



Micron Storage Solutions

SSD kill the mechanical disk Star

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Enterprise Sales EMEA

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Who is Micron?



We are the 75% of your server value.

Our memory & storage solutions make your workloads

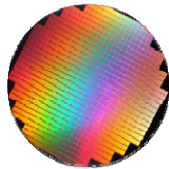
faster



greener



...just better



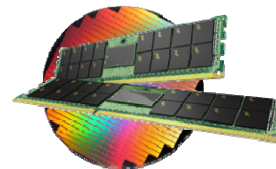
4

NAND Flash
Manufacturers



3

DRAM Manufacturers



2

Both DRAM
& NAND
for the Enterprise



1

The only
firm with the next generation
memory solution (3DXPoint)

Micron's Major Brands

- » Micron – Enterprise Focused
- » Crucial – Business and Consumer
- » Lexar – Consumer
- » Ballistix - Gaming



Micron
Consumer Products Group

Micron

Micron® enterprise-class SSDs deliver industry-leading performance and the most complete portfolio of SATA, SAS, and PCIe drives.

crucial
by **Micron**

Crucial® SSDs and DRAM deliver reliable performance gains for more than 50,000 desktops, laptops, servers, and workstations.

Lexar
by **Micron**

Lexar® memory cards, card readers, and USB flash drives deliver performance that's trusted by professional photographers and consumers.

Innovation – Customer Thought Leadership

World's Largest Web-Scale Companies use Micron Memory & SSDs



Gartner:

"By 2017, Web-Scale will be an architectural approach found operating in 50% of Global Enterprises"

Innovation – Customer Thought Leadership

Some of Europe's Largest Firms

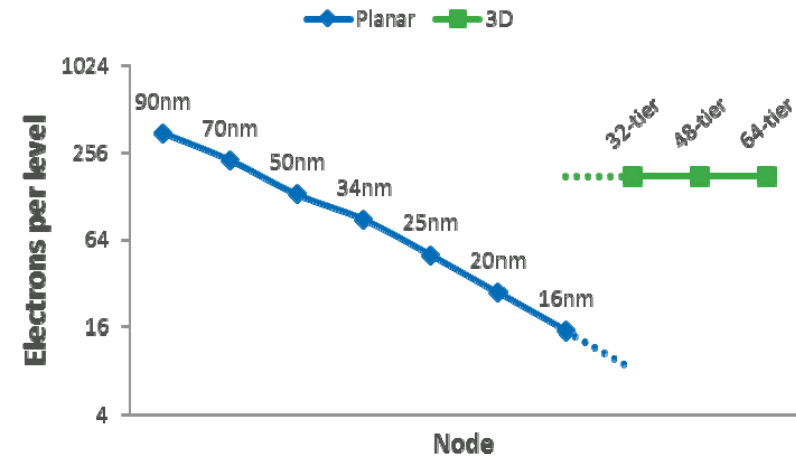
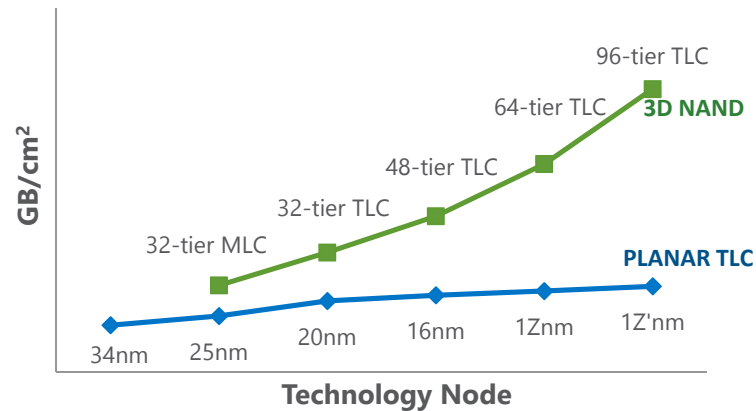


Industry Trends & Market Views

What is going on with Technology and the Market



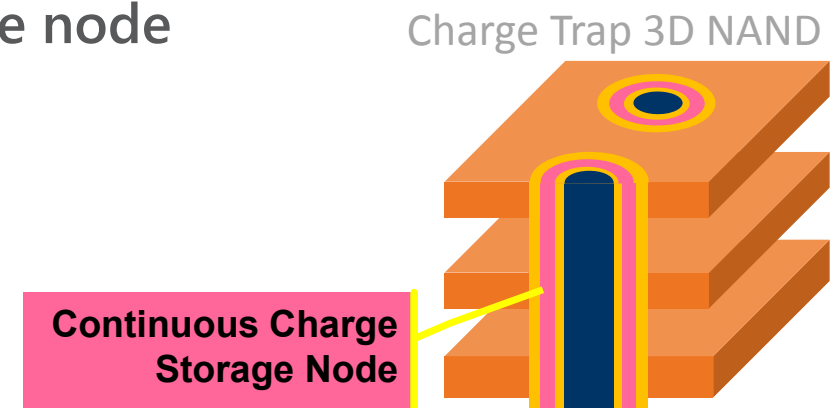
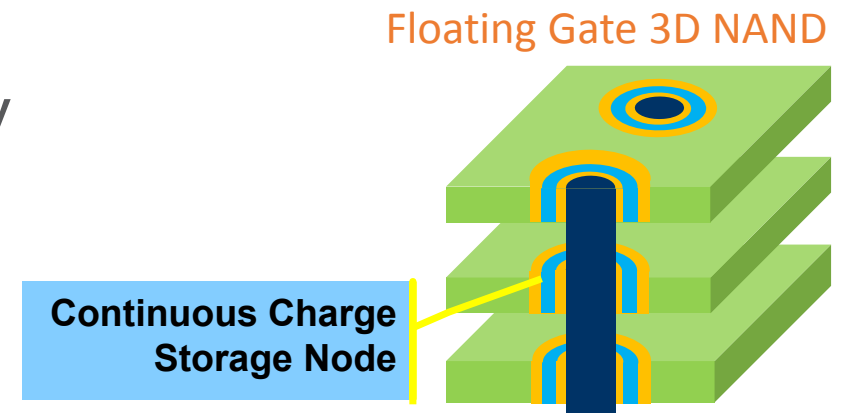
NAND Scaling Trend



