STORAGE UPDATES

OpenVMS 8.4 and Beyond

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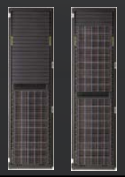
Agenda

- New Storage Updates
- OpenVMS 8.4 Storage
  - Software Updates
  - Hardware Updates
- Future Storage Connectivity

NEW STORAGE INTRODUCTION

HP SAN Storage Portfolio

	Storage Consolidation	Virtual IT	Application Consolidation	Utility Storage	Mission Critical Consolidation
	P2000 MSA	**P4000**	**P6000 EVA**	**3PAR**	**P9500**
					
Architecture	Dual Controller	Scale-out Cluster	Dual Controller	Mesh-Active Cluster	Fully Redundant
Connectivity	SAS, iSCSI, FC	iSCSI	FC, iSCSI, FCoE	FC, iSCSI	FC, FCoE
Performance	30K Random Read IOPs ; 1.5GB/sec Seq reads	35K Random read IOPs 2.6 GB/sec Seq reads (P4800)	55K Random read IOPS 1.7 GB/Sec Seq Reads	250K random IOPs; 5+ GB/sec seq reads – T class	350K Random IOPS 12GB/Sec Seq reads
Application Sweet spot	SMB , enterprise ROBO, consolidation & virtualization DAS, Video surveillance	SMB, ROBO and Enterprise – Virtualized inc VDI , Microsoft apps BladeSystem SAN (P4800)	Enterprise - Microsoft, Virtualized, OLTP	Enterprise and Service Provider - Utility-based, Cloud, Virtualized, Microsoft, OLTP, Mixed Workloads	Large Enterprise - Mission Critical w/Extreme availability
Capacity	600GB-192TB; 12TB average	7TB - 768TB; 36TB average	2TB-480TB; 36TB average	5TB – 800TB;120TB average T-class	10TB – 2000 TB; 150TB average
Key features	Price: performance Controller Choices (5) Snapshots (remote and local) HP Server Attach	All-inclusive SW Multi-Site DR included Virtualization VM Integration Virtual SAN Appliance	Command View Simplicity Integration/Compatibility Multi-Site Failover	Multi-tenancy Efficiency (Thin etc) Performance Tiering Autonomic Management	Highest Availability Heterogeneous Virtualization Multi-site Disaster Recovery Application QOS (APEX) Smart Tiers

StorageWorks P2000 Family of Arrays

FUTURE

4x 6 Gb ports per controller

P2000 G3 SAS MSA

Latest 6 Gb SAS host connect for blazingly fast transmission rates with low cost connections. Four ports per controller support a highly efficient direct connect configuration

Current

2x 8 Gb + 2x 1 GbE ports per controller

P2000 G3 Combo FC/iSCSI MSA

Latest 8 Gb FC **AND** 1 GbE iSCSI enabling shared storage between departments needing high performance, and small budget constrained entities. Also perfect enabler for replication over Ethernet

Current

2x 8 Gb ports per controller

P2000 G3 FC MSA

Latest 8 Gb FC, high performance with a mature topology. Compatible w/ huge installed base

Current

2x 1 GbE ports per controller

MSA2000i G2 iSCSI

Bringing the cost efficiencies and ease-of-use advantages of 1 GbE iSCSI shared storage to the entry-level SAN segment

Note: OpenVMS doesn't support iSCSI

G3 SAS: What's New

- 6 Gb vs. 3 Gb SAS host port
  - **Benefit:** Increased throughput (bandwidth)
- Increased snapshots w/ 64 snaps included in all G3 arrays
  - **Benefit:** Strengthen data security
- 2 GB vs. 1 GB cache
  - **Benefit:** Apps that do random small block 60/40 read/write transfers to the storage. (Exchange, SQL, Oracle)
- Boosted capacity to 57+ TB of SAS or 192 TB SATA
  - **Benefit:** >50% increase gives room to grow when needed
- DSD – Drive Spin Down
  - No need to purchase license, integrated into the firmware

