QSAN Leading Price Performance SAN Solutions —AFA and HFA

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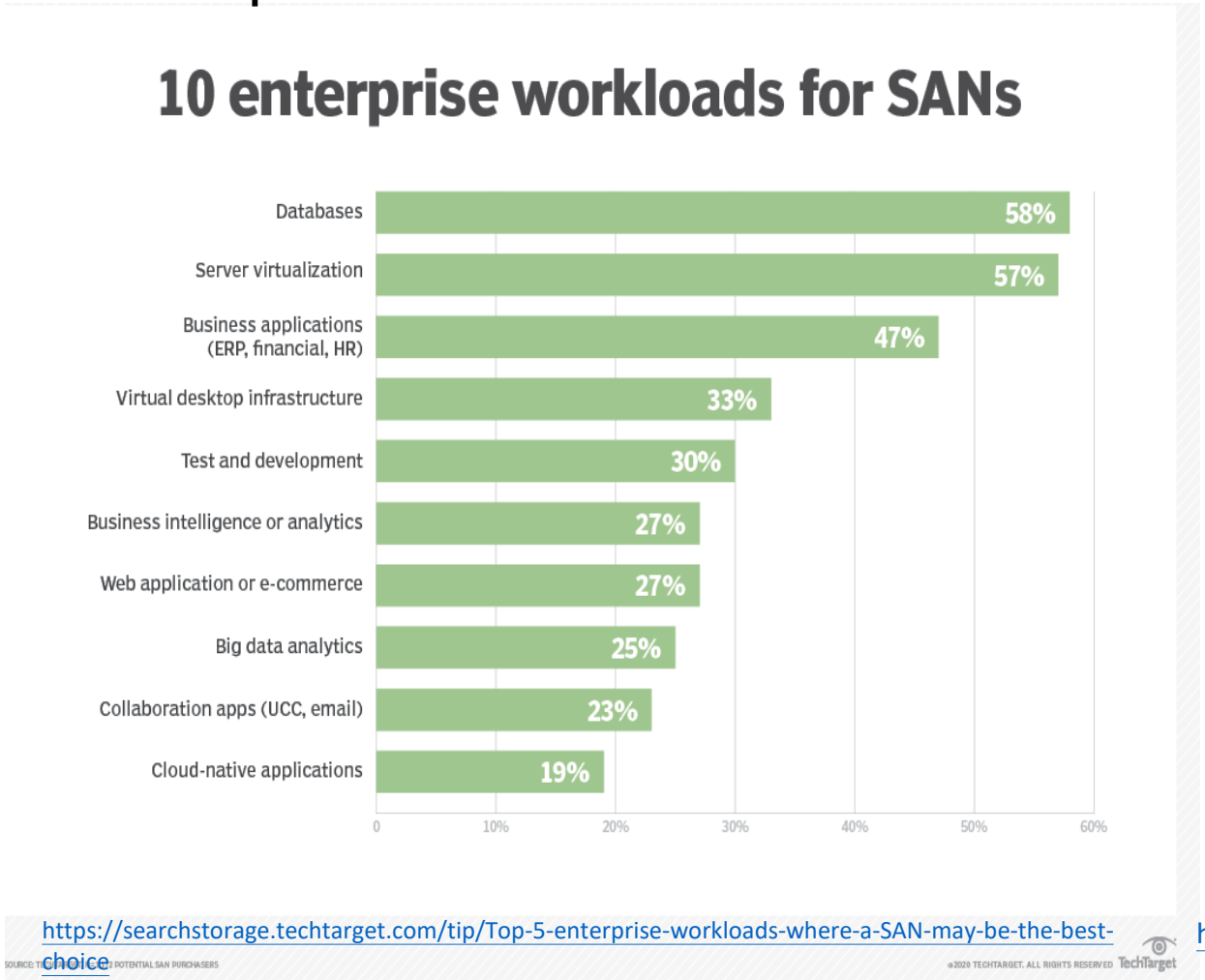
Agenda

- Benefit From Faster Storage Solutions
- QSAN NVMe All Flash Array
- HDD & SSD Trends and Modern RAID EE Technology
- QSAN Hybrid Flash Array
- Ideal Applications
- Summary

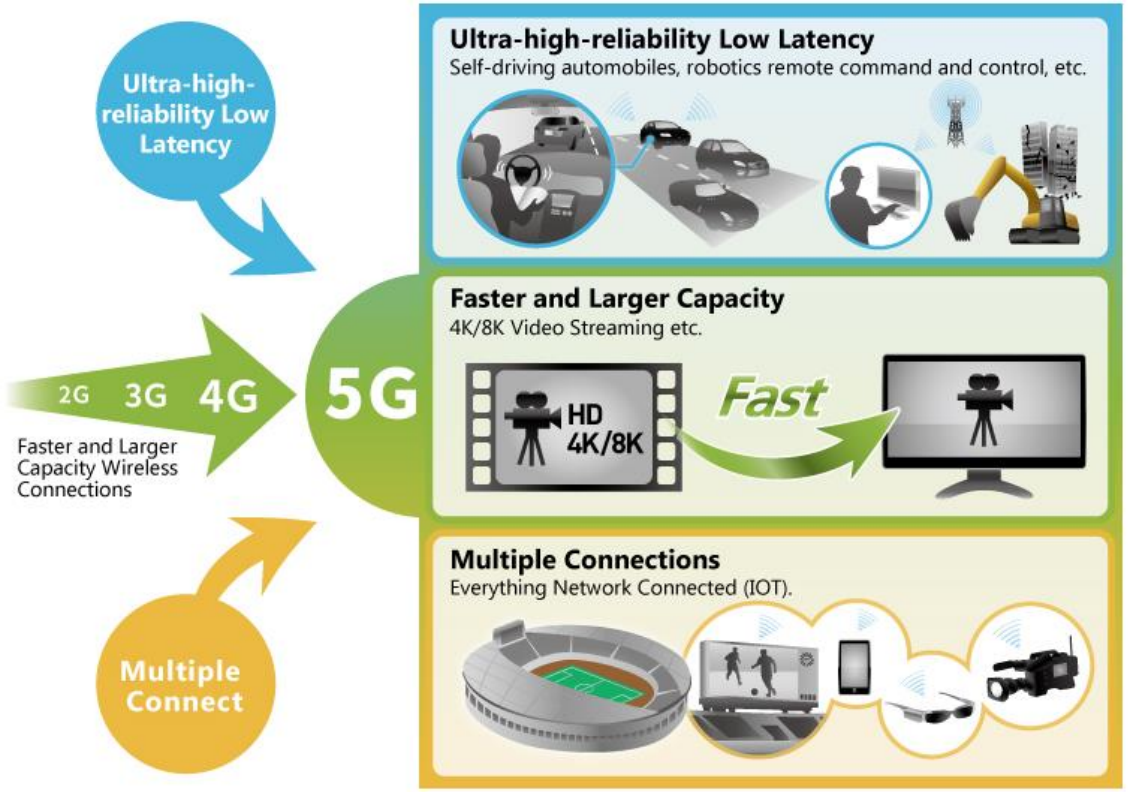
Applications That Need Low Latency

- Enterprise workloads



https://searchstorage.techtarget.com/tip/Top-5-enterprise-workloads-where-a-SAN-may-be-the-best-choice

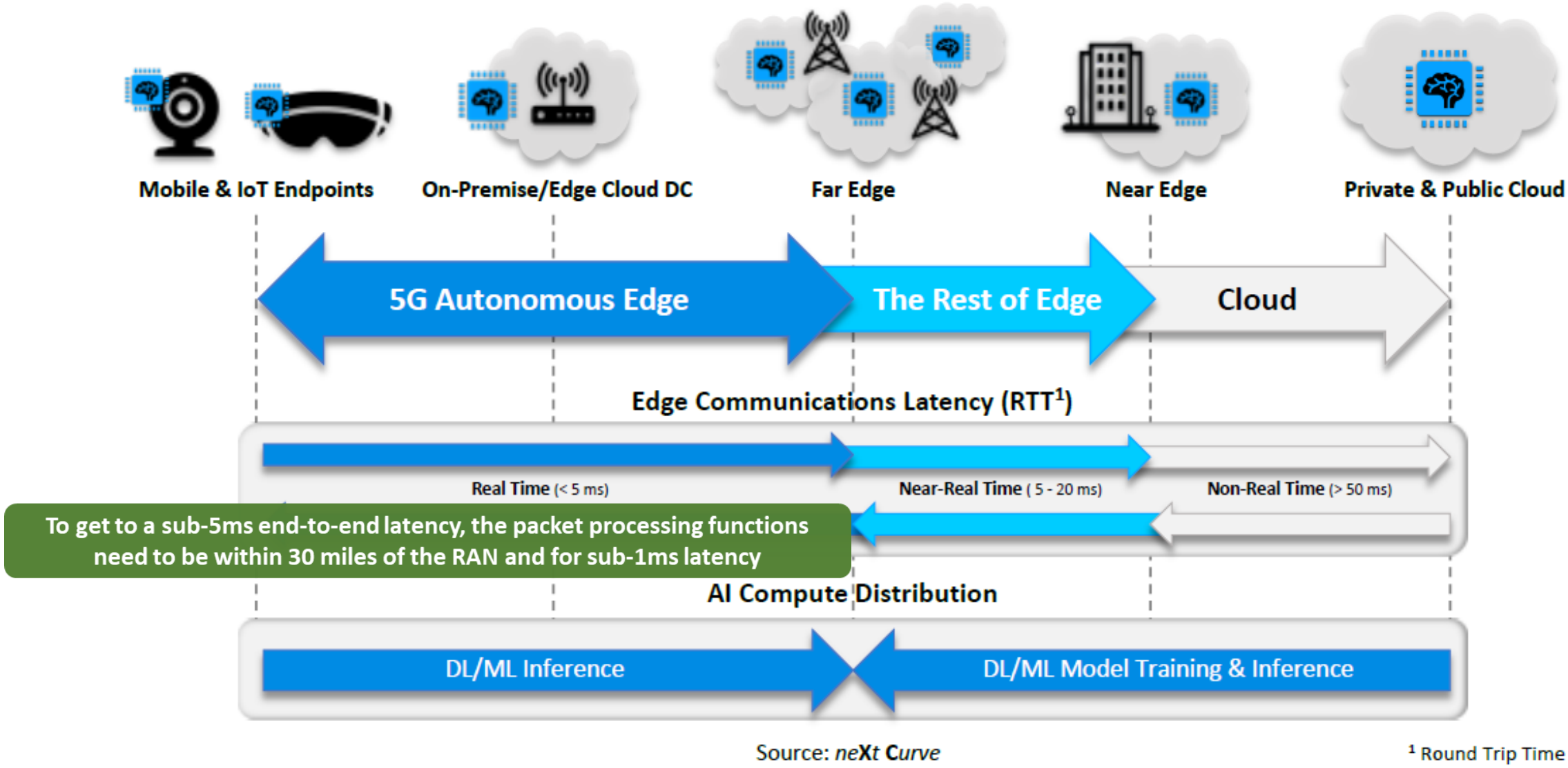
- The 5G era



Usage image of 5G Mobile Network

https://www.anritsu.com/en-au/test-measurement/solutions/mt1000a-05/index

The 5G Autonomous Edge



Source: *neXt Curve*

[1] Round Trip Time

https://www.intel.sg/content/www/xa/en/wireless-network/5g-autonomous-edge-whitepaper.html