- 2D NAND scaling has slowed due to physics limitations
- 3D NAND enables further scaling with improved cell reliability
 - Vertical stacking allows large number of electrons per cell independent of scaling
 - No longer relying on lithography to continue scaling
 - Decreased interference between cells translates into higher cycling endurance

Micron's Cell Technology Choice

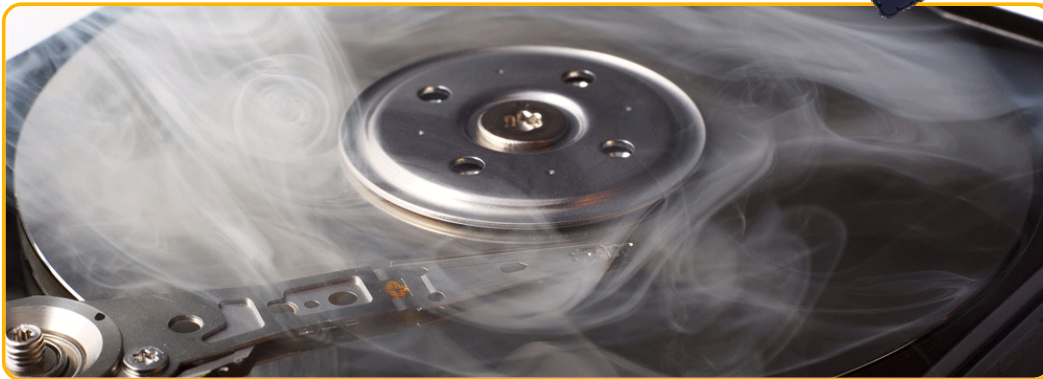
- **Micron Utilizes Floating gate cell technology**
 - Smaller cell footprint
 - Charge isolation between cells
 - Preserves data retention benefits
- **Others have focused on a charge trap storage node**
 - Larger cell footprint
 - Charge dispersion between cells
 - Leads to data retention failure



Solid State Storage Eclipses Spinning Disks



- Dramatically Lower \$/IOPS
- Rapidly Increasing Density
- No Moving Parts
 - Higher Reliability
 - Lower Power and Heat
 - Smaller footprint form factors



- IOPS per GB Decreasing
- Capacity Growth Slowing
- Performance Requires
 - Short Stroking
 - Striping Across Many

5100 ECO vs. 10K HDD

TOTAL COST OF OWNERSHIP

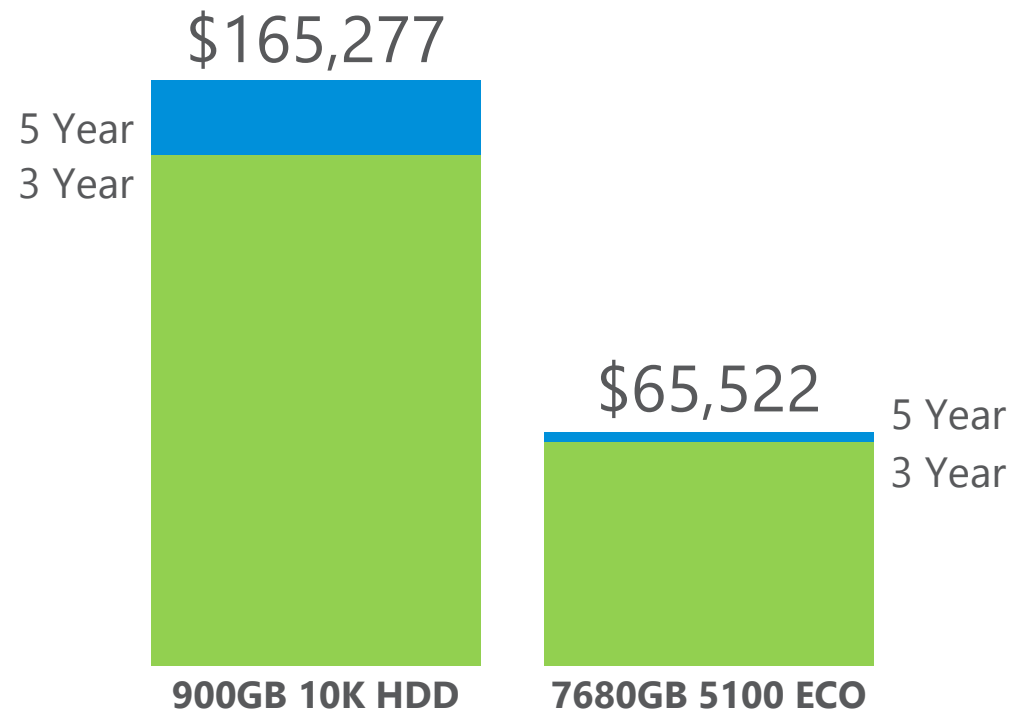
High Performance Storage Solution

91% Fewer Drives
(22 vs. 240)