Feature	MSA2000sa G2	P2000 G3 SAS MSA
Host Connectivity	3 Gb SAS	6 Gb SAS
Software	– Optional Snapshot • Maximum **256** Snaps – Optional Clone	– STANDARD Snapshot (64) • Maximum snaps raised to **512** – STANDARD Clone
Capacity w/ expansion	60 LFF Drives 99 SFF Drives	↑96 LFF Drives ↑149 SFF Drives

P6000 EVA Delivers:

Trusted enterprise application consolidation

- Built-in Thin Provisioning with 30-50% more capacity utilization
- Dynamic LUN/RAID migration with a simple one step process to move data across storage tiers
- LUNS up to 32TBs supported with additional features: expand, shrink, snap
- A 50% smaller footprint in your data center with 2.5-inch SAS disk drives with improved energy savings over 40%
- Flexible connectivity to your SAN with 8 Gb/s Fibre Channel, 1 Gb/s iSCSI, and 10 Gb/s iSCSI/FCoE options
- Command View EVA Enhancements
- EVA Performance Advisor [Coming Soon!!]

EVA Differences

Speeds and Feeds

New

	EVA4400	EVA6400	EVA8400	P6300	P6500
Model	HSV300	HSV400	HSV450	HSV340	HSV360
Memory /controller pair	4GBytes	8GBytes	14/22GBytes	4GBytes	8GBytes
Host Ports / controller pair	**4** FC 20 w switches	**8** FC	**8** FC	**8** FC, 0 GbE 4 FC, 8 1GbE 4 FC, 4 10GbE	**8** FC, 0 GbE 4 FC, 8 1GbE 4 FC, 4 10GbE
Host Port speed	4Gb/s FC	4Gb/s FC	4Gb/s FC	8Gb/s FC 1Gb/s iSCSI 10Gb/s iSCSI/FCoE	8Gb/s FC 1Gb/s iSCSI 10Gb/s iSCSI/FCoE
Device Ports, #	4	8	12	8	16
Device Ports, Speed	4Gb/s FC	4Gb/s FC	4Gb/s FC	6Gb/s	6Gb/s
# 3-1/2 drives	96	216	324	120	240
# 2-1/2 drives	0	0	0	250	500
Max. Vdisk	1024	2048	2048	1024	2048
I/O Read Bandwidth	780 MB/s	1,250 MB/s	1,545 MB/s	1,700 MB/s	1,700 MB/s
I/O Write Bandwidth	590 MB/s	510 MB/s	515 MB/s	600 MB/s	780 MB/s
Random Read I/O	26,000 IOPs	54,000 IOPs	54,000 IOPs	45,000 IOPs	55,000 IOPs

P9500 new hardware/software

- Scale online from the smallest configuration to the largest with a single model
  - 1-6 industry standard 19-inch racks
  - 1-2 interconnected controller modules (DKCs)
  - SFF 2.5-inch 6 Gbps SAS HDDs and SSDs
  - Fibre Channel, FICON, and FCoE ports
- ~1.5X performance over XP24000
- Front-to-back cooling
- Software Updates
  - Improved Smart Tiers software, security management
  - Application Performance Extender v2.2
  - Resource Partition software
  - Annual Purchase Enrollment Program
  - Meter-based Term licensing
  - Performance Advisor v5.3
  - Command View Advanced Edition v7.1.1
  - Many more….

P9500 principal characteristics

	1 Module	2 Modules	XP24000
Max Internal Disks	1024	2048	1152
Max Virtual Capacity	255 PB	255 PB	247 PB
Host Ports	80 Fibre Channel 80 FICON 40 FCoE	160 Fibre Channel 160 FICON 80 FCoE	128 Fibre Channel 64 FICON
Cache Size	512 GB	1 TB	512 GB
Cache Protection	SSD (+ Battery)	SSD (+ Battery)	Battery
Internal Bandwidth (Data/Control)	64/32 GB/sec	128/64 GB/sec	68/39 GB/sec
Power Consumption (fully configured)	19.9 KVA	39.8 KVA	33.1 KVA
Business Copy Pairs	16K	16K	16K
Continuous Access Pairs	32K	32K	32K
LUNs/LDEVs	64K	64K	64K