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XCube Platform – One Architecture

Block Storage		File Storage	
XCubeFAS All-Flash Block Storage	**XCubeSAN** Hybrid-Flash Block Storage	**XCubeNXT** Unified Storage	**XCubeNAS** File Storage
Production Datastore AI/ML & HPC	Production Datastore Backup Surveillance	Datastore Backup Production	Datastore Backup Disaster Recovery

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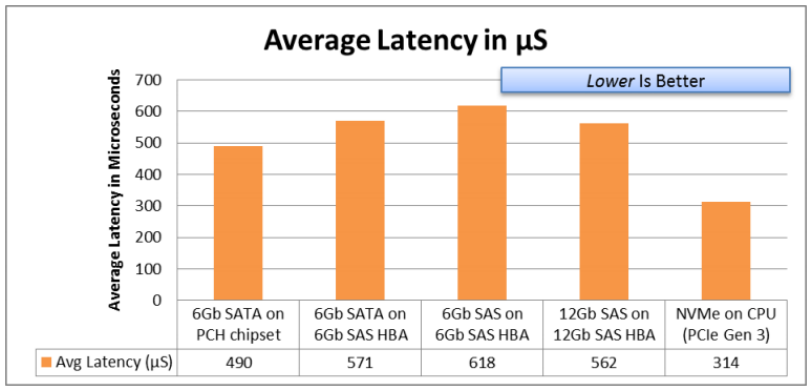
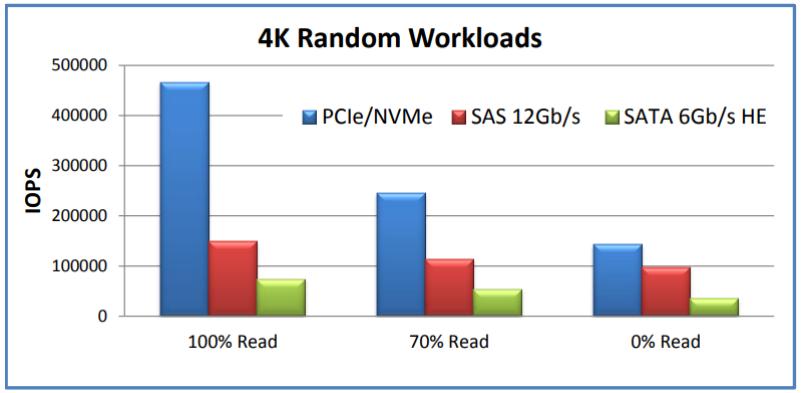
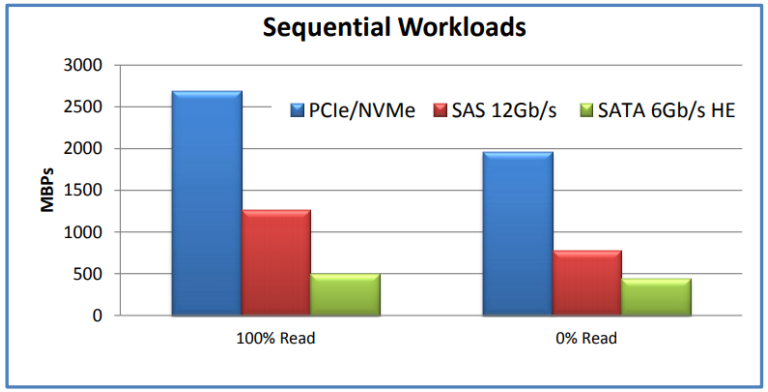
Why NVMe ?

Metrics	NVMe Beneifts Over 12Gb SAS
Latency	**> 200 µs** Lower
IOPS	100% random reads: **> 3X** Higher 100% random writes: **> 1.5X** Higher
Throughput	100% reads: **>2X** Higher 100% writes: **>2.5X** Higher







https://www.nvmexpress.org/wp-content/uploads/NVMe-Webcast-Slides-20141111-Final.pdf

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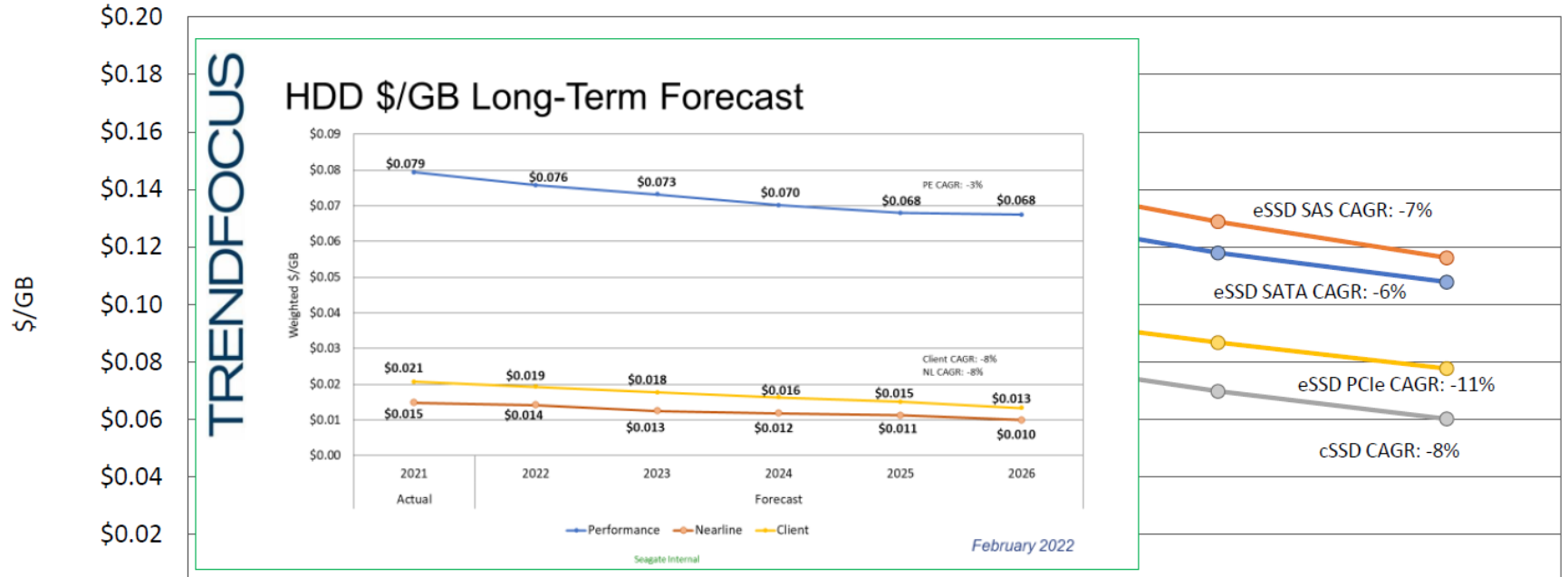
Why NVMe ?

TRENDFOCUS

SSD $/GB Forecast, 1 DWPD



	2021 Actual	2022	2023	2024 Forecast	2025	2026
eSSD SAS	$0.169	$0.188	$0.163	$0.144	$0.129	$0.116
eSSD SATA	$0.150	$0.171	$0.150	$0.132	$0.118	$0.108
eSSD PCIe	$0.110	$0.117	$0.096	$0.082	$0.070	$0.060
cSSD	$0.115	$0.125	$0.110	$0.097	$0.087	$0.078

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Media Awards

StorageReview

*"QSAN's 3126D is **one of the better** entry-level all-flash arrays we've come across"*

ITPro. EDITOR'S CHOICE ★★★★★

***FIVE STARS** - "Qsan delivers an enterprise-class NVMe AFA at an SMB price"*

TOP TEN SIMPLY.REVIEWS

***GAME CHANGER**- "As the first native NVMe AFA with a price tag below $20K, the XCubeFAS XF3126D is a game changer."*

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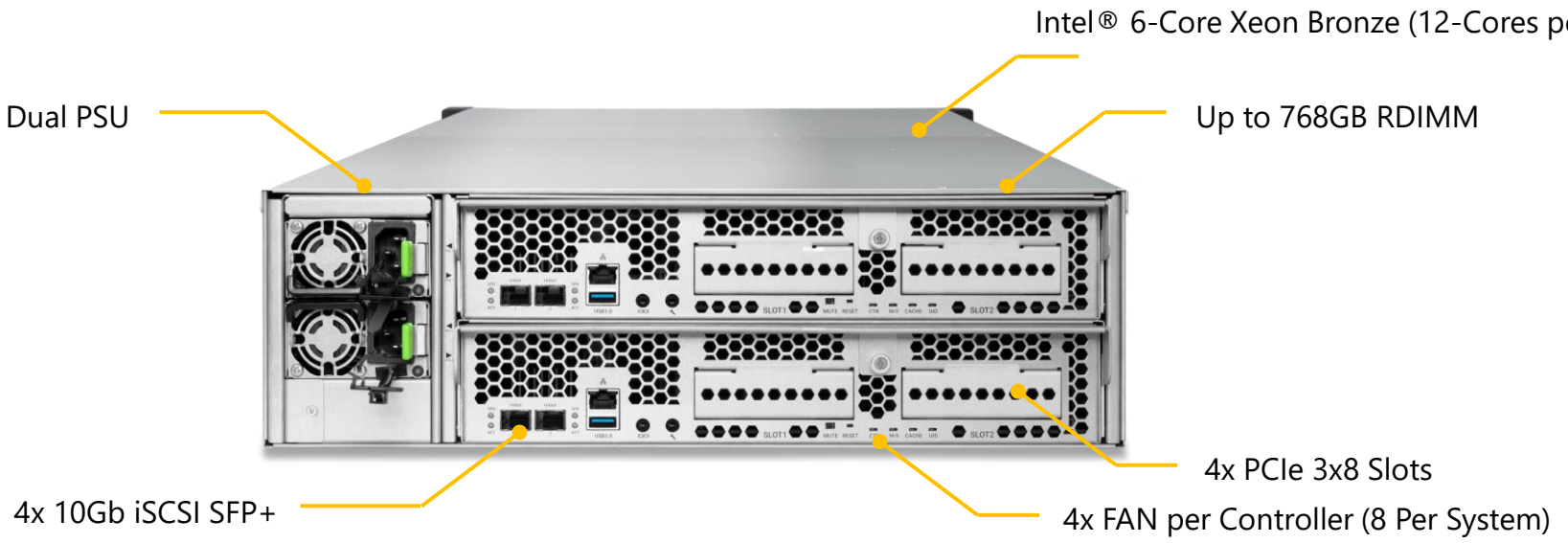
NVMe All Flash Array – XCubeFAS XF3126D