Identical Capacity

20X Higher Performance
(2046K vs. 96K IOPS)

66% Lower TCO
(\$65K vs. \$165K)



10K HDD System – 900GB 10K HDD, MSRP of \$375 per newegg.com, 400 IOPS, 7.6W, 24 HDDs per chassis, RAID5, 80% utilization; 5100 ECO SSD System – 7860GB, 93K IOPS, 6W, 24 HDDs per chassis; Chassis cost of \$2200, \$0.077/KWh, Cooling Factor of 1.7, 100% Read, Queue Depth 32, 4KB block size, 100% random

SSDs Versus HDDs: A deeper look

Micron® S610DC SAS SSD

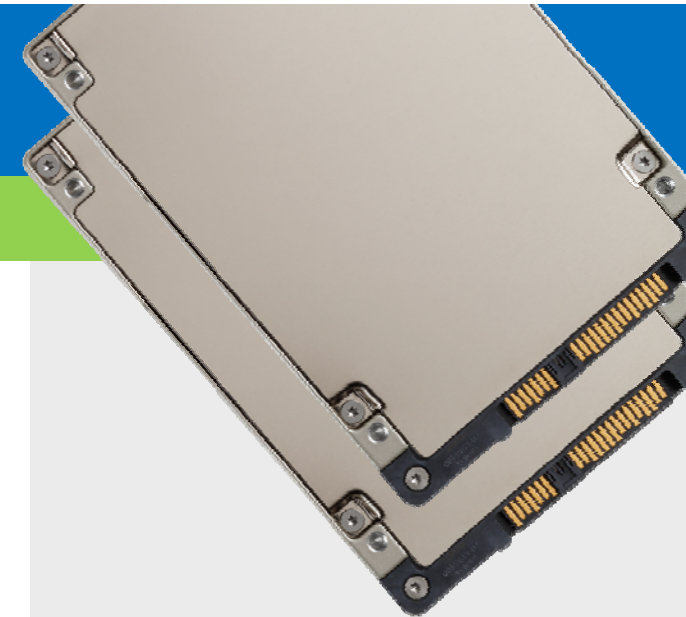
SYSTEM COMPARISON

BEFORE		AFTER	
▪ Dell R730	\$4,550	▪ Dell R730	\$4,550
▪ 96 x 15K 300GB	\$30,240	▪ 8 x S610DC 3.84TB	\$24,480
- No Parity		- No Parity	
- 28.8TB Usable Capacity		- 30.72TB Usable Capacity	
- 57.6K Read\Write IOP		- 1.52M/120K Read/Write IOPS	
▪ 4 x 24 Drive JBOD	\$5,200	▪ Item	
Total	\$39,990	Total	\$29,030

KEY BENEFITS

- ✓ 2X the Write Performance
- ✓ 26X the Read Performance
- ✓ 27% Lower Acquisition Cost
- ✓ Greater Capacity
- ✓ 80% Less Rack Space
- ✓ Fewer Drives to Manage
- ✓ Higher System Reliability

Dell R730, Intel Xeon E5-2660 v3, 64GB RDRAM, PERC H730 – www.dell.com – MSRP OCT15
15K SAS HDD - \$1.05/GB – estimated
15K SAS HDD – 600 Read/Write IOPS

