



HYPERION RESEARCH

SC22 HPC Market Update - Storage and Interconnects

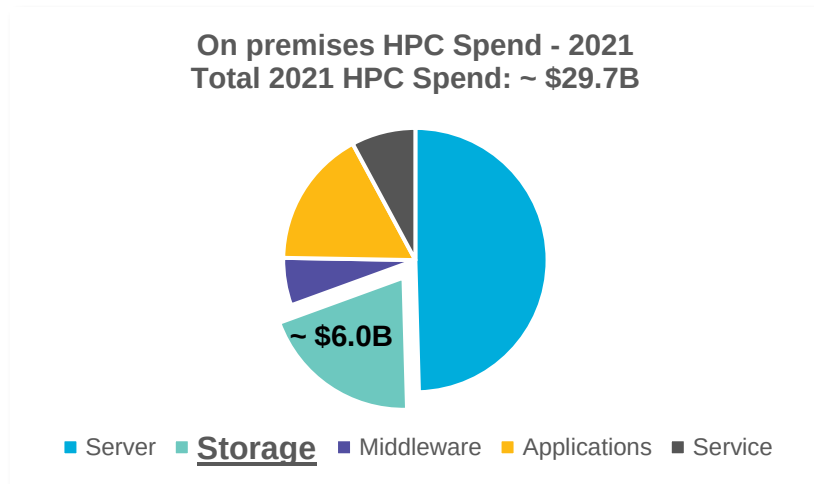
November 2022

www.HyperionResearch.com
www.hpcuserforum.com

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HPC Storage Growth Continues

Demand increasing across all sectors and verticals



Source: Hyperion Research, 2022

- **Storage historically the highest growth HPC element**
- **Storage represents ~ 20% of on-premises HPC spending and growing**
- **Almost half of sites surveyed expect their storage budgets to increase more than 5%**

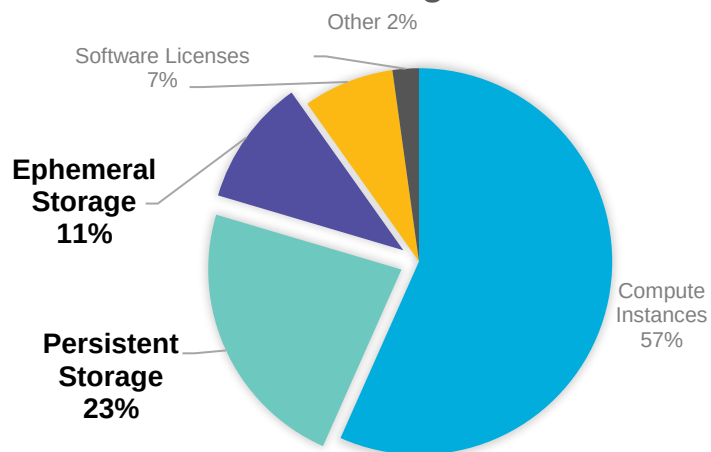
Area (\$M)	2021	2022	2023	2024	2025	2026	CAGR 21-'26
Server	\$14,748	\$16,077	\$17,738	\$19,565	\$19,495	\$20,481	6.8%
Add-on Storage	\$5,971	\$6,677	\$7,457	\$8,388	\$8,491	\$9,027	8.6%
Middleware	\$1,729	\$1,863	\$2,030	\$2,212	\$2,172	\$2,268	5.6%
Applications	\$4,948	\$5,302	\$5,731	\$6,195	\$6,089	\$6,326	5.0%
Service	\$2,266	\$2,316	\$2,389	\$2,468	\$2,336	\$2,296	0.3%
Total Revenue	\$29,662	\$32,236	\$35,345	\$38,828	\$38,584	\$40,398	6.4%

Source: Hyperion Research, 2021

HPC Storage and the Cloud

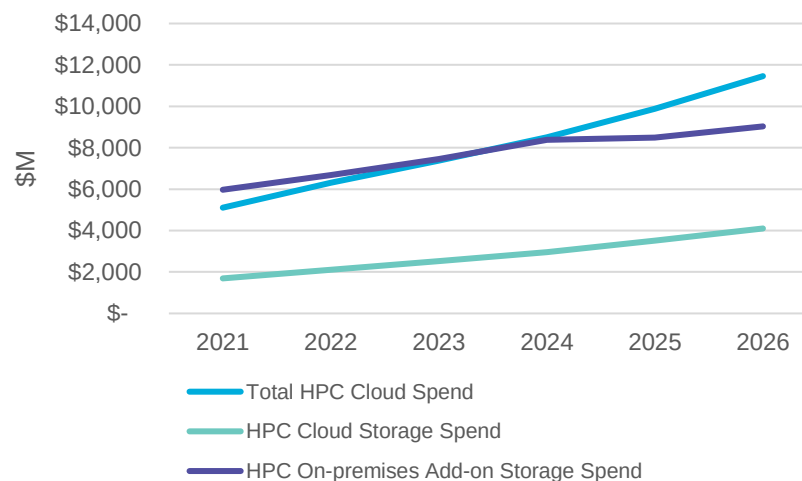
Cloud adoption for storage remains strong and growing

