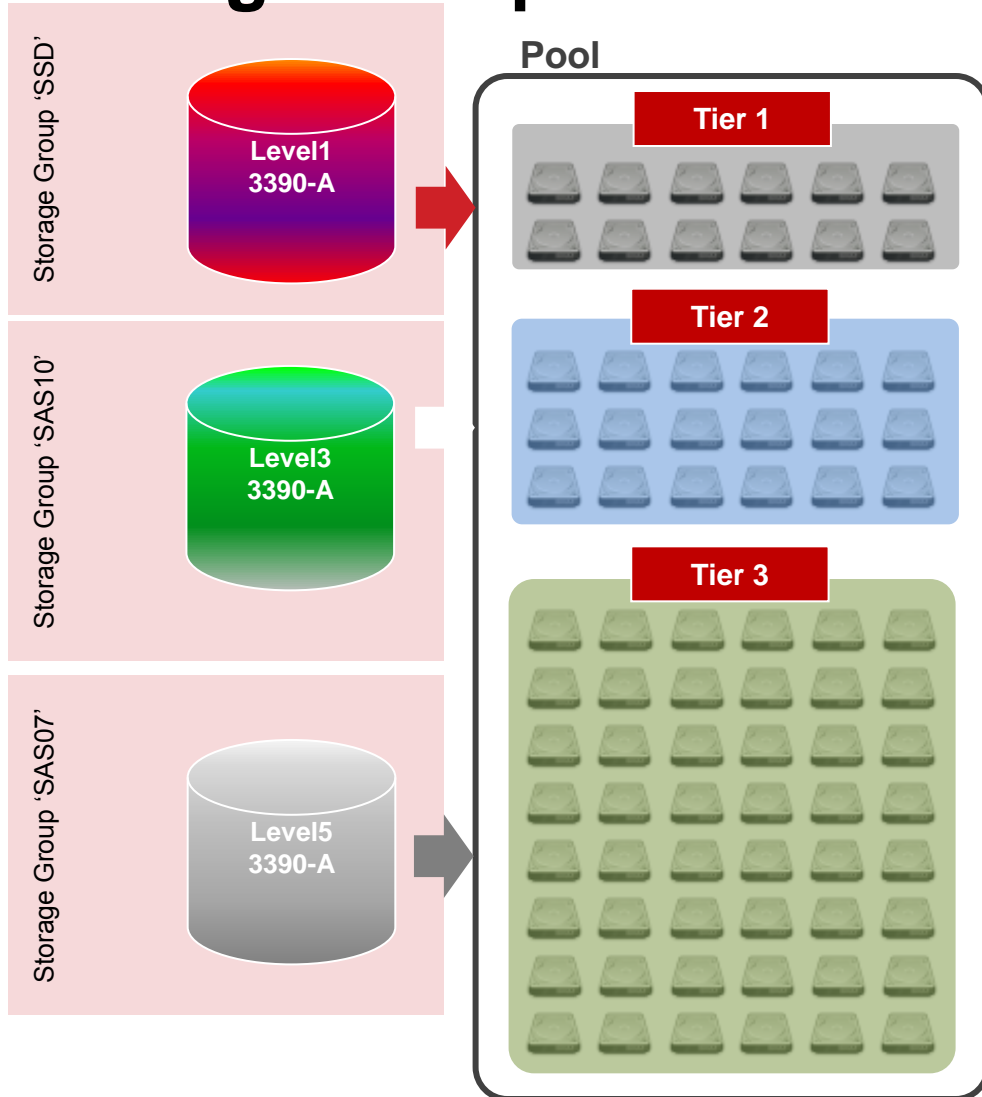
- Now the default Storage Group dynamically adjusts

- You can still have the 'old style' Storage Groups but now HSM isn't needed to transition between tiers or solve performance problems

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DFSMS Storage Groups and MF HDP and HDT

- Tiered Storage can be implemented with DFSMS Storage Groups
- DFSMS Attributes such as Data Class and Storage Class are used to direct allocation to the right Tier