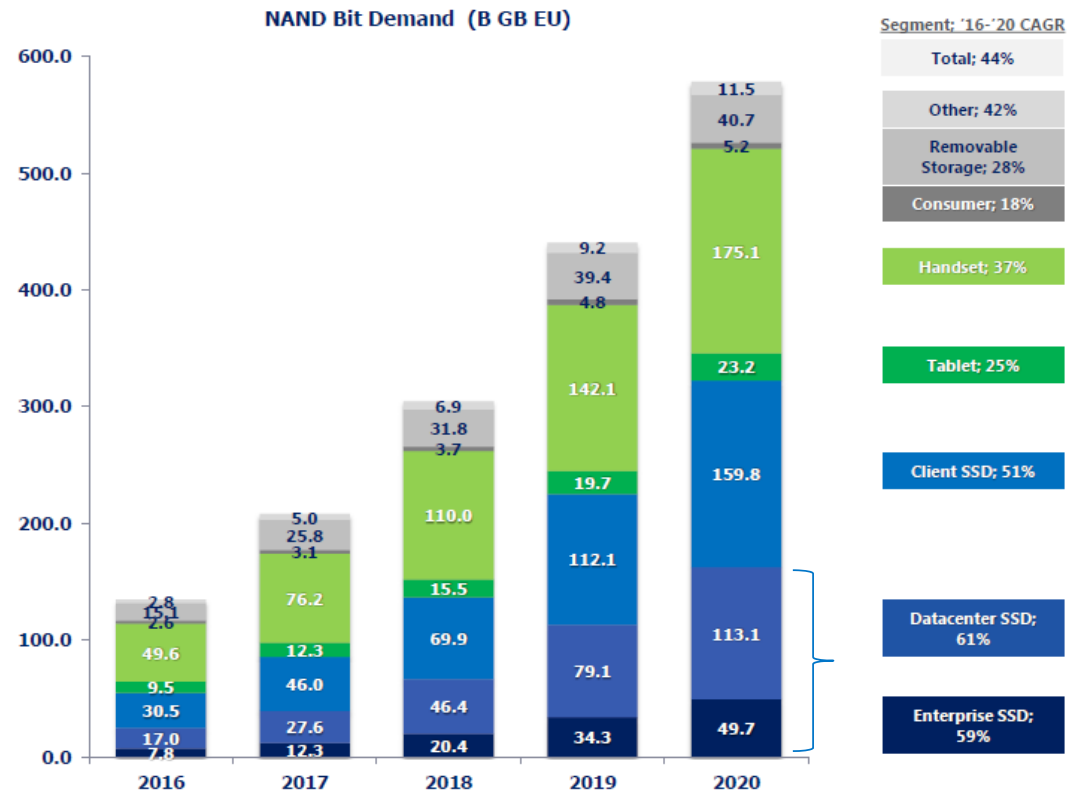


SSD Growth Rate

SSDs are the fastest growing segment of flash bit growth

Enterprise and data center growth are the fastest growing SSD segments

NAND Bit Demand Segmentation SSD'S GROW DEMAND SHARE

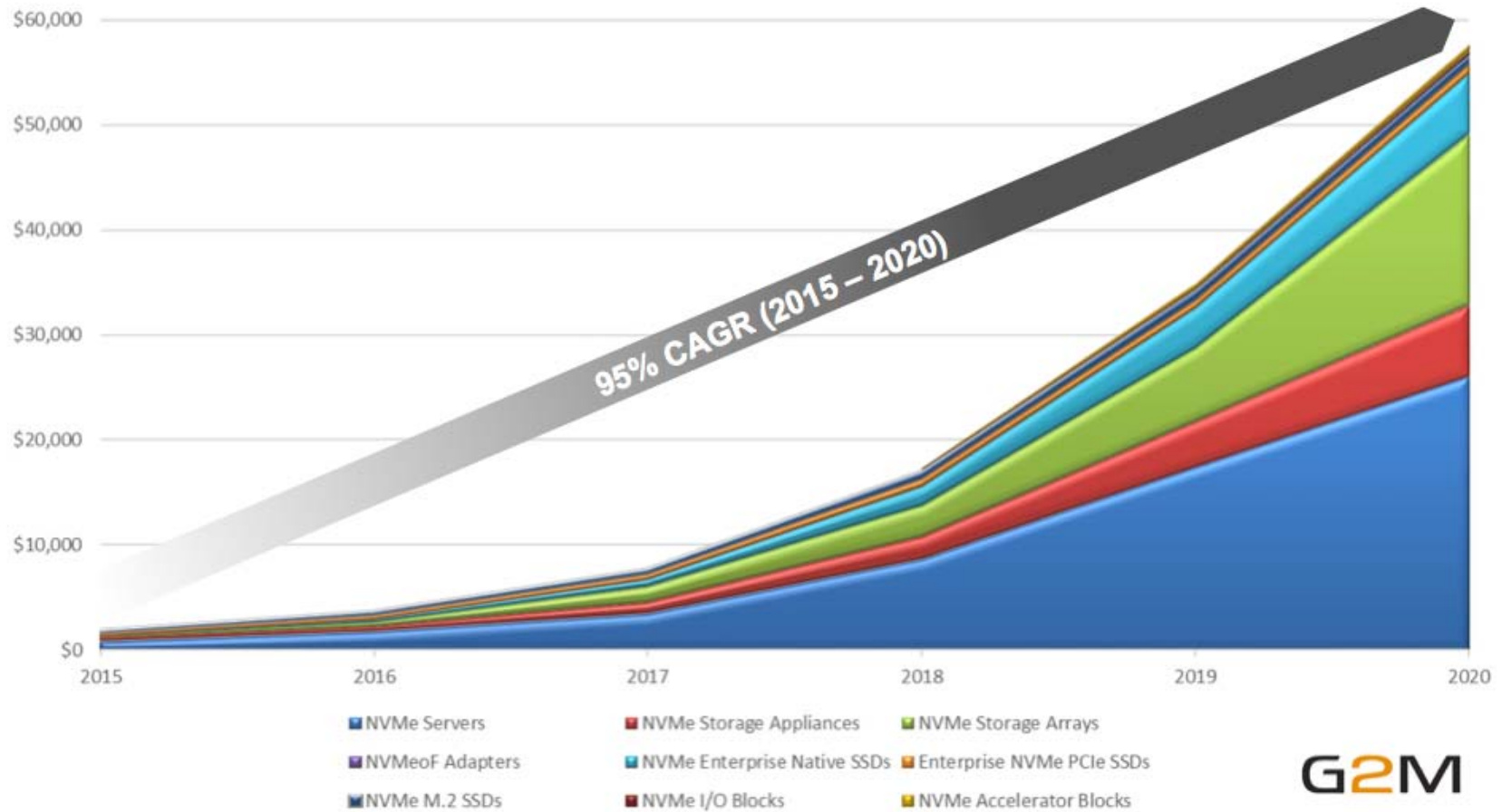


Source: FSG, with BU collaboration

Tablet includes tablets with SSDs
Other includes H-HDD, Enterprise IDC/OEM, AIMM, Networki
Consumer includes MP3/PMP, DSC, DVC, Gaming, Graphics, F