2022 Cloud Budget Distribution



n = 94
Source: Hyperion Research, 2022

HPC Cloud and Storage Forecast

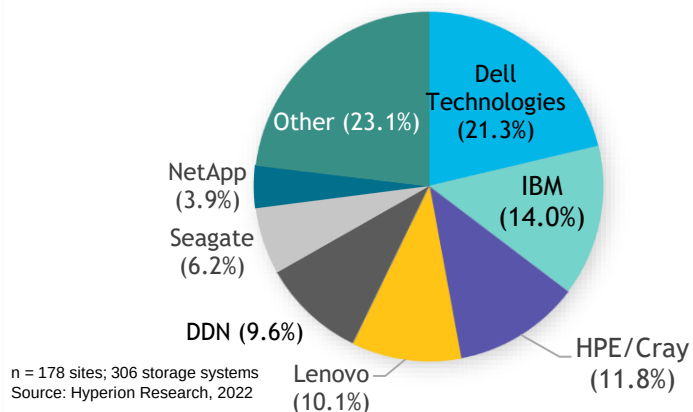


- **Storage ~ 1/3 total HPC spending in the cloud**
- **Spending on persistent, durable storage 2x greater than ephemeral, temporal storage**
- **~ \$1.7B cloud storage spend in 2021**
- **Cloud storage growth ~ 2.3x on-premises storage growth**
- **Total cloud spending projected to overtake on-premises storage spending in 2024**

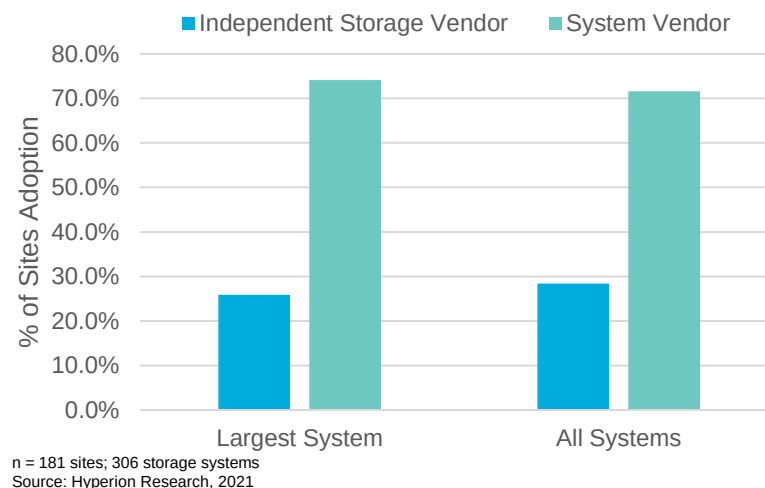
2022 HPC Storage Vendor Preferences

Dell Technologies continues as top preferred storage vendor

2022 On-Premises HPC Storage Vendor Preferences - Largest Systems



2022 On-premises HPC Storage Vendor



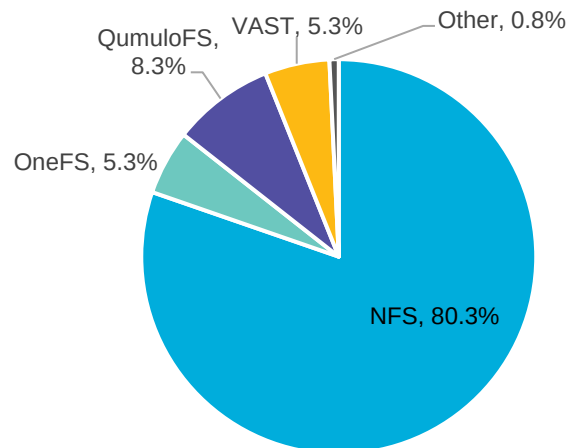
- **Dell Technologies first overall; preferred by Industry & Academia**
- **IBM second preferred overall, tied with HPE/Cray in Government and Academia**
- **DDN 4th continues as preferred independent storage vendor**
- **Users continue to prefer sourcing storage from their system providers**

Storage Technology Ecosystem

File System Preferences – Largest System

Large % of sites adopt both NAS/scaleout and parallel file systems on their largest systems