OpenVMS and Thin-provisioning

- OpenVMS supports thin-provisioned volumes from P6000 and P9000
- P9000 supports a re-claim feature for deleted space from OS
  - OpenVMS takes advantage of re-claim feature
  - By default the `/HIGHWATER_MARK` feature will be enabled, which clears disk space before it is allocated
  - Or use `SET VOLUME/FILE /ERASE_ON_DELETE` options to zero off the deleted blocks
  - There will be additional I/O overhead for erasing each deleted block

Virtual Tape Library

Virtualizes disk storage and presents it as tapes

- Easily integrates with the backup applications

Offerings from HP

- HP VLS (Virtual Library System)
  - Accelerated De-duplication: Post Processing Approach
  - Backup windows not affected
- HP D2D (Disk-to-Disk)
  - Dynamic/Inline De-duplication: Based on StoreOnce Technology

General Features

- Auto Migration
- Low Bandwidth/Remote Replication

HP DISK-BASED DATA PROTECTION

For data centers and remote offices

New Features
- HP StoreOnce Deduplication
- 64-bit architecture
- 10GbE
- 8Gb FC
- NAS (NFS & CIFS) backup target
- Optional D2D Replication Manager software
- OST Plug-in
- HP Systems Insight Manager support

D2D2500 Series

- Small IT environments or remote offices
- Choice of 1.5 & 3 TBs usable
- 450 GB/hour

D2D4106 Series

- Remote offices and small to mid-sized data centers
- 4.5 - 9 TBs usable
- 800 GB/hour

D2D4112 Series

- Remote offices and small to mid-sized data centers
- 9 -18 TBs usable
- 1.3 TB/hour

D2D4312 Series

- Remote offices and mid-sized data centers
- 9 - 36 TBs usable
- 2.4 TB/hour

New

D2D4324 Series

- Leading capacity
- Large data centers
- 18 - 72 TBs usable
- 4.0 TB/hour

All models feature HP StoreOnce deduplication, data replication and offer NAS or VTL targets for backup