SG1

SG2

SG3
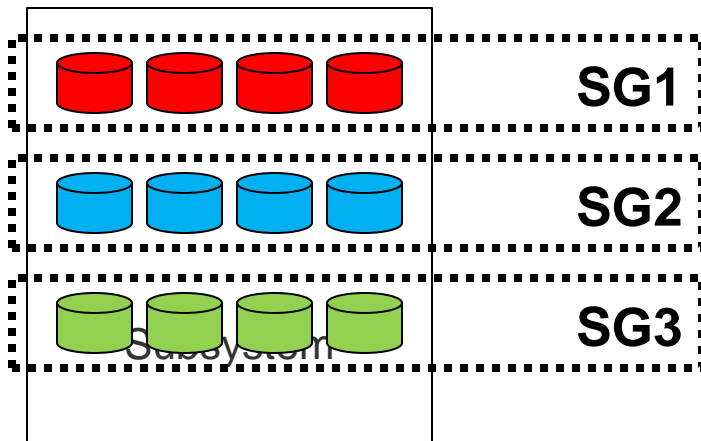
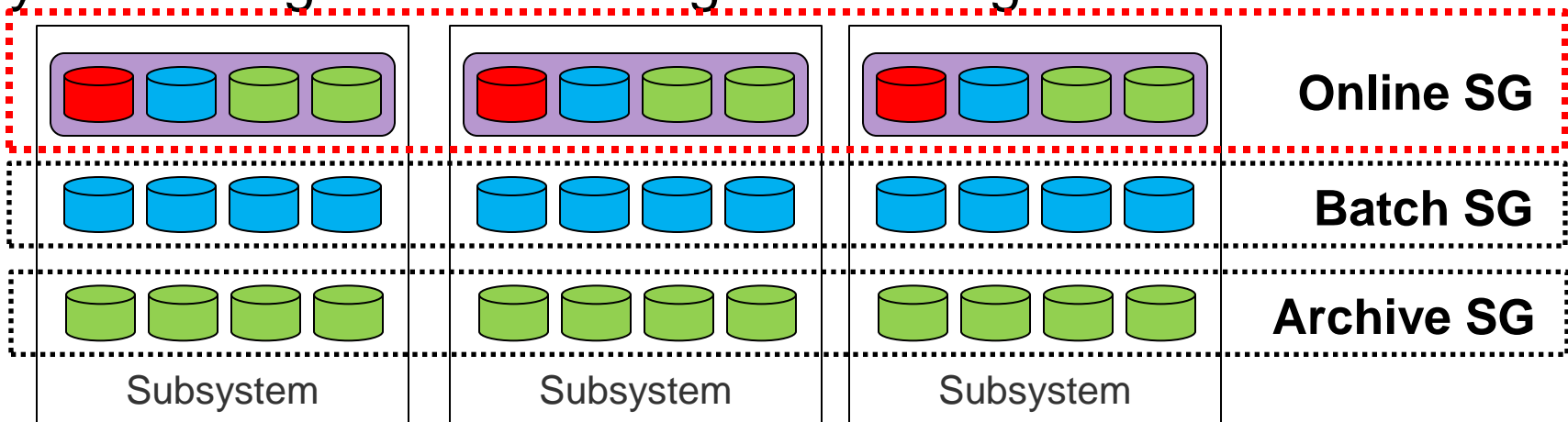SSD Tier 1

SAS Tier 2

SATA Tier 3

HDT

Storage Group

- With MF HDT may combine all SG's into one and use HDT to move data to the right Tier automatically based on Workload performance

ONE SG
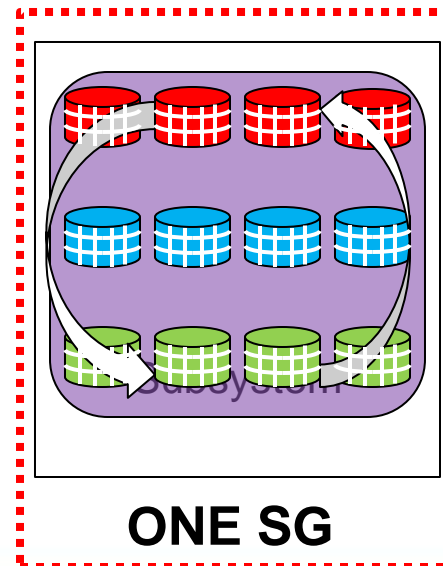
HDP Volumes are managed at page-level