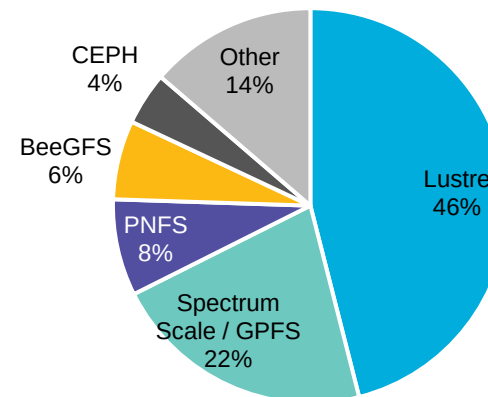
2022 NAS/Scaleout File System Adoption - Largest System



n = 132

% represents adoption at sites that indicated they deploy NAS/Scaleout on their largest system
Source: Hyperion Research, 2022

2022 Parallel File System Adoption - Largest System



n = 139

% represents adoption at sites that indicated they deploy parallel file systems on their largest system
Source: Hyperion Research, 2022

Interconnect Architecture

Subtle shift expected in interconnect implementation

Network Architecture	Current	Next Procurement
Independent Networks	54.1%	47%
Converged Networks	45.9%	53%

n = 94
Source: Hyperion Research, 2022

- **Site's largest systems architecture preference today skew towards independent system-system and system-storage**
- **Site's expressed preference to skew toward converged system-system and system-storage network in next procurement**
- **What's happening:**
 - Networking rates are increasing to the point of being able to support the demands of converged networks
 - Features are being implemented to optimize overall performance
 - Requirements to support the mixes workloads of compute-intensive and data-intensive workloads are being addressed to alleviate the need and expense of separate networks

Independent Networks: System-System

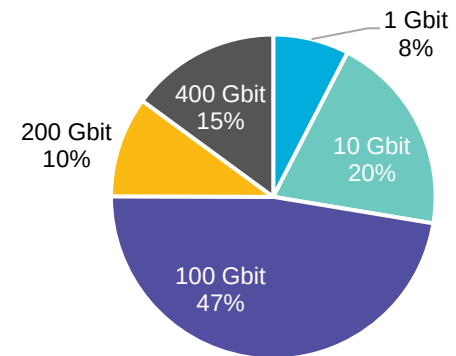
Ethernet preferred over Infiniband for system-system

- **Ethernet**
 - 44.9% of sites surveyed with independent networks
 - 100Gb overtakes 10Gbit as most widely deployed within Ethernet sites
- **InfiniBand**
 - 35.9% of sites surveyed with independent networks
 - HDR 200 catches up with EDR 100 Gbit as most widely deployed at Infiniband sites
- **Other**
 - Omni-Path = 4.5%
 - Other = 4.5%