VLS9200 VLS12200 Gateway

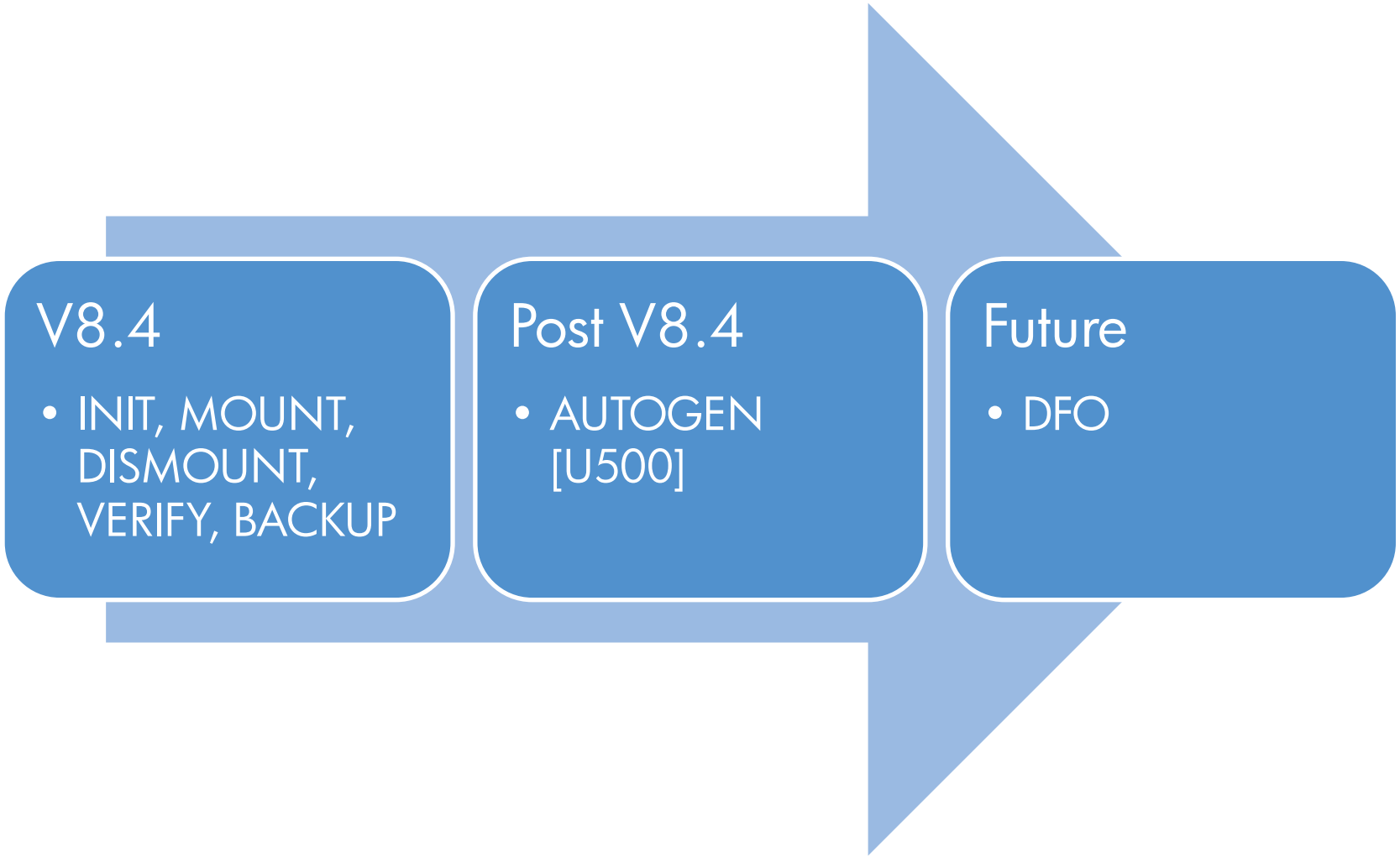
New

- Single or Multi-node system (VLS9200)
- High performance & scalable
- Enterprise data centers
- Large FC SANs
- 10 – 1280 TBs usable
- Up to 4.4 TB/hour/node

Featuring deduplication for performance critical environments

OPENVMS V8.4 – SOFTWARE UPDATES

2TB Support



* U500 means V8.4 Update500 Patch

BACKUP Updates

V8.4

- BACKUP Compression Support - zlib
- 2-3X Less disk/tape space based on data
- Single compression utility for Alpha/IA64

V8.4 – U400

- BACKUP to a propagate GPT.SYS file from source to destination disk
- /GPT or /GPT=NONE options

V8.4 – U600 [NEW]

- BACKUP to report "BACKUP-I-SYMNOTFLW" message for SYMLINKS

Storage Utility Enhancements

- MSA$UTIL – Configuring and Managing Utility for HP Smart Array Family of Storage HBA(53xx series, 64xx series, P4xx, P700, and P800) and MSA1000 and MSA1500
  - Changes to display status and error messages
  - Now supports creating LUN > 1TB
  - Supports upgrading SAS Firmware > 2MB
  - Supports creating RAID 50 and 60 Volumes on new i2 servers
  - Supports P410i, P411 and P812

- EFI> VMS_SHOW DEVICE is enhanced to show i2 server boot devices

- BOOT_OPTIONS.COM had undergone changes to support i2 servers

Storage Management Product Updates

ABS – Archive Backup System	• ABS V4.5 (1201) • Software Encryption Support (1200)
Data Protector – OpenVMS as Client	• DP latest Version 6.11
Backup	• Compression Support • 2TB Volume support on OpenVMS 8.4
SLS – Storage Library System	• Only on Alpha and VAX • SLS V2.9J ECO02
SWRAID	• Version V3.0-138B • RAID Level 0, 5, 0+1
DFO	• Version 3.0