DFSMS Storage Groups and MF HDT

- HDT can be applied to selected Storage Groups only
- DFSMS Horizontal Storage Groups and HDT Pools with Dynamic Page based Tiering can be aligned

Online SG

Batch SG

Archive SG

Subsystem   Subsystem   Subsystem

SSD Tier 1

FC/SAS Tier 2

SATA Tier 3

HDT

Storage Group

DFSMS Storage Groups and MF HDT

- HDT can be applied to selected Storage Subsystems only
- DFSMS Vertical Storage Groups and HDP Pools with Dynamic Page based Tiering can be aligned
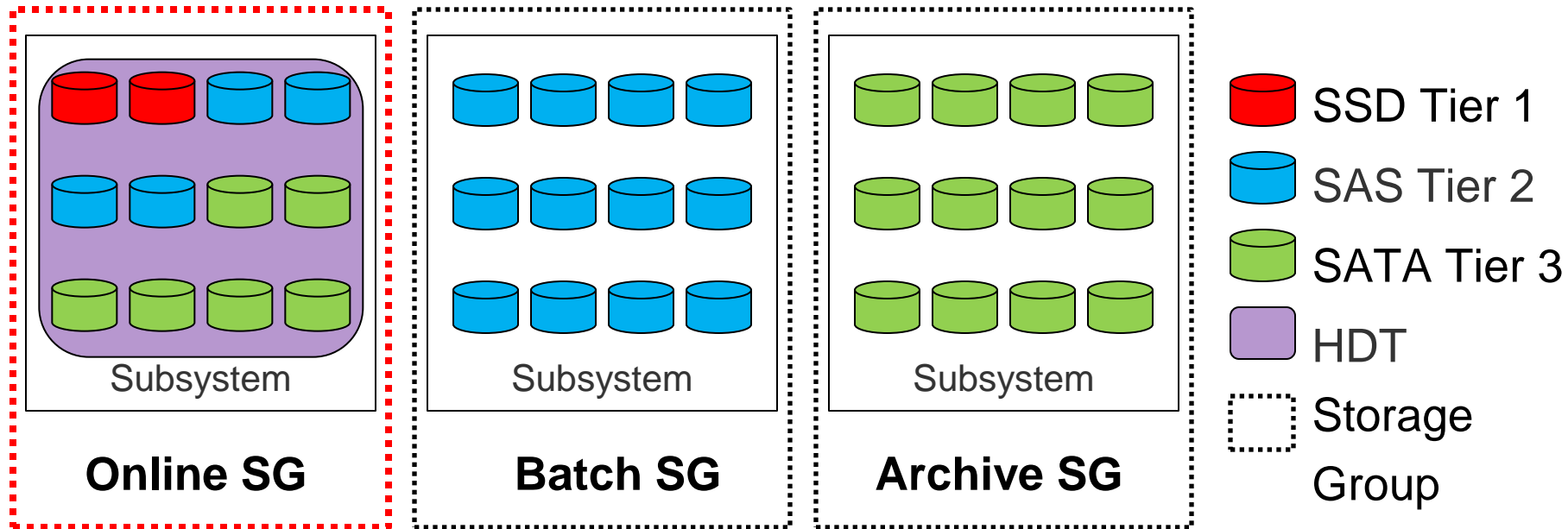