Random Write Performance
110,000 4K IOPS @ 0.3ms
300,000 4K IOPS @ 0.5ms

3U 26-bay

XF3126D

Flash-Based Management System



Optional Host Cards

2 port 32Gb FC	2 port 25Gb SFP28	4 port 1GbE Base-T
2/4 port 16G FC	4 port 10GbE SFP+	2 port 10GbE Base-T

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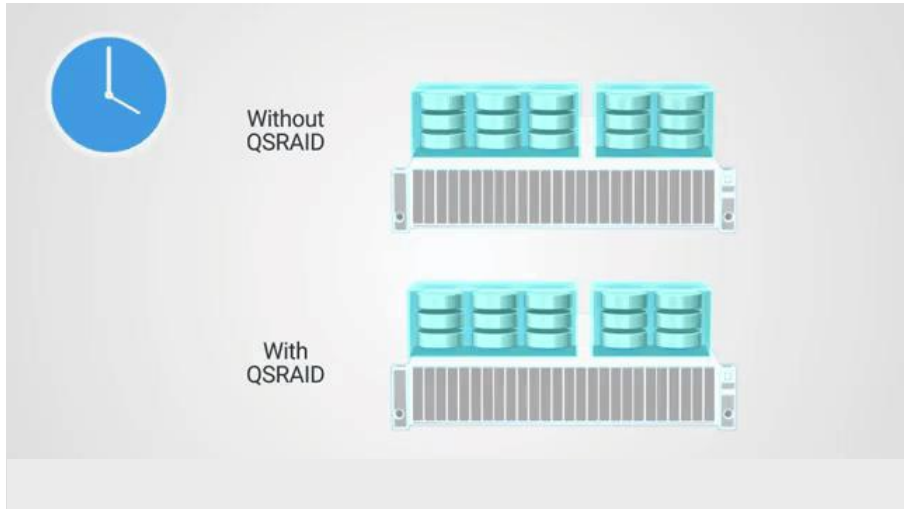
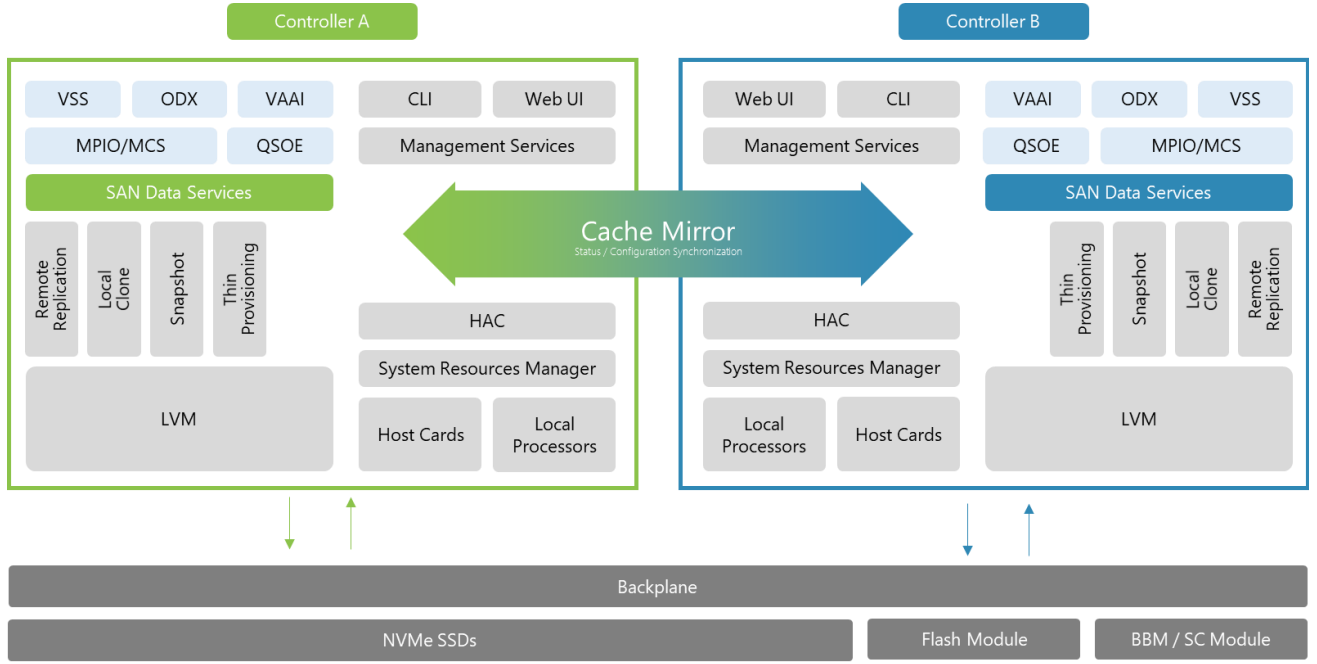
• Live Demo

XEVO 1.1





QSRAID
SSD Data Distribution

QSLife
SSD Life Monitoring

QReport
Historical Performance

RAID EE
50% Faster RAID Rebuilds

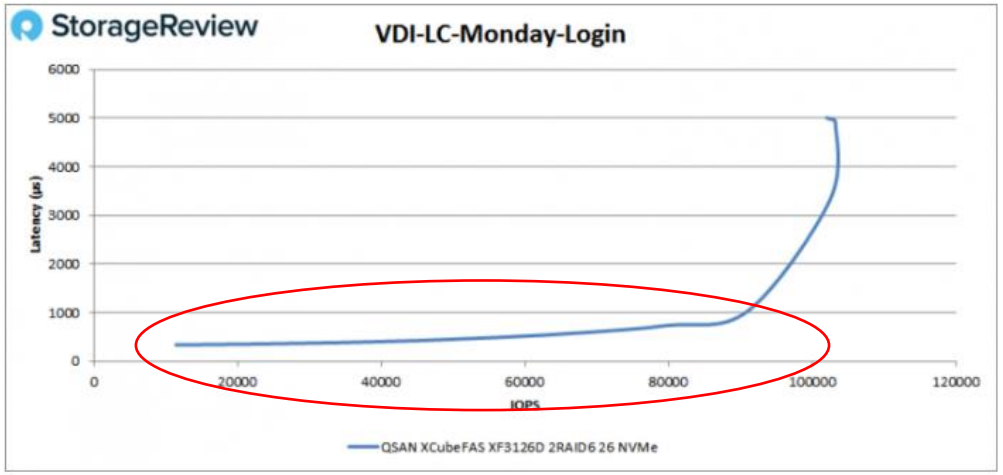
QReplica
Remote Replication

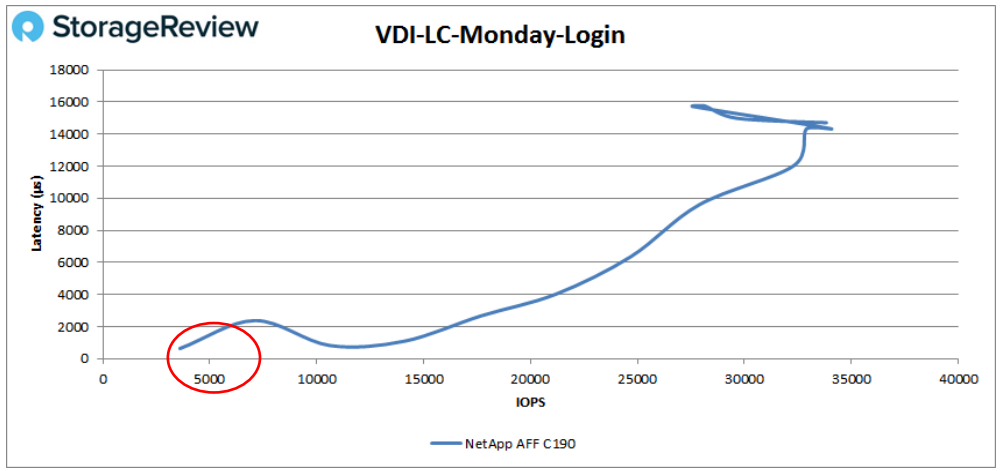
QSnap
16,000 Snapshots

VDI Performance Reference (Monday Login Storm)

	XCubeFAS XF3126D	NetApp C190
Normal Users 50-100 IOPs/user	1200 users @1ms latency (calculate 75 IOPs/user)	66 users @1ms latency (calculate 75 IOPs/user)
Performance Reference (Storagereview.com)	**90K @1ms (RAID 6)**	**5K @1ms (RAID 10)**