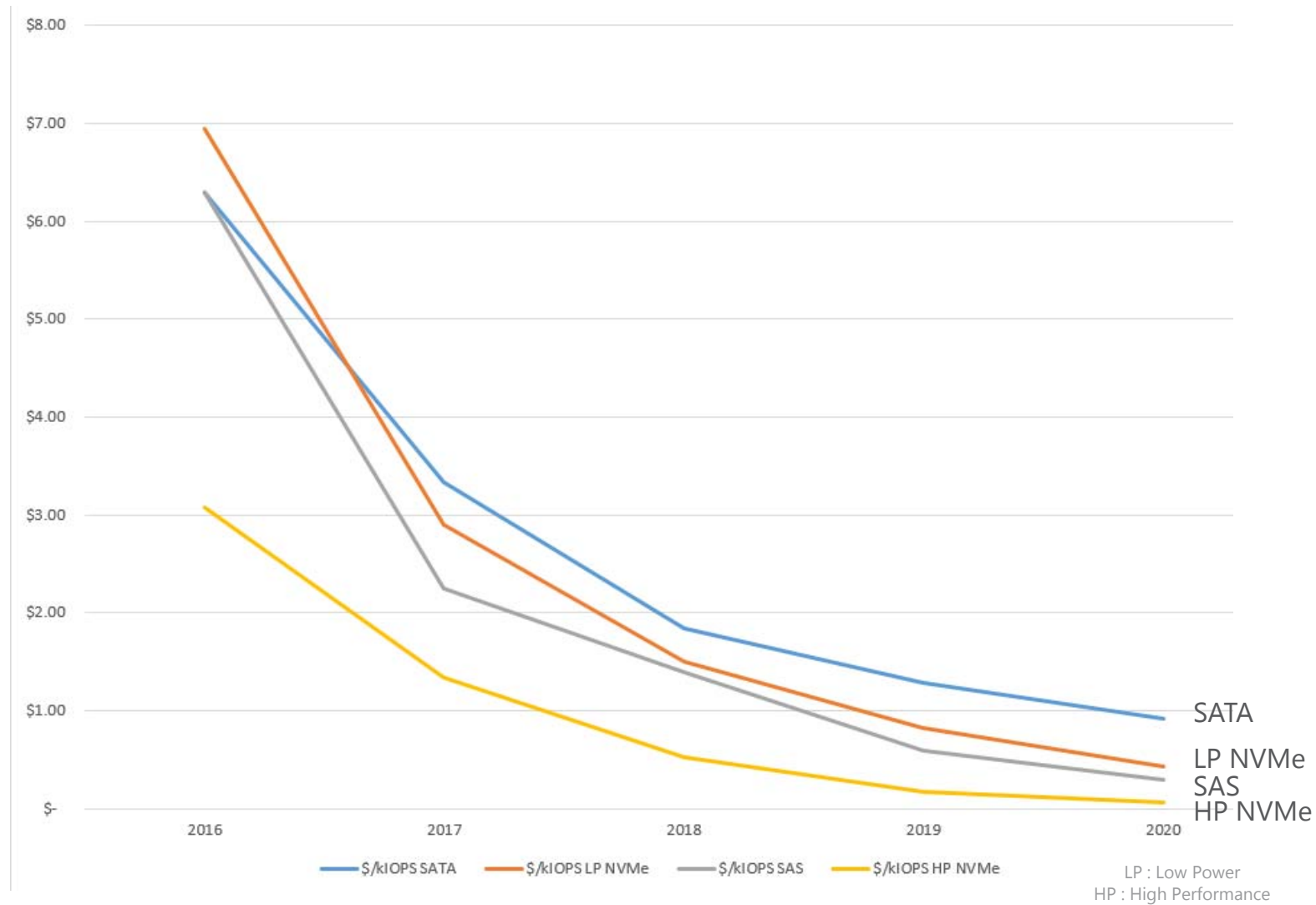
NVMe Servers Grow from \$2B to \$25B by 2020



\$ / IOP Trend

- HP NVMe is the least expensive \$/ IOP
- SATA is the lowest cost / GB but highest in \$ / IOP