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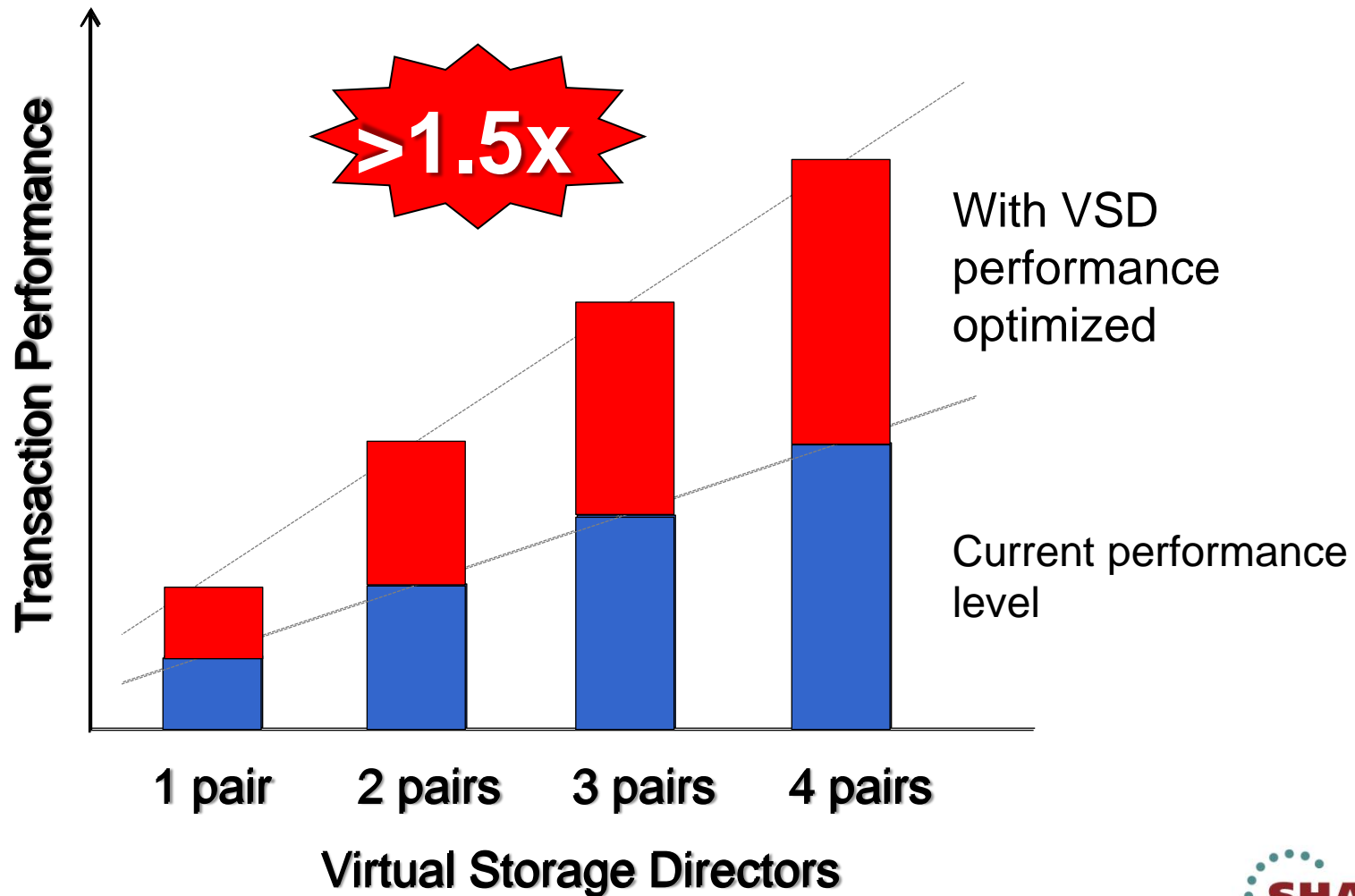- Virtual Storage Platform (VSP) – Other NEW Features

- Summary

VSP – Other NEW Features

- Multi-Tier External Storage (virtualiztion)
  - High, Medium, and Low tiers in virtualized tier 3.

- % Tier Allocations
  - Tier 1 % Minimum and Maximum
  - Tier 3 % Minimum
  - Allows for 26 new Tiering policies beyond current policies.

- Flash Acceleration Microcode
  - Improve throughput and performance
  - Microcode only change
  - Approximate 50% performance boost of VSD's.