Under 1ms





http://www.storagereview.com

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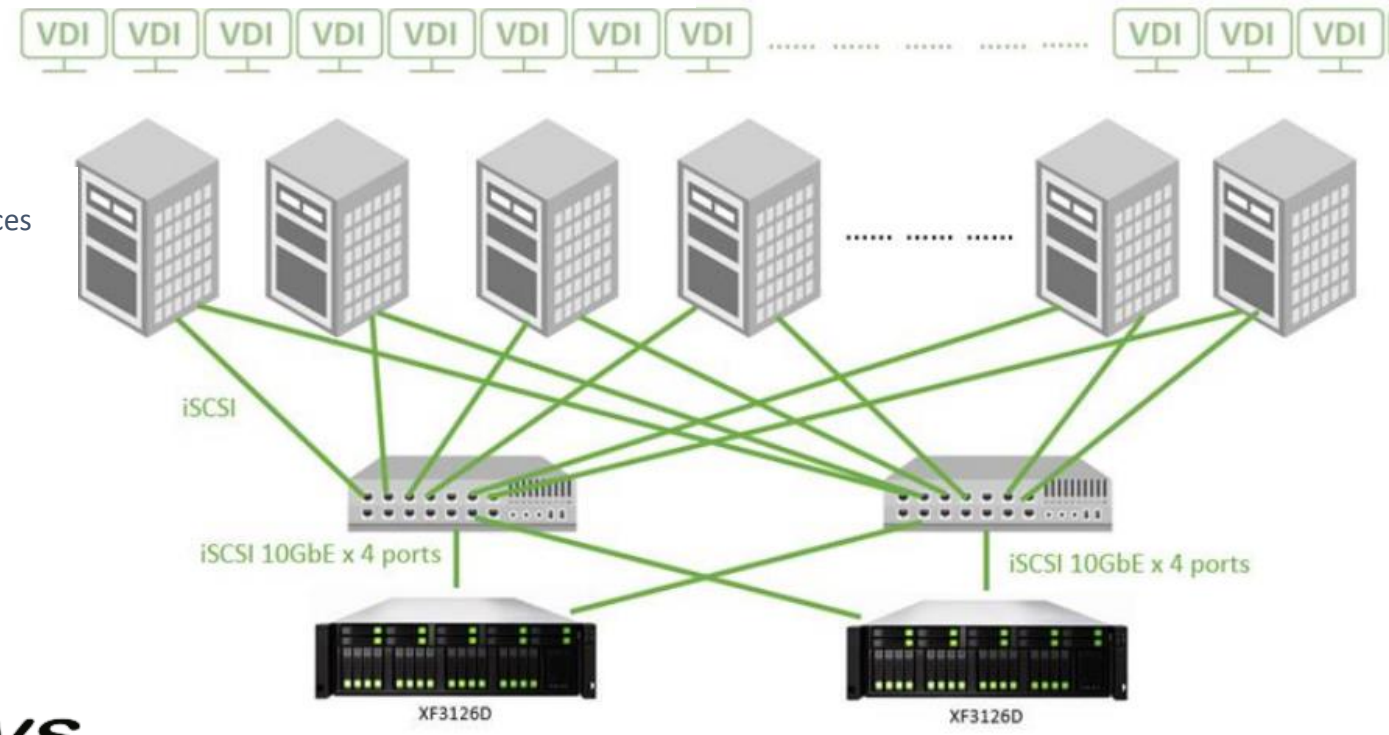
Success Story – Solution Provider, TSYS in Bulgaria

Around 3000 virtual machines (VMs)

Provide Vhost services
Up to 90 servers



Using QSAN AFA to provide storage services for the virtual hosts

- All-NVMe flash storage
  →26 bays
  →2.5" U.2 dual-port NVMe SSDs
- High IOPs at μs-level latency
- NO restriction for drive brands
  →choose a large variety of drives available on market

“Hybrid Flash Arrays Still a Compelling Storage Solution for Many Enterprises”

– IDC Spotlight, April 2022

https://www.delltechnologies.com/asset/en-us/products/storage/industry-market/idc-hybrid-flash-arrays-still-a-compelling-storage-solution-for-many-enterprises.pdf.external

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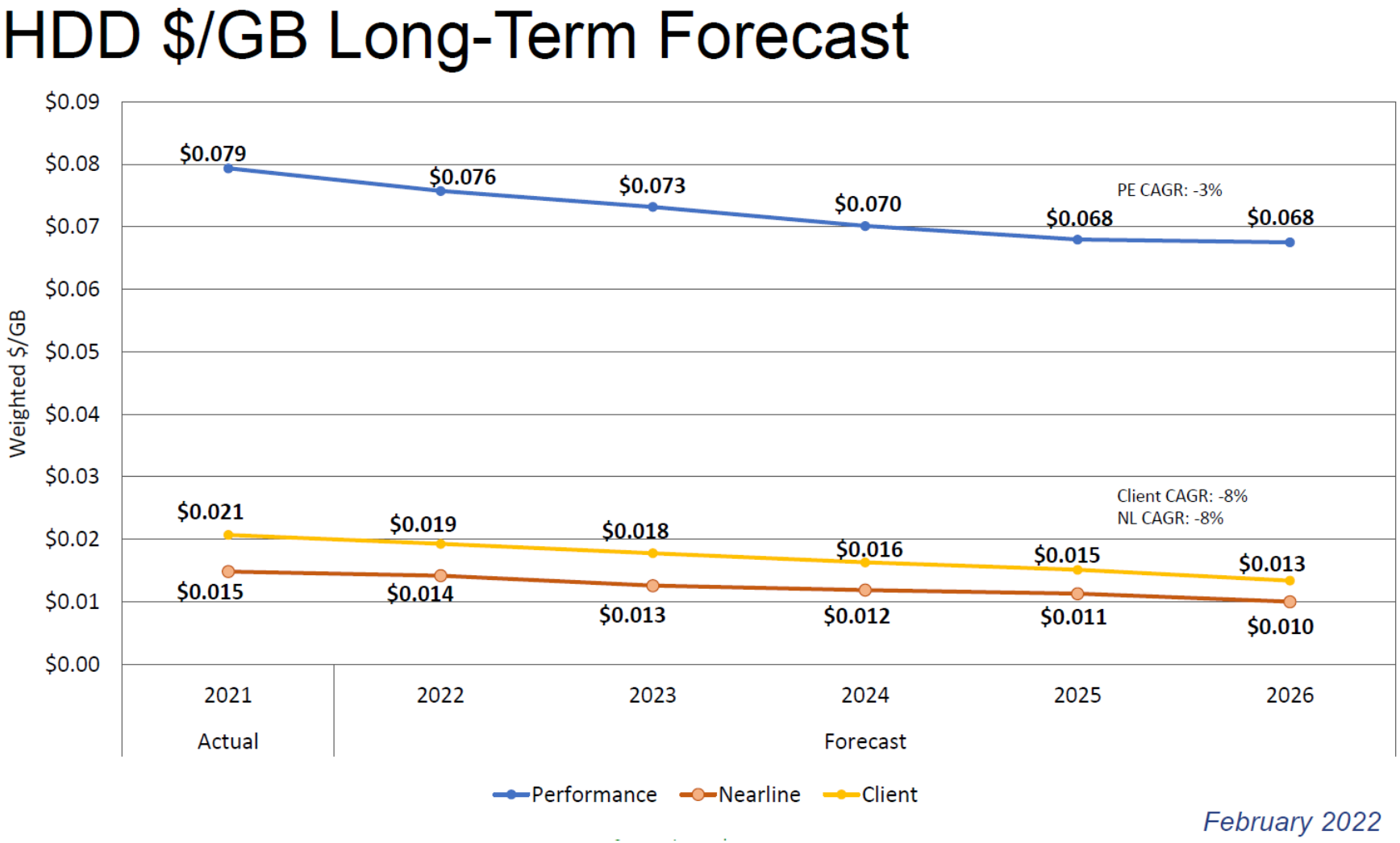
HDD Market & Trend

TRENDFOCUS



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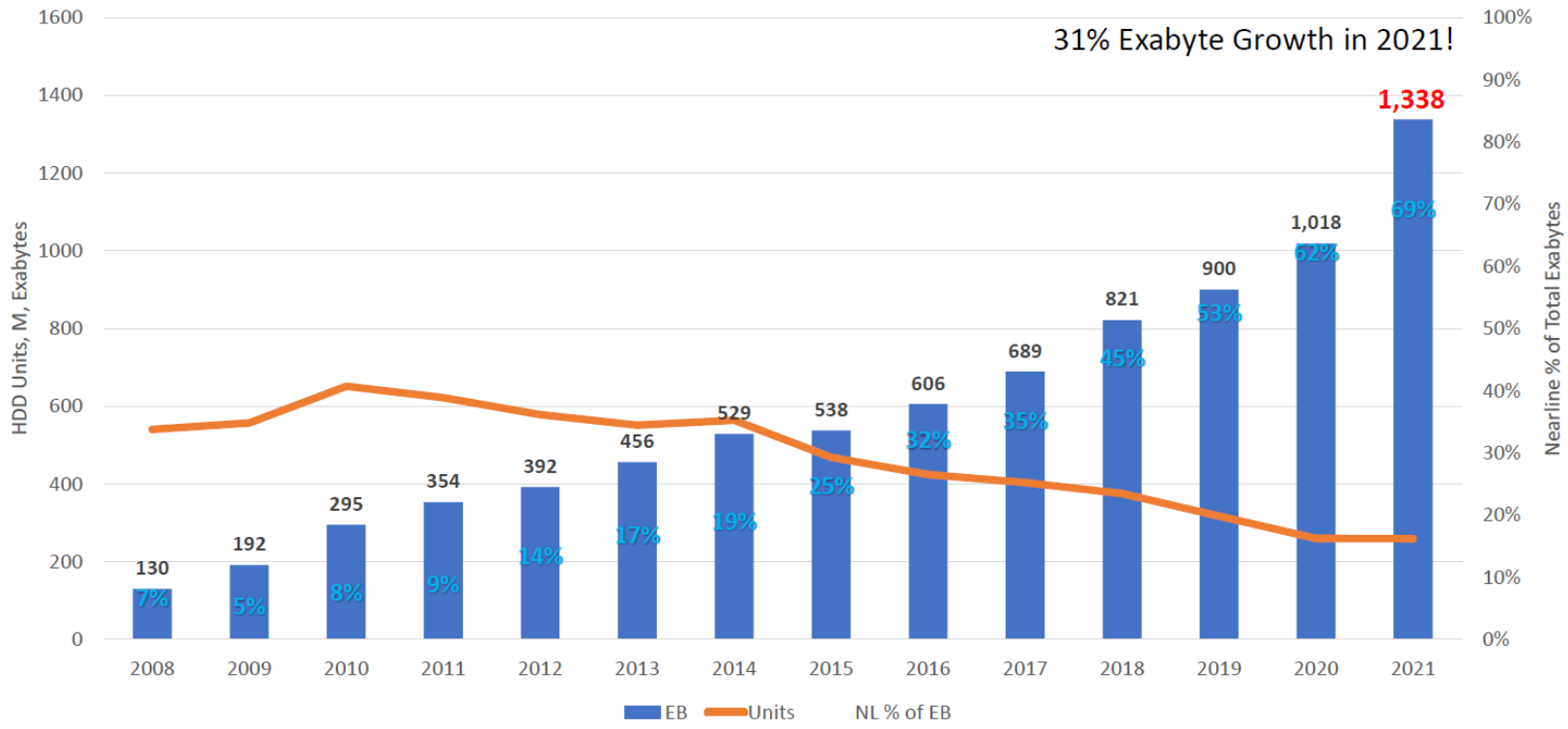
HDD Market & Trend