Disclaimer :
pre-shortage
view



Server Based Storage Adoption

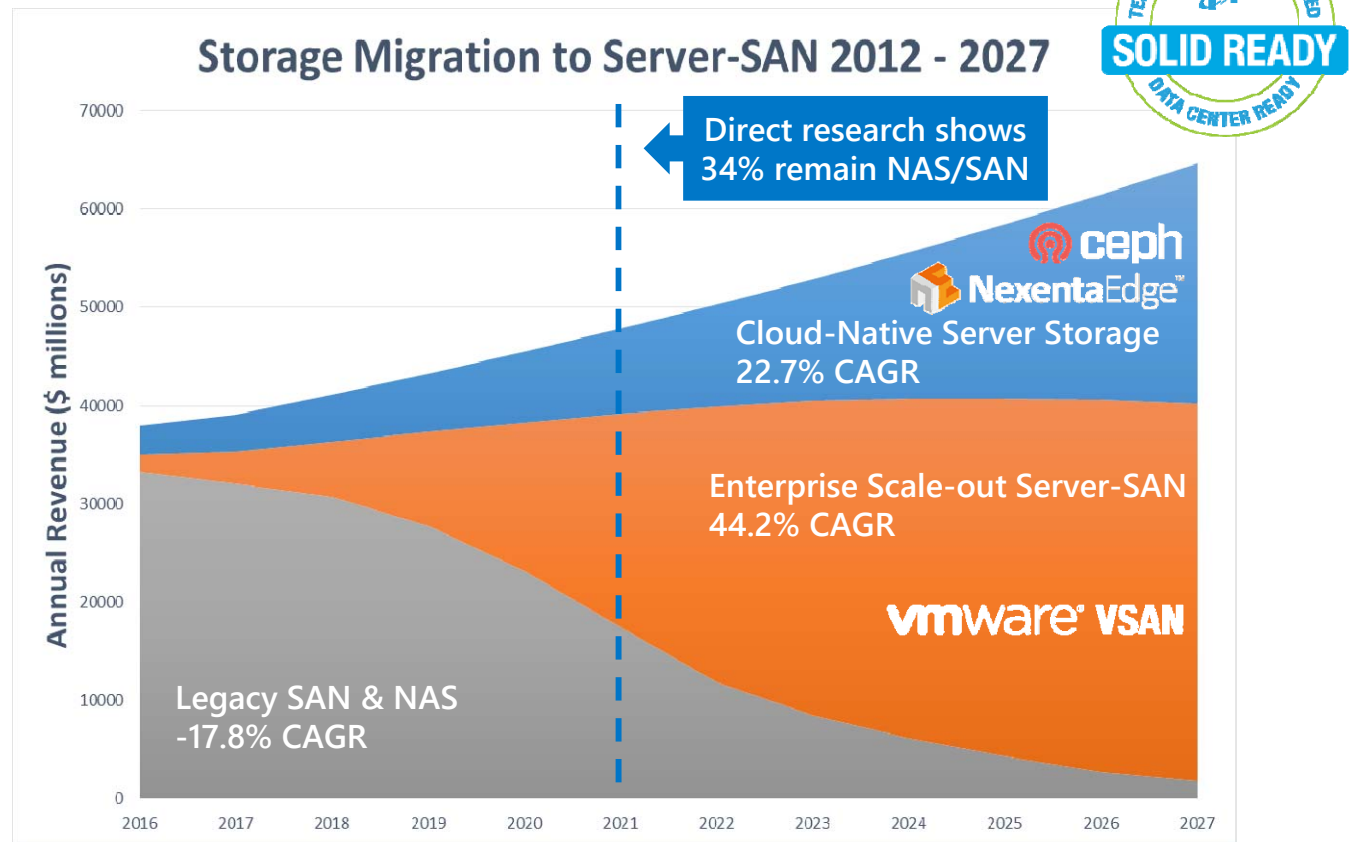
THE SERVERIFICATION OF STORAGE

Frame-based Arrays

Transitions Rapidly to

Server-based Storage

- “Serverfication” the server becomes the primary storage element both for legacy and next-gen applications
- Server based storage reduces the cost and complexity of legacy applications freeing up resources to focus on next-gen cloud-native apps