OPENVMS V8.4 – HARDWARE UPDATES

Introducing HP Integrity rx2800 i2

The ultimate 2U mission-critical rackmount server

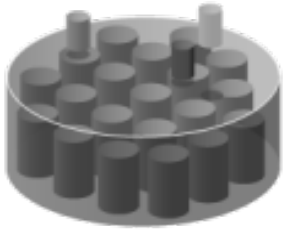
New

Storage Highlights

- Embedded HP Smart Array P410i Controller
- Up to 2.4 TB storage
- 6 I/O slots, PCIe 2/3-Slot Riser Board
- Internal disk drives (Min 0 – Max 8)
- 72, 146, 300, 450*, 600*, 900* GB 15K SFF SAS HDD, SSD*
- Supports RAID 0,1,5,6,50,60 volumes as Core I/O
  - Zero cache added - Raid 0 and 1 only
  - SA 512 MB Cache/Battery Kit - All Raid levels
- PCIe 1/2-port 8 Gb FC SR Qlogic HBA
- PCIe 2p P411/256 MB SAS Ctlr
- Multi function Cards (Mass Storage/LAN)
  - PCIe 1p 4 Gb FC AND 1p 1000BT
- (SATA) DVD-ROM or DVD+RW drive

* Future

OpenVMS 8.4 Storage Support



What is new?

Fibre Device Support

- P2000 G3 (FC & SAS/6Gb)
- P6300/P6500, EVAx400
- P9500

SAS Device Support

- Blade Solution with p700m/p411 Raid Controller and 3Gb BLSAS Switch
  - HP StorageWorks MDS600 (blade/rack mounted)
  - HP StorageWorks MSA2000sa Modular Smart Array (SAS)
- MSA60/70 w/p800 Smart Array Controller or w/ HP SC44Ge SAS HBA
- D2600/2700 w/p411 Smart Array Controller [U600, supports legacy IA64 Servers]

Archiving Device Support

- HP StorageWorks D2D Backup Systems
- HP StorageWorks Ultrium Tape blades (SB1760c, SB920c, 448c)
- HP StorageWorks Secure Key Manager (SKM)
- MSL LTO5 Encryption Kit
- VLS 9200 Series, 12200 Gateway

* Devices marked in blue are supported from OpenVMS V8.4 Update200 or onwards

OpenVMS 8.4 HBA Support

SAS

- HP Smart Array P700m (3Gb SAS)
- HP Smart Array P411 (6Gb SAS Standup Card)
- HP Smart Array P410
- HP Smart Array P812 controller [U600]

FC

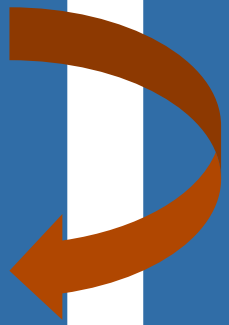
- 1/2-port 8 Gb Fibre Channel Adapter PCI-Express (PCIe) [Now supports legacy Platform]
- 2-port 8 Gb Fibre Channel Mezzanine Card for HP BladeSystem (currently Qlogic)

* Devices marked in blue are supported from OpenVMS V8.4 Update200 or onwards

Third Party Storage Support

HP OpenVMS certifies only HP StorageWorks storage solutions

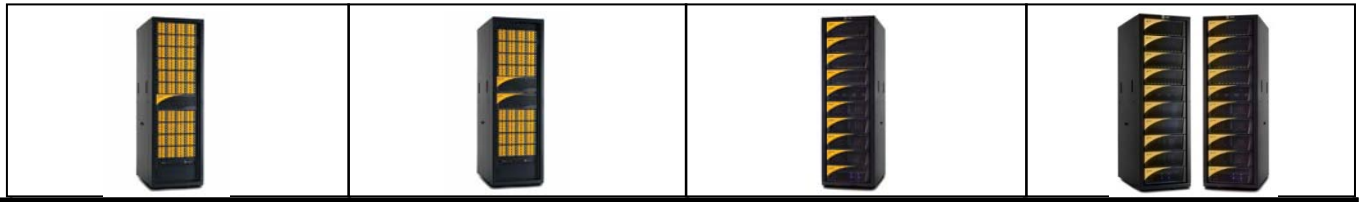
3rd party storage providers certify and offer support to customers with OpenVMS