TRENDFOCUS

2021 HDD Market



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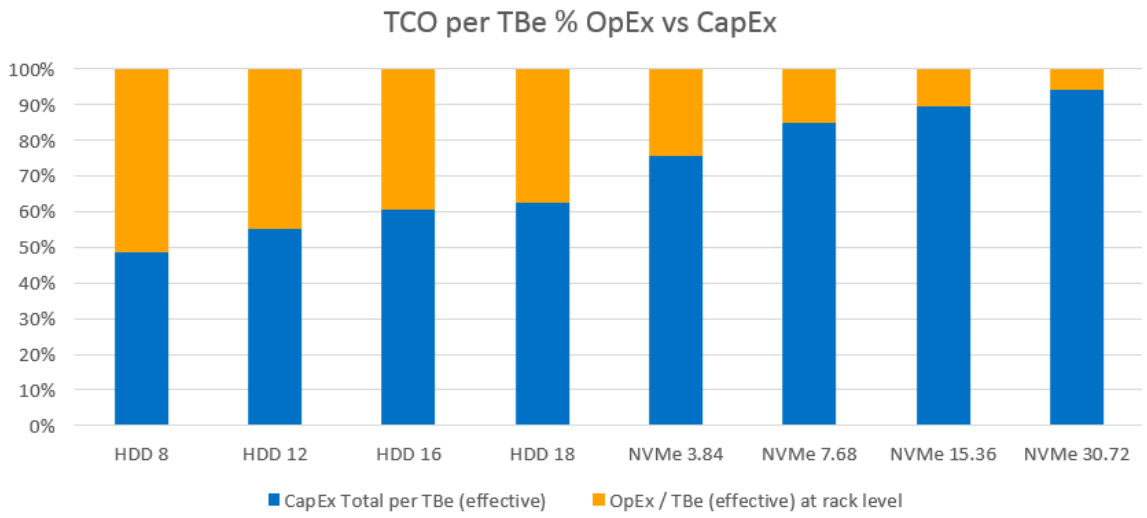
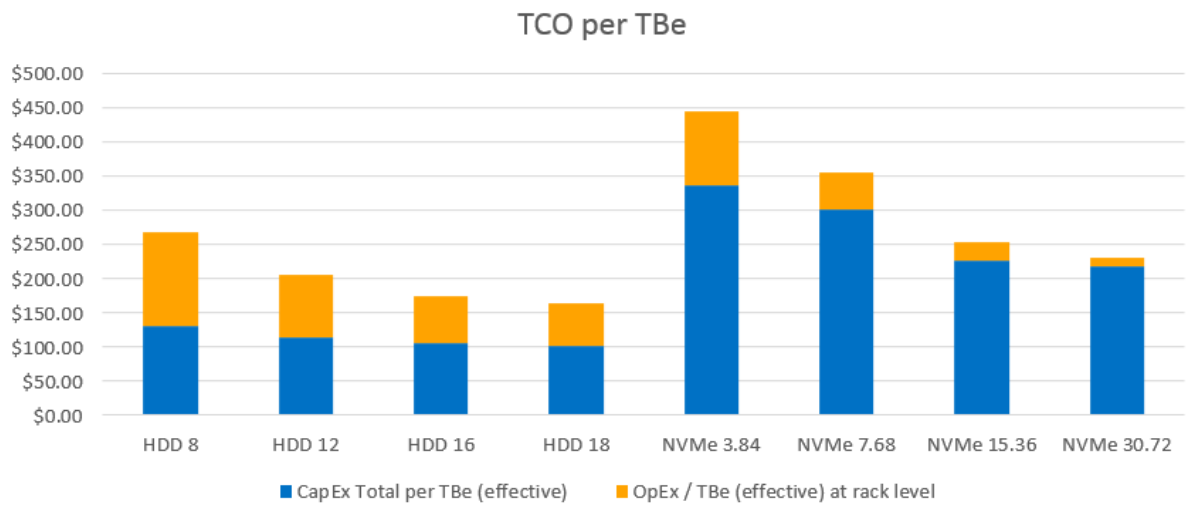
TCO for Enterprise Storage





https://www.snia.org/sites/default/files/SSSI/SNIA%20TCO%20%20rev1%20generic%2012-2020.xlsx

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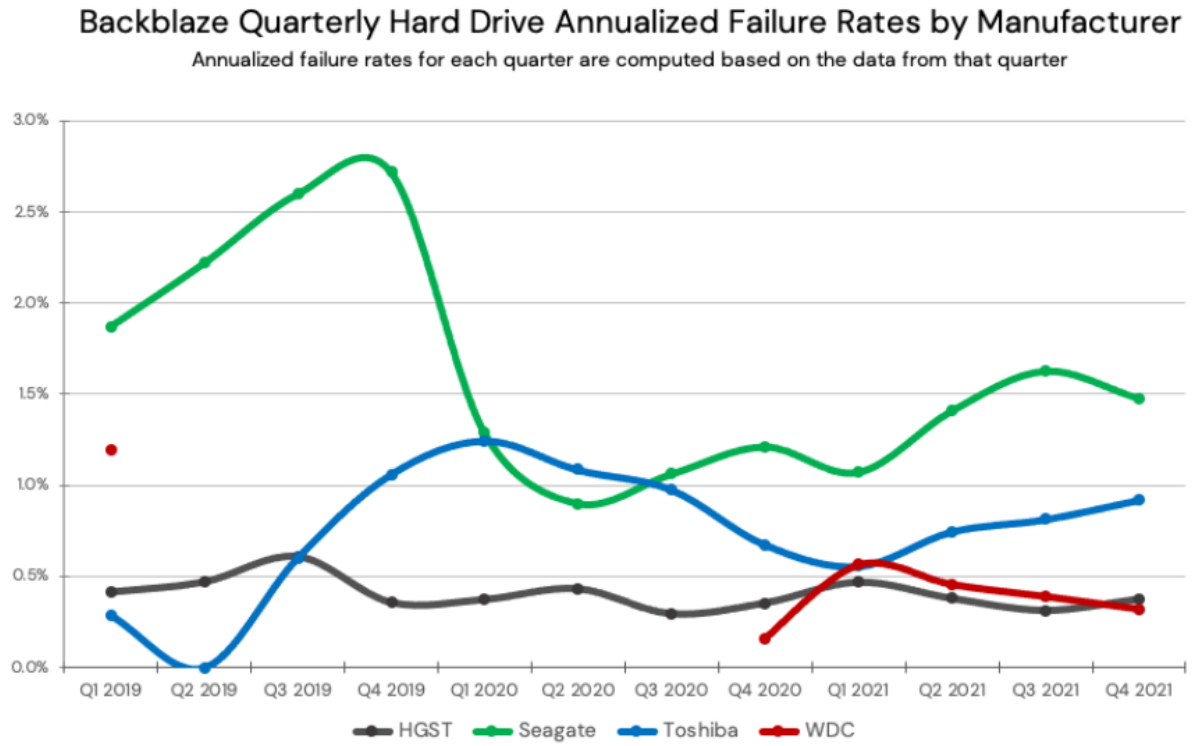
HDD Annual Failure Rate



	Q1 2019	Q2 2019	Q3 2019	Q4 2019	Q1 2020	Q2 2020	Q3 2020	Q4 2020	Q1 2021	Q2 2021	Q3 2021	Q4 2021
HGST	0.41%	0.47%	0.61%	0.36%	0.37%	0.43%	0.30%	0.35%	0.47%	0.38%	0.31%	0.37%
Seagate	1.87%	2.22%	2.60%	2.72%	1.29%	0.90%	1.06%	1.21%	1.07%	1.41%	1.63%	1.48%
Toshiba	0.29%	0.00%	0.60%	1.06%	1.24%	1.09%	0.98%	0.67%	0.56%	0.75%	0.81%	0.92%
WDC	1.20%							0.16%	0.57%	0.46%	0.39%	0.32%

https://www.backblaze.com/blog/backblaze-drive-stats-for-2021/ Backblaze

Three Year Comparison of Annual Backblaze Hard Drive Failure Rates

Reporting periods: 1/1/2019 - 12/31/2019, 1/1/2020 - 12/31/2020, 1/1/2021 - 12/31/2021

			2019		2020		2021	
MFG	Model	Size	Drive Count	AFR	Drive Count	AFR	Drive Count	AFR
HGST	HMS5C4040ALE640	4TB	2,826	0.59%	3,100	0.27%	3,429	0.58%
HGST	HMS5C4040BLE640	4TB	12,746	0.44%	12,744	0.27%	12,703	0.31%
Seagate	ST4000DM000	4TB	19,211	2.00%	18,939	1.41%	18,611	1.80%
Toshiba	MD04ABA400V	4TB	99	0.00%	99	2.01%	97	2.04%
Seagate	ST6000DX000	6TB	886	0.96%	886	0.23%	886	0.11%
HGST	HUH728080ALE600	8TB	1,000	0.79%	1,075	0.29%	1,124	0.64%
Seagate	ST8000DM002	8TB	9,809	1.26%	9,772	0.93%	9,718	1.46%
Seagate	ST8000NM0055	8TB	14,447	1.56%	14,406	1.22%	14,334	1.49%
Seagate	ST10000NM0086	10TB	1,200	1.00%	1,201	1.33%	1,192	2.26%
HGST	HUH721212ALE600	12TB	1,560	0.56%	2,600	0.31%	2,600	0.27%
HGST	HUH721212ALE604	12TB			2,506	1.19%	13,138	0.29%
HGST	HUH721212ALN604	12TB	10,859	0.40%	10,830	0.46%	10,818	0.48%
Seagate	ST12000NM0007	12TB	37,004	3.31%	23,036	1.04%	1,324	2.01%
Seagate	ST12000NM0008	12TB	7,215	1.14%	19,287	1.01%	20,201	1.08%
Seagate	ST12000NM001G	12TB			7,130	0.84%	12,171	0.52%
Seagate	ST14000NM001G	14TB			5,987	1.04%	10,738	1.03%
Seagate	ST14000NM0138	14TB			360	0.00%	1,611	4.79%
Toshiba	MG07ACA14TA	14TB	3,619	0.65%	21,046	0.91%	38,214	0.77%
Toshiba	MG07ACA14TEY	14TB			160	0.00%	462	1.66%
WDC	WUH721414ALE6L4	14TB			6,002	0.16%	8,408	0.43%
Seagate	ST16000NM001G	16TB			59	1.71%	10,861	1.11%
Toshiba	MG08ACA16TE	16TB					5,985	0.91%
Toshiba	MG08ACA16TEY	16TB			1,014	0.00%	2,367	0.70%
WDC	WUH721816ALE6L0	16TB					1,767	0.14%
			122,481	**1.89%**	**162,239**	**0.93%**	**202,759**	**1.01%**