Latency Kills

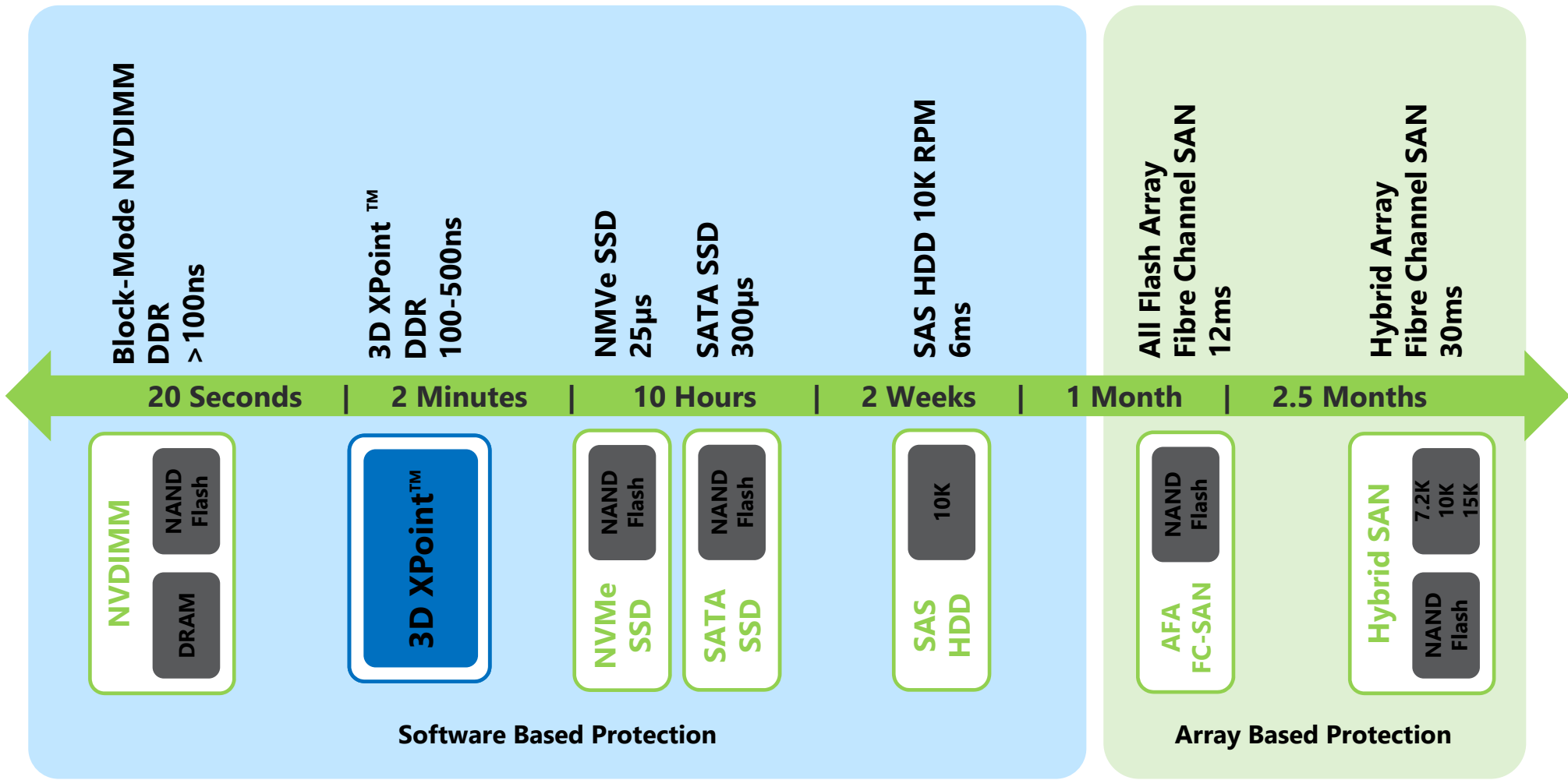
Cost of Latency

 “...every 100ms of latency cost them 1% in sales”

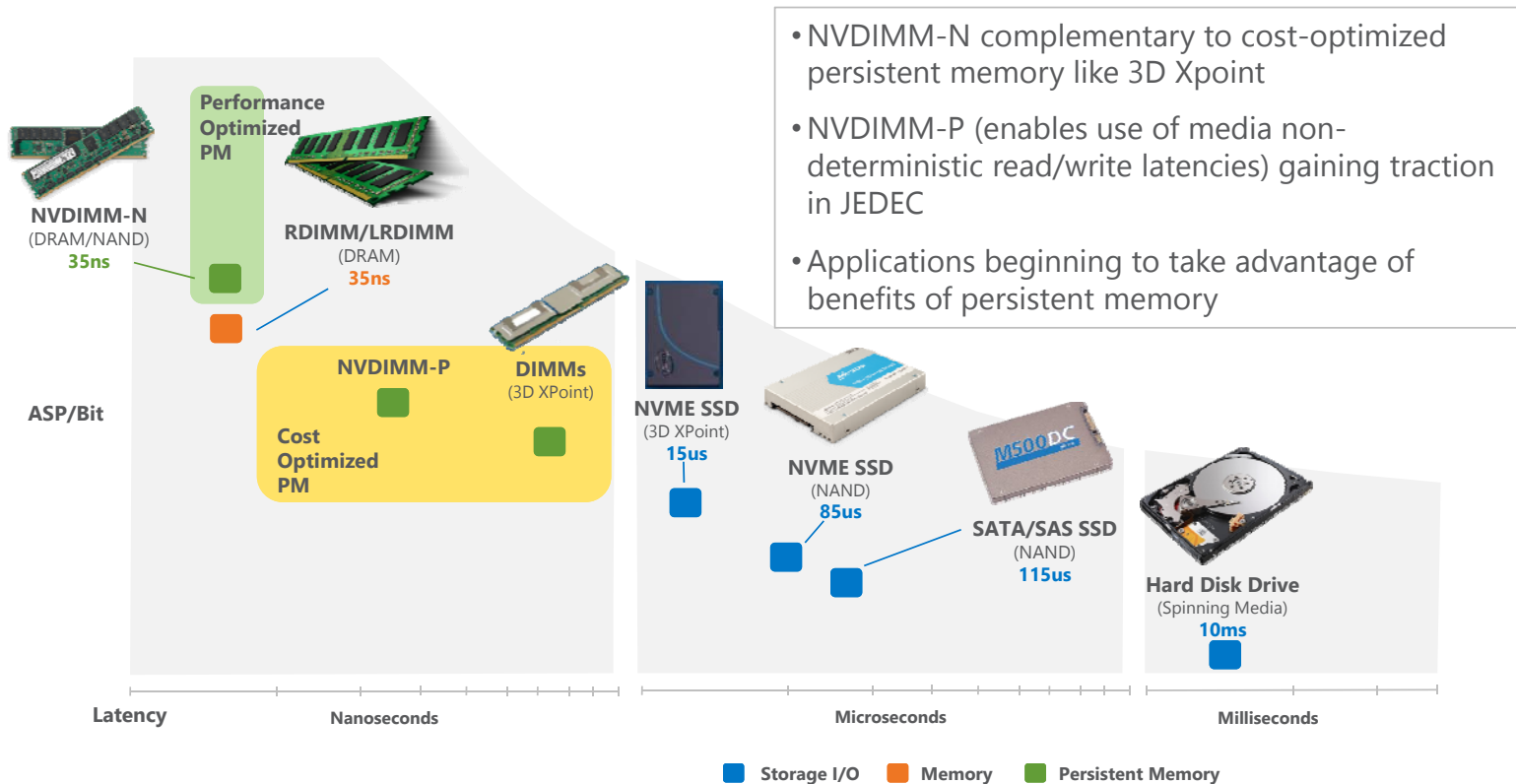
 “...an extra 500ms in search page generation time dropped traffic by 20%”

 “...a broker could lose \$4M per millisecond if their electronic trading platform is 5ms behind the competition”

April 25, 2016



Memory/Storage Technology Hierarchy



- NVDIMM-N complementary to cost-optimized persistent memory like 3D Xpoint
- NVDIMM-P (enables use of media non-deterministic read/write latencies) gaining traction in JEDEC
- Applications beginning to take advantage of benefits of persistent memory