- Hitachi Accelerated Flash storage (HAFs)
  - 1.6TB capacity SSD
 - Hitachi ASIC controller on each SSD drive.

NEW

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VSP Microcode Enhancement - Flash Acceleration

VSD PERFORMANCE OPTIMIZATION

>1.5x

With VSD performance optimized

Current performance level

Transaction Performance

1 pair   2 pairs   3 pairs   4 pairs

Virtual Storage Directors

Hitachi Accelerated Flash storage (HAFs)

- The Flash Memory Drive (FMD) is Hitachi built specifically for Hitachi arrays.
- Each FMD is as follows:
  - Raw capacity option of 1.6TB
  - eMLC based
  - Each FMD uses an Hitachi designed and built System-On-Chip (SOC) ASIC
    - Multi-Core ASIC performs flash memory management, data transfer, RAS etc.
    - High bandwidth PCIe Gen2 data paths to eMLC memory
   - Much improved performance over industry SSD
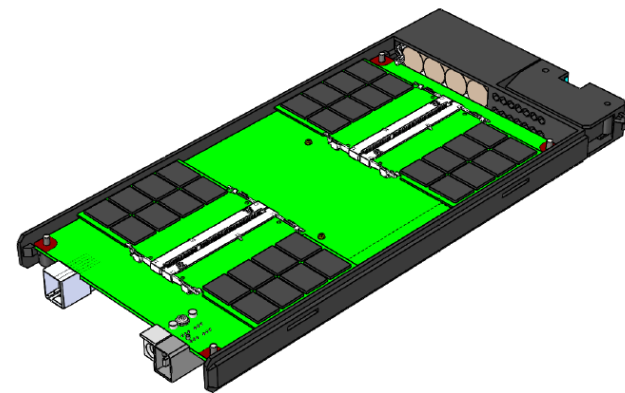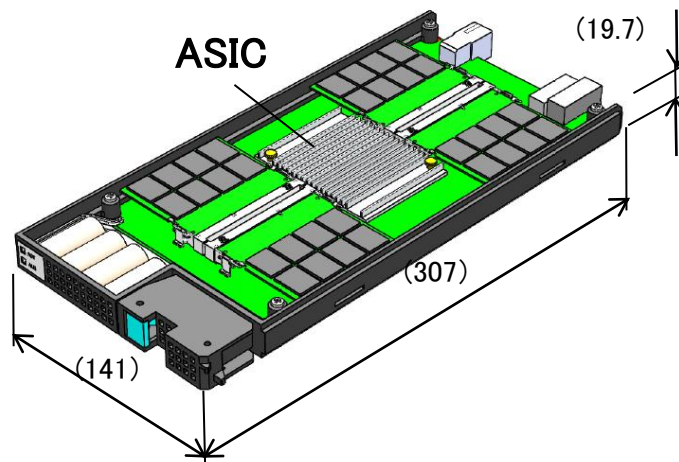
Hitachi Accelerated Flash storage (HAFs)

- VSP will offer granularity of 4 Flash Memory Drives (FMD) minimum, in 4 separate FMU (tray)
- VSP can support a total of 192 FMD's
  - 12 Flash FMD's per FMU
  - 4 FMU per Flash Box (FBX - similar to current Disk Chassis)
  - 4 FBX per VSP (2 per Control Chassis)
  - Total raw capacity: **307TB** (1.6TB FM)
- Target performance is >1 Million Random Read IOPS per FMU
- Available for all VSP's and non-disruptive install on live VSP's
- Latest Improvements in flash technology
  - Cost effectiveness per TB improved considerably
  - Expect market adoption to be very high

87.6
:
2U

(64
9)