Please refer to their support

FUTURE STORAGE

3PAR Storage Servers

				
	F200	F400	T400	T800
Controller Nodes	2	2 – 4	2 – 4	2 – 8
Fibre Channel Host Ports Optional iSCSI Host Ports Built-in Remote Copy Ports	0 – 12 0 – 8 2	0 – 24 0 – 16 2	0 – 64 0 – 16 2	0 – 128 0 – 32 2
GBs Control Cache GBs Data Cache	8 12	8-16 12-24	8-16 24-48	8-32 24-96
Disk Drives	16 – 192	16 - 384	16 – 640	16 – 1,280
Drive Types	50GB SSD, 300/600GB FC and/or 2TB NL	50GB SSD, 300/600GB FC and/or 2TB NL	50GB SSD, 300/600GB FC and/or 2TB NL	50GB SSD, 300/600GB FC and/or 2TB NL
Max Capacity	128TB	384TB	400TB	800TB
Throughput/ IOPS (from disk)	1,300 (MB/s) / 46,800	2,600 (MB/s) / 93,600	3,200 (MB/s) / 156,000	6,400 (MB/s) / 312,000
SPC-1 Benchmark Results (SPC-1 IOPS)		93,050		224,990
	← Same OS, Same Management Console, Same Replication Software →			

HP P10000 3PAR Storage Systems

Technical Specifications

	V400 NEW!	V800 NEW!
Controller nodes	2 – 4	2, 4, 6, 8
8Gb/s FC host ports	0 – 96	0 – 192
Optional 10Gb/s iSCSI host ports	Post GA	Post GA
Optional 10Gb/s FCoE host ports	Post GA	Post GA
Built-in remote copy ports	2	2
Control cache GBs	32 – 64	64 – 256
Data cache (Adaptive) GBs	64 – 128	128 – 512
Disk drives	16 - 960	16 – 1,920
Drive types	100/200 GB SSD 300/600 GB 15K FC 2TB 7.2K SATA	100/200 GB SSD 300/600 GB 15K FC 2TB 7.2K SATA
Maximum capacity	800TB	1.6PB
Throughput/ IOPS (from disk)*	6,500 (MB/s)/ 180,000	13,000 (MB/s)/ 360,000
Benchmark Result Plans	--	SPC-1

* Throughput figures represent sequential reads/ IOPS figures represent Raid 10, random reads

What's Changed between T-Class and P10000 3PAR?

	HP 3PAR T-Class	HP P10000 3PAR
Bus Architecture	PCI-X	PCIe
CPUs	2 x dual-core per node	2 x quad-core per node
ASIC	1 per node	2 per node
Control cache	4GB per node	16GB (V400)/ 32GB (V800) per node
Data cache	12GB per node	32GB (V400)/ 64GB (V800) per node
I/O slots	6	9
FC host ports	0 -128 4GB/s	0 -192 8GB/s
iSCISI host ports*	0 - 32 1GB/s	0 - 32 10GB/s
FCoE host ports*	N/A	0 - 32 10GB/s
Rack options	2M HP 3PAR rack	2M HP 3PAR rack or 3rd party rack**
Drives	16 - 1280	16 - 1920
Max capacity	800TB	1.6PB
T10DIF	N/A	Supported

**10Gb/s FCoE/iSCSI host port support on V-Class planned for post-GA*
*** Only on the V400, post-GA*

Storage Future…OpenVMS Support

FCoE/FlexFabric

- Defines encapsulation of Fibre frames onto Ethernet frames
- Fairly new. Enables Converged Infrastructure. Building block for CNA

iSCSI

- iSCSI Software Initiator available on 1H1 (but low performing, test ver.)
- Will enable NAS connectivity for OpenVMS Customers

DirectIO

- Improves IO Performance for Guest Environments
- With DIO, Guest has direct access to physical device(dedicated/shared)

Questions/Comments

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THANK YOU