* % of site adoption Ethernet and Infiniband, respectively

2022 Ethernet Breakdown*

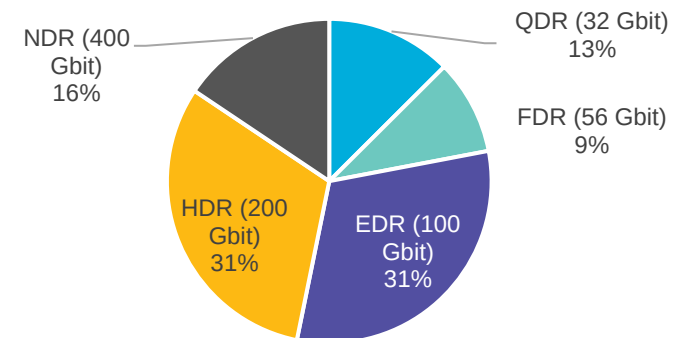
44.9%



n = 86 sites;
Source: Hyperion Research, 2022

2022 Infiniband Breakdown*

35.9%



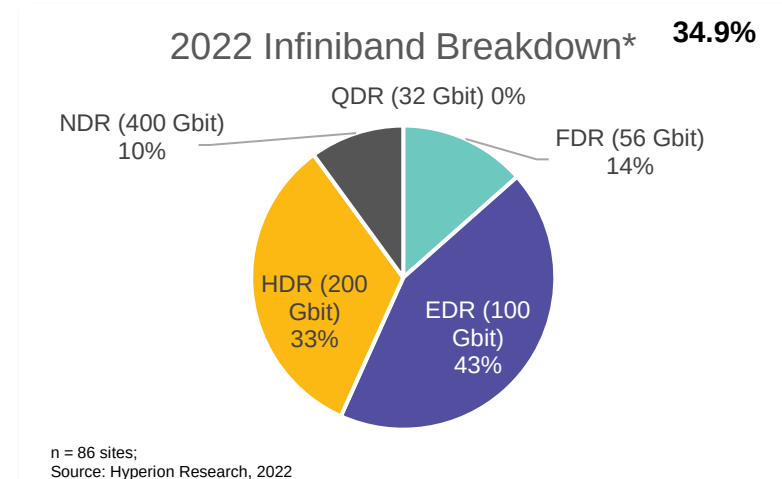
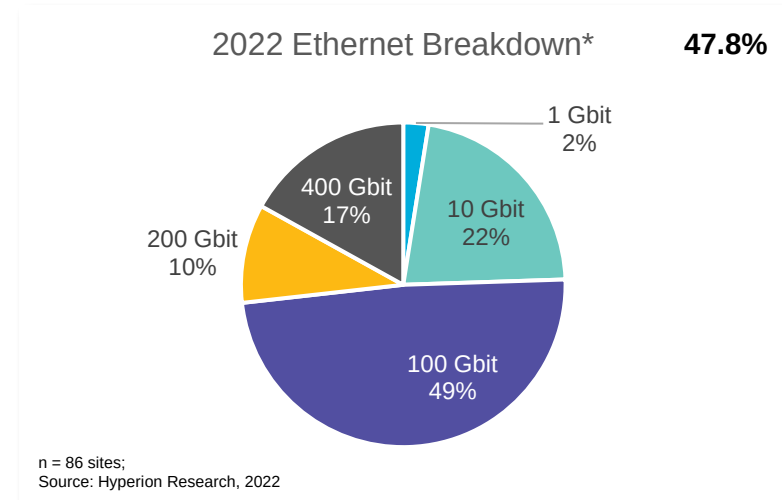
n = 86 sites;
Source: Hyperion Research, 2022

Independent Networks: System-Storage

Ethernet preferred over Infiniband for system-storage

- **Ethernet**
 - 47.8% of sites surveyed with independent networks
 - 100Gb most widely deployed at almost half of Ethernet sites
- **InfiniBand**
 - 34.9% of sites surveyed with independent networks
 - EDR 100 Gbit most widely deployed at Infiniband sites
- **Other**
 - Omni-Path = 3.5%
 - Other = 1.2%

* % of site adoption Ethernet and Infiniband, respectively



Converged Networks

Infiniband preferred over Ethernet for converged networks

- **Ethernet**

- 42.5% of sites surveyed with independent networks
- 100Gb most widely deployed within Ethernet sites

- **InfiniBand**

- 45.2% of sites surveyed with independent networks
- EDR 100 Gbit most widely deployed at Infiniband sites

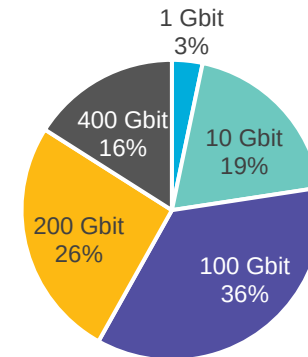
- **Other**

- Omni-Path = 4.1%
- Other = 8.2%

* % of site adoption Ethernet and Infiniband, respectively

2022 Ethernet Breakdown*

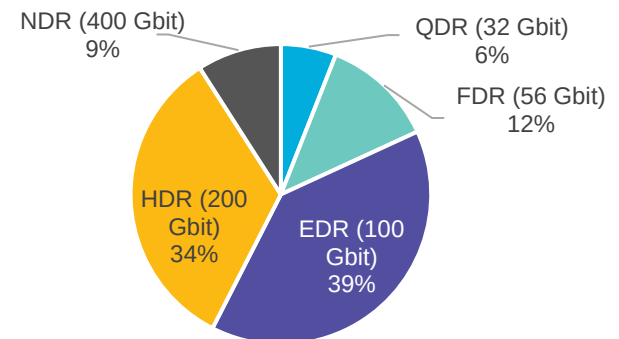
42.5%



n = 73 sites;
Source: Hyperion Research, 2022

2022 Infiniband Adoption*

45.2%



n = 73 sites;
Source: Hyperion Research, 2022

Future Research Direction

Future Research Direction

Broad range of topics across diverse storage ecosystem

- **Grow on-premises census data including HDD, solid state and tape**
 - Use cases
 - Temporal, durable
 - File, block, object
 - Scratch, user, home directory, project, campaign, archive
 - Capacity
 - Internal to servers and compute nodes
- **Expand cloud storage coverage**
 - Storage landscape model
 - Workload usage and requirements
 - Impact of containers
- **Edge computing implications on storage**
 - Capacities
 - Architectures
 - Computational storage
- **Intranode interconnects and protocols**
 - NVMeoF
 - CXL
 - Memory pooling
 - Chiplet standards and adoption
 - UCle
 - OCP Bunch of Wires (BoW)
- **Memory topics**
 - Big memory
 - In-and-near memory computing

**PLEASE SHARE YOUR
THOUGHTS!**



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