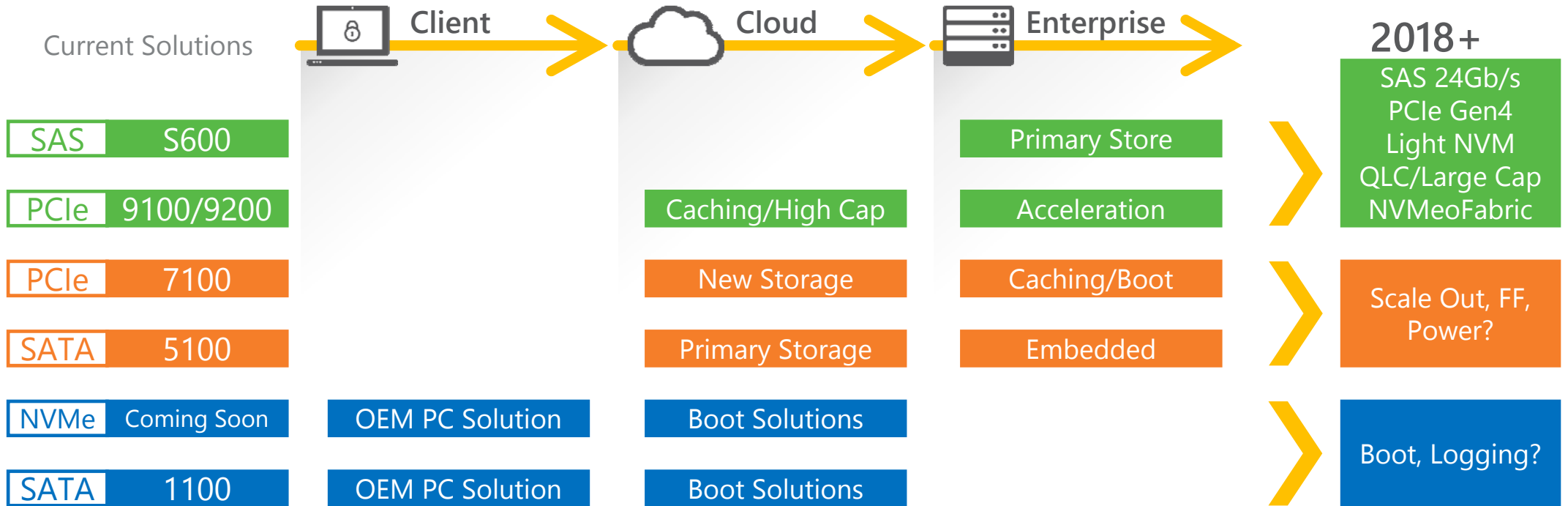


Micron SSD Roadmaps

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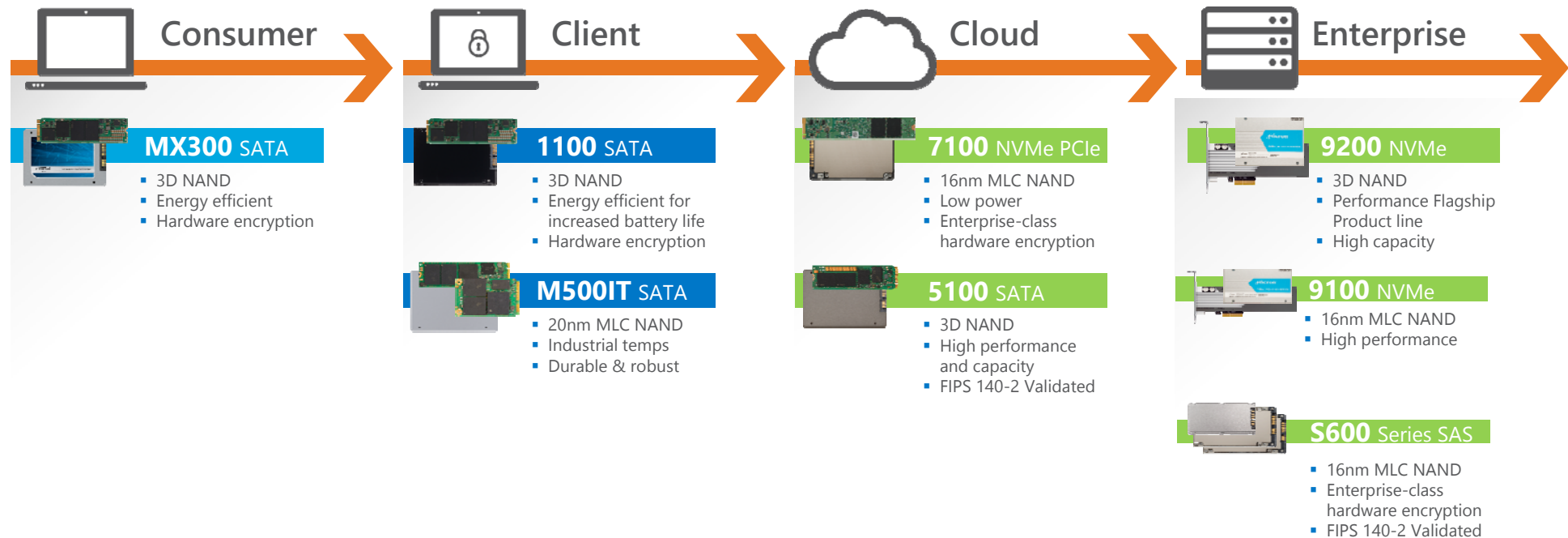
Micron SSD Portfolio by Market Segment & Future Trends



Planning for the Future Now... What trends interest you?