Backblaze

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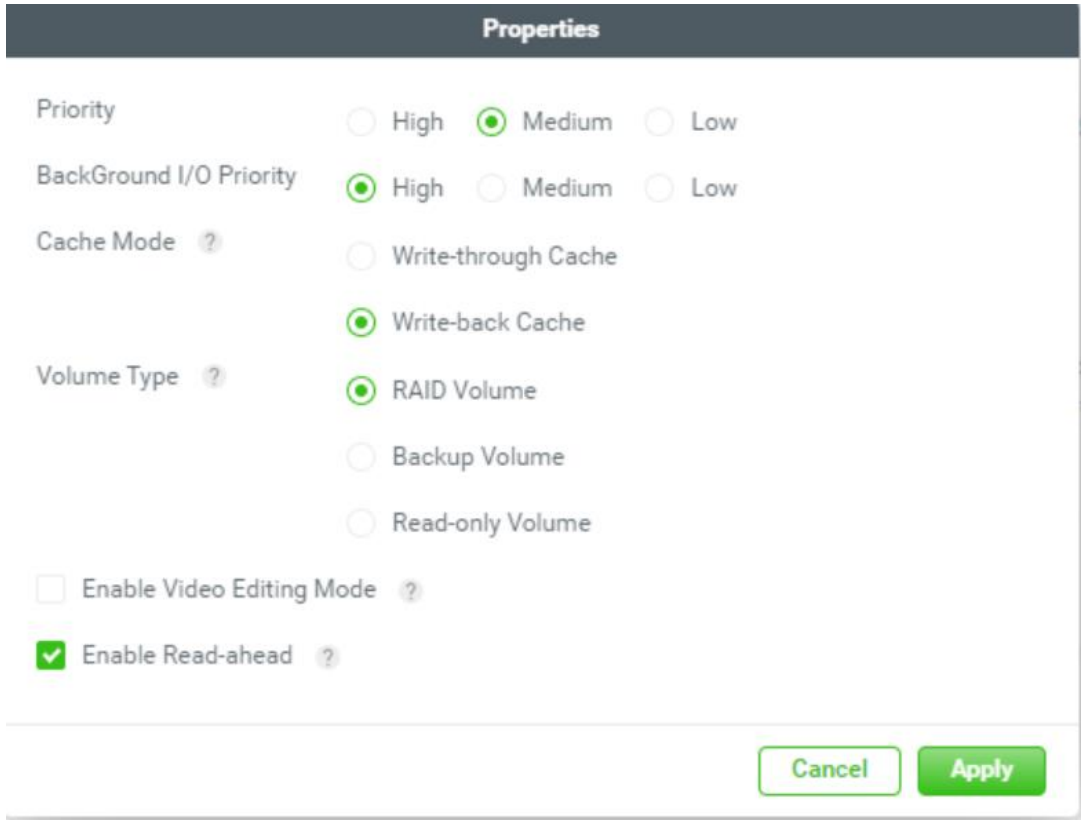
Larger Capacity and HDD AFR

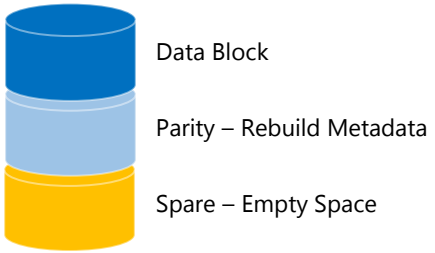
Best-case rebuild rate fairly simply: as rebuild is sequential, the needed time is capacity / transfer rate. For example, rebuilding a 20 TB disk with a 200 MB/s transfer rate needs at least 20,000,000MB / 200 = 100,000s = ~28h

But in practice, with 20TB drives, you could be looking at two weeks.

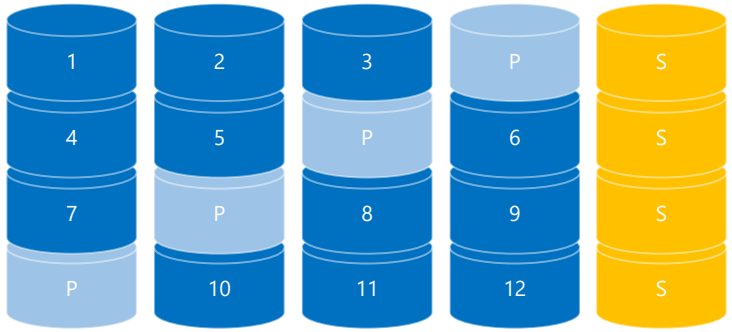


https://www.backblaze.com/blog/backblaze-drive-stats-for-2021/

QSAN RAID EE in XCubeFAS & SAN



Traditional RAID 5



RAID 5 EE

Note: Supported RAID 5 EE and RAID 6 EE
Empty blocks are skipped

Benefits

Up to 58% less time to rebuild RAID
Better performance due to additional active drive in RAID Group

https://www.qsan.com/data/dl_files/QSAN_White%20Paper_SANOS_RAID%20EE%20Technology_1910_(en).pdf

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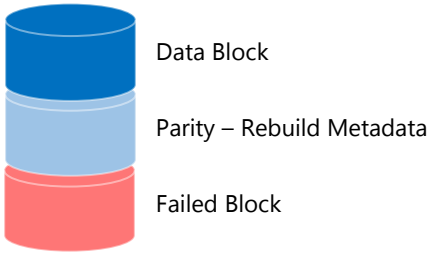
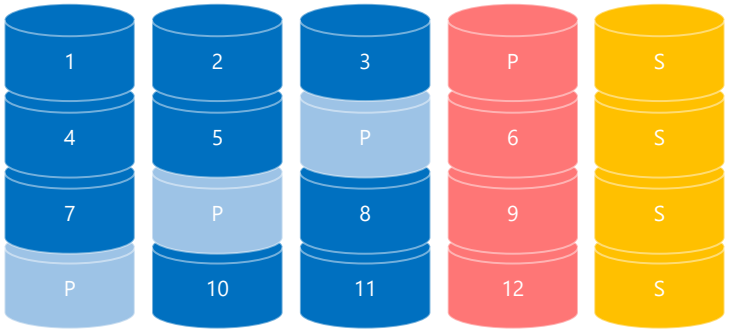
QSAN RAID EE in XCubeFAS & SAN



Traditional RAID 5



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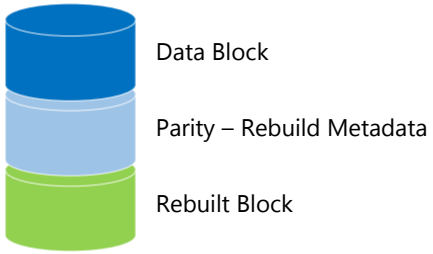
QSAN RAID EE in XCubeFAS & SAN



Traditional RAID 5

- The hot spare drives are inactive
- When a member drive fails, data is written to only one drive, which affects the IO performance
- RAID rebuild takes longer limited by the time taken to write an entire drive

RAID 5 EE

- Data is distributed between all drives, including spares, which increases IO performance
- Upon a drive failure, data is written into the spare capacity on many drives, thus saving rebuild time
- Performance impact on external IO is minimized during the rebuild process

Benefits

Up to 58% less time to rebuild RAID
Better performance due to additional active drive in RAID Group

https://www.qsan.com/data/dl_files/QSAN_White%20Paper_SANOS_RAID%20EE%20Technology_1910_(en).pdf

XCube Platform – One Architecture

Block Storage		File Storage	
XCubeFAS All-Flash Block Storage	**XCubeSAN** Hybrid-Flash Block Storage	**XCubeNXT** Unified Storage	**XCubeNAS** File Storage
Production Datastore AI/ML & HPC	Production Datastore Backup Surveillance	Datastore Backup Production	Datastore Backup Disaster Recovery

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XCubeSAN – Hybrid Flash Storage for SMB Workloads

	2U 12-bay	3U 16-bay	4U 24-bay	2U 26-bay
XS5300 Series (Intel® Ice-Lake D, XEON 8/4 Cores, 16GB to 256GB DDR4 Memory Per Controller)	XS5332D XS5312S	XS5316D XS5316S	XS5324D XS5324S	XS5326D XS5326S
XS3300 Series (Intel® Ice-Lake D, XEON 4 Cores, 8GB to 256GB DDR4 Memory Per Controller)	XS3312D XS3312S	XS3316D XS3316S	XS3324D XS3324S	XS3326D XS3326S
XD5300 Series (Expansion unit)	XD5312D XD5312S	XD5316D XD5316S	XD5324D XD5324S	XD5326D XD5326S

D: Dual Controller
S: Single Upgradable

LFF SFF

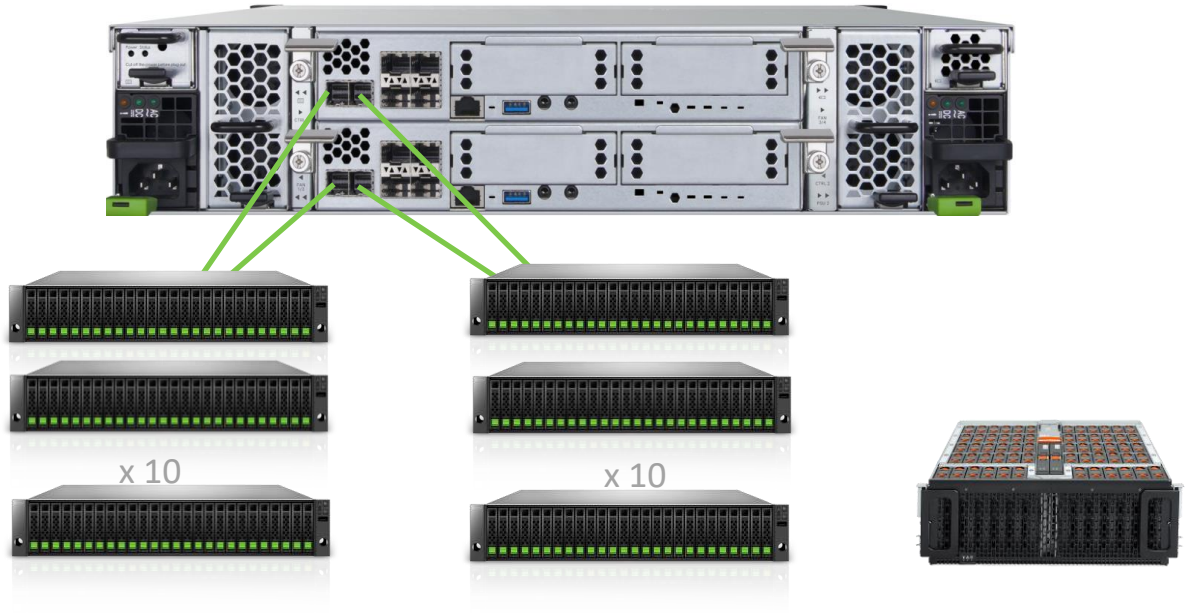
Onboard
8 x 10GbE SFP+ iSCSI

Optional Host Cards and Accessories:

- 2/4 port 16Gb FC
- 2/4 port 32Gb FC
- 2 port 10GbE iSCSI RJ45
- 2 port 25Gb iSCSI
- C2F 256G SC
- 4 port 10GbE iSCSI SFP+

Outstanding Scale-Up and Direct Host Attach

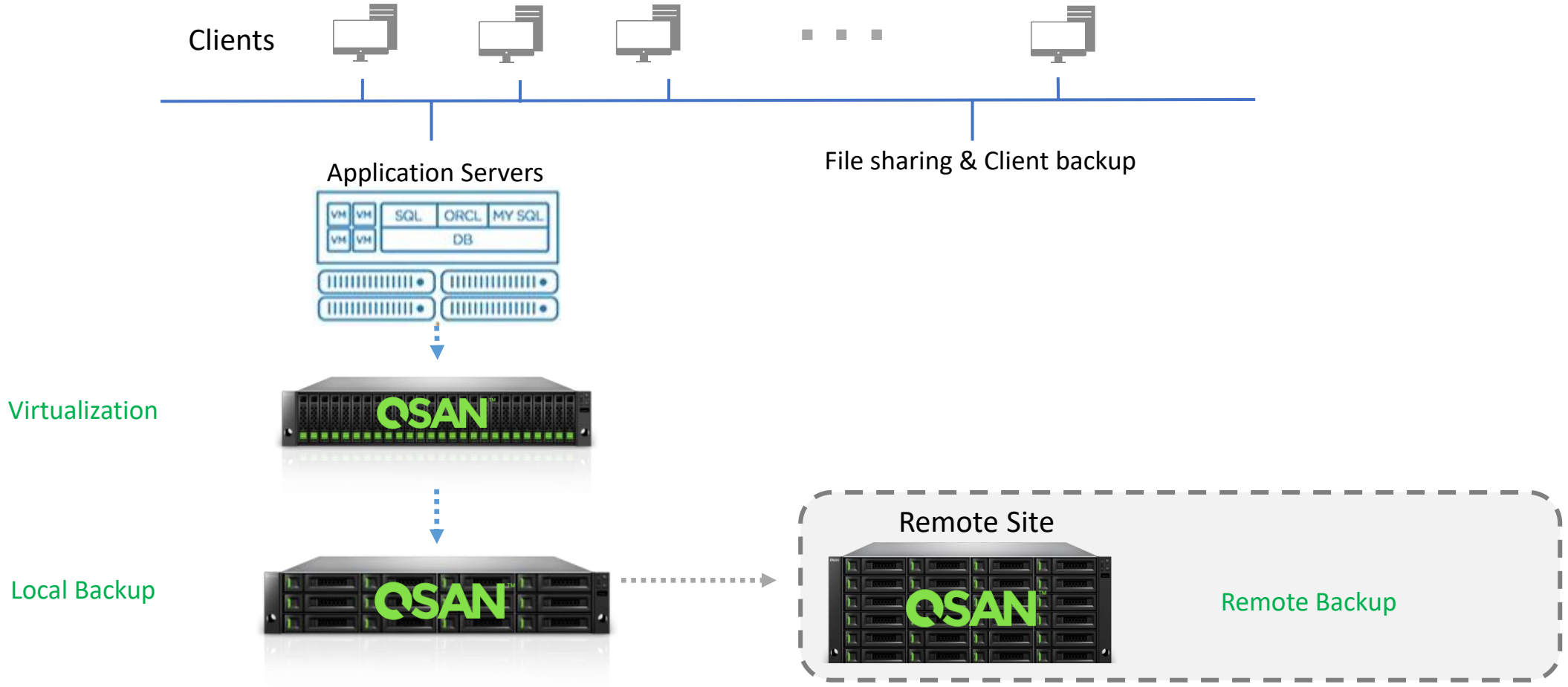
- **Max. 12 host connections per controller**



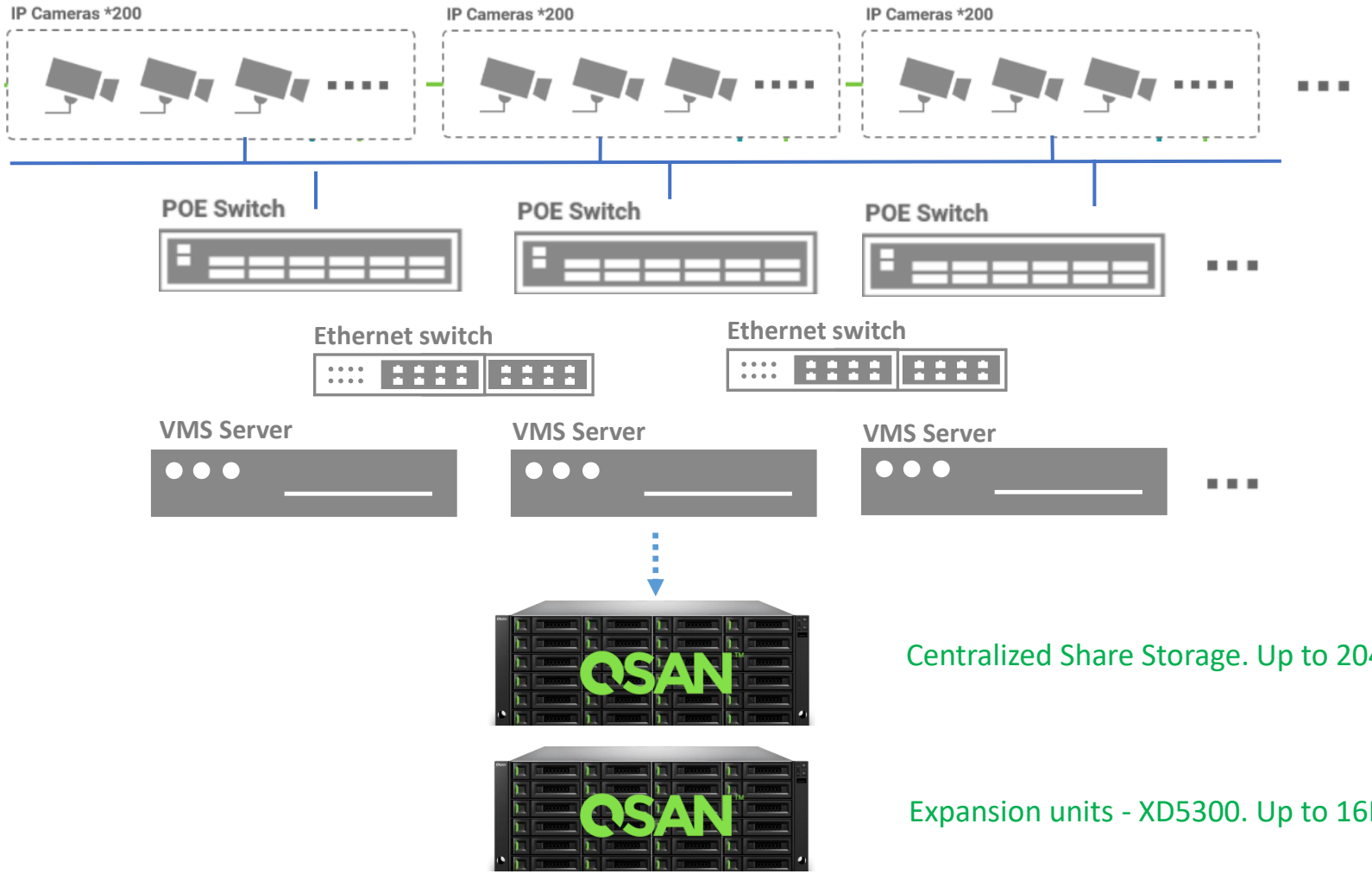
- **Up to 20*XD5300 or 4*3rd-party JBODs**
- **Max. 546 drives**
- **Max. 16PB raw capacity**