48
3

PKG x12

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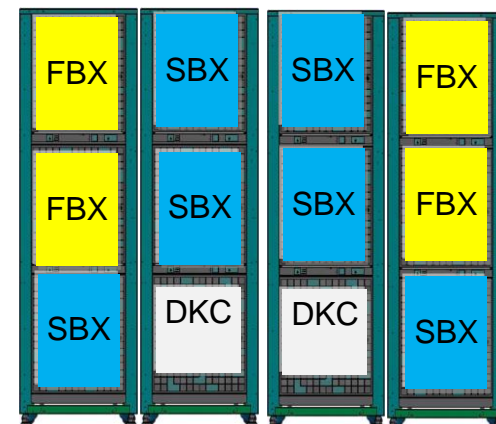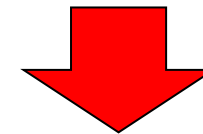2013
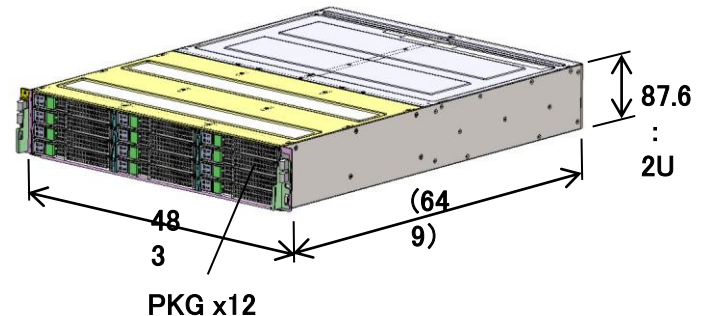
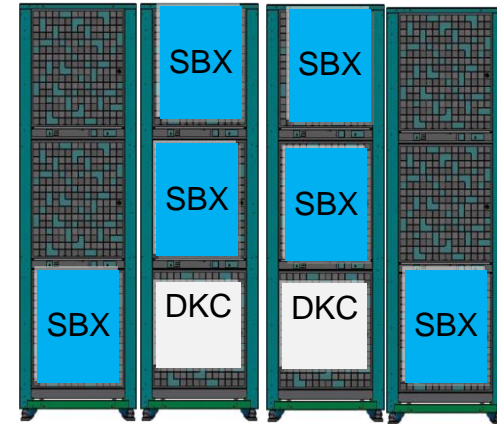# New Hitachi Flash Technology
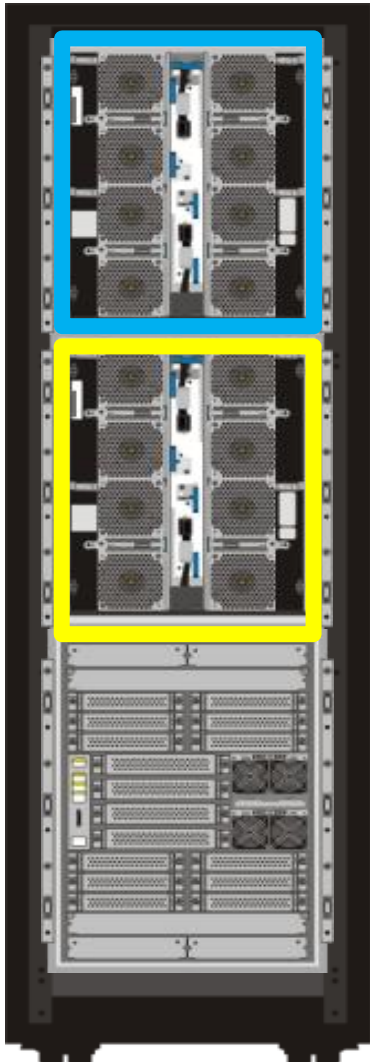
SBX Drive Chassis
- 80/128 HDD/SSD's

FBX Flash Tray Chassis
- 4 Trays
- 12 Flash Modules / Tray
- 48 Flash Modules / Chassis

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Mainframe VSP Summary

- **Easy to implement**

- **Take advantage of storage tiers**

- **Take advantage of advanced features and functions of the VSP**

- **Extend the useful life of existing assets**

- **Provide Mainframe connectivity to lower cost Midrange storage platforms**

- **Single management point for all Mainframe storage**

- **Non-disruptively move data within a single VSP frame**

- **Non-disruptively move data across multi-vendor storage frames**

- **Improved storage utilization**

- **Improved Quality of Service (QoS)**

Thank you!

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