Ideal Applications

Ideal Application (1/4) – Enterprise IT



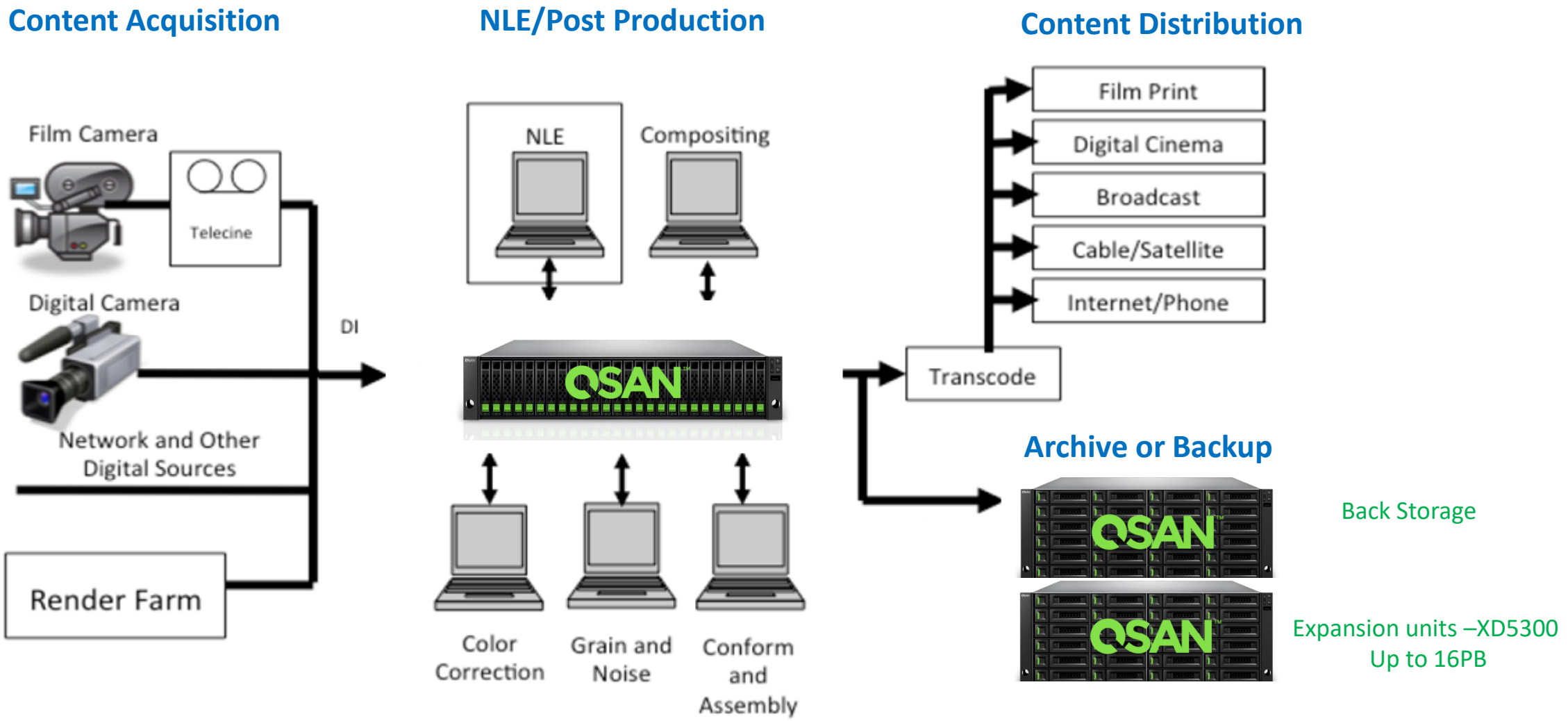
Ideal Application (2/4) – Large Surveillance



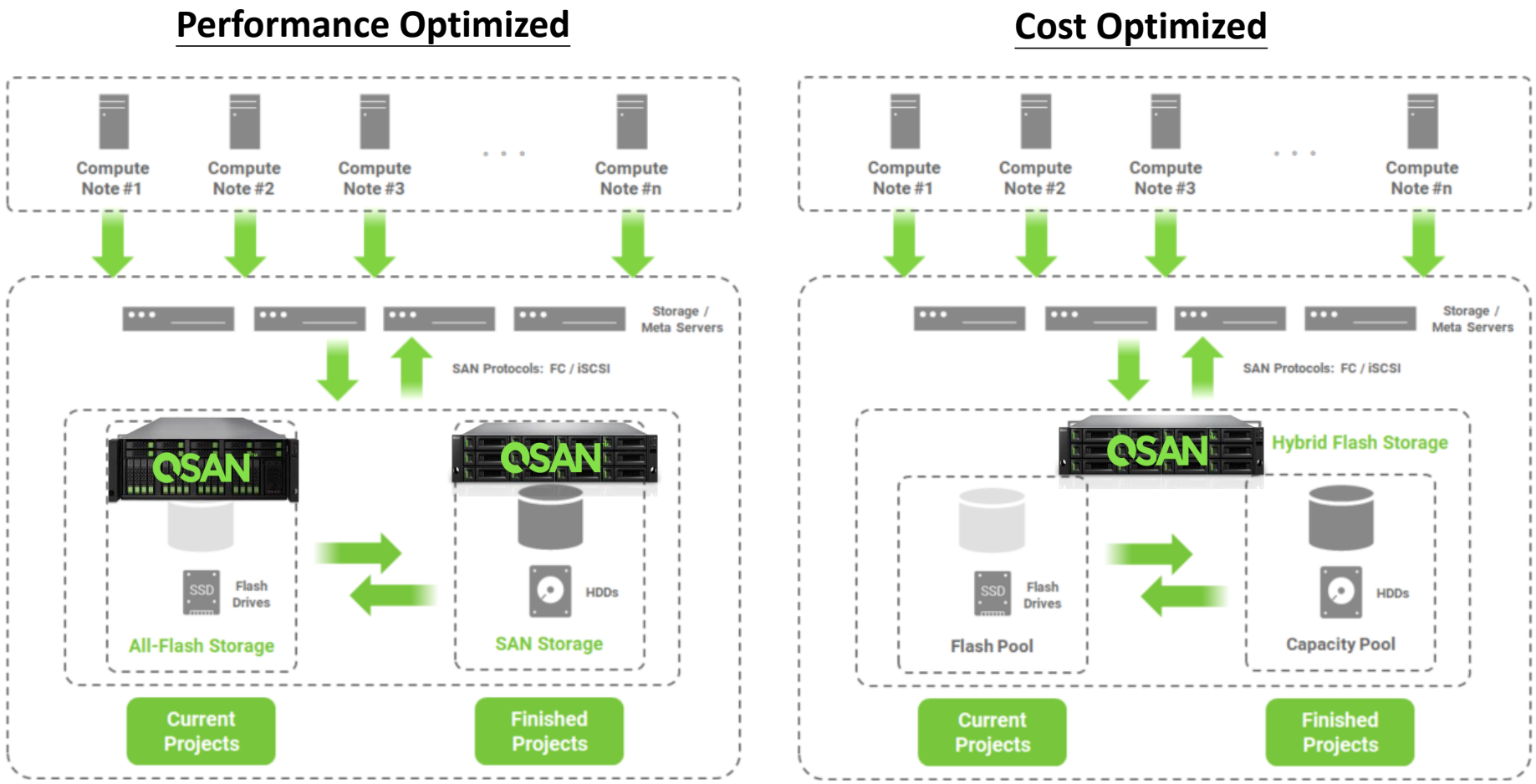
Centralized Share Storage. Up to 2048 cameras

Expansion units - XD5300. Up to 16PB

Ideal Application (3/4) – Media Editing



Ideal Application (4/4) – HPC&AI

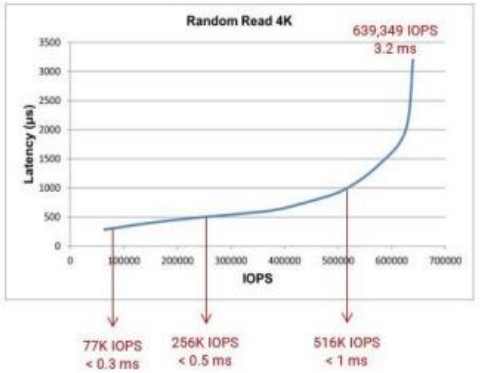


Summary – QSAN Block Storage Advantages

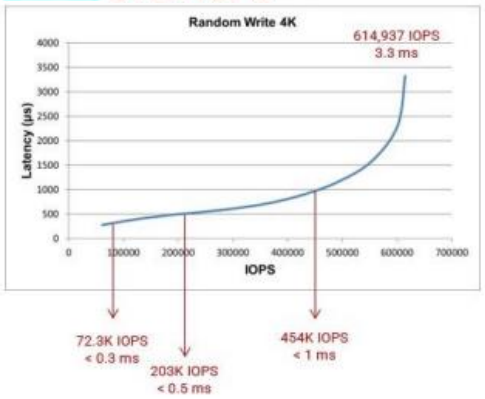
Leading price performance ratio

- XF3126D

RAID 10 **639K IOPS** Random Read 4K

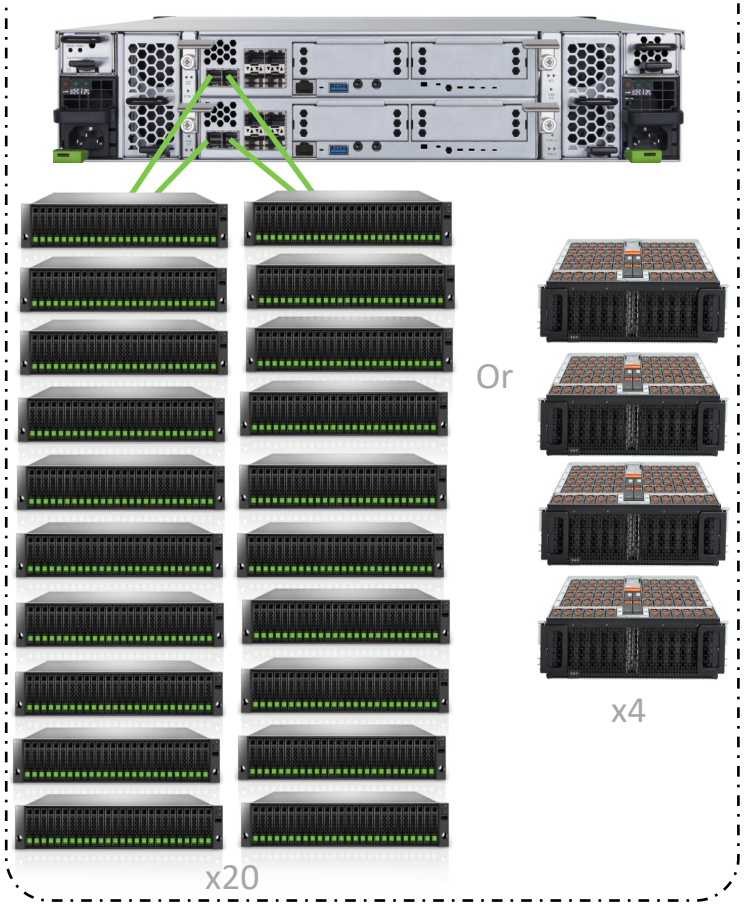


RAID 10 **615K IOPS** Random Write 4K



Scale up capability

- XS5300/XS3300 series
  - Up to 16 PB



Extreme simplicity in management

- Flash-optimized management system for AFA and HFA

- 5 mins setup
- Intuitive GUI w/ wizard
- Historical performance report
- Host group
- Build multi-volume up to #4096 at a time

Thank you.

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071 082 079 087 073 078 071 032 087 073 084 072 032 080 065 082 084 078 069 082 083
068 069 076 073 086 069 082 073 078 071 032 085 078 073 081 085 069 032 080 082 079 068 085 067 084 032 086 065 076 085 069 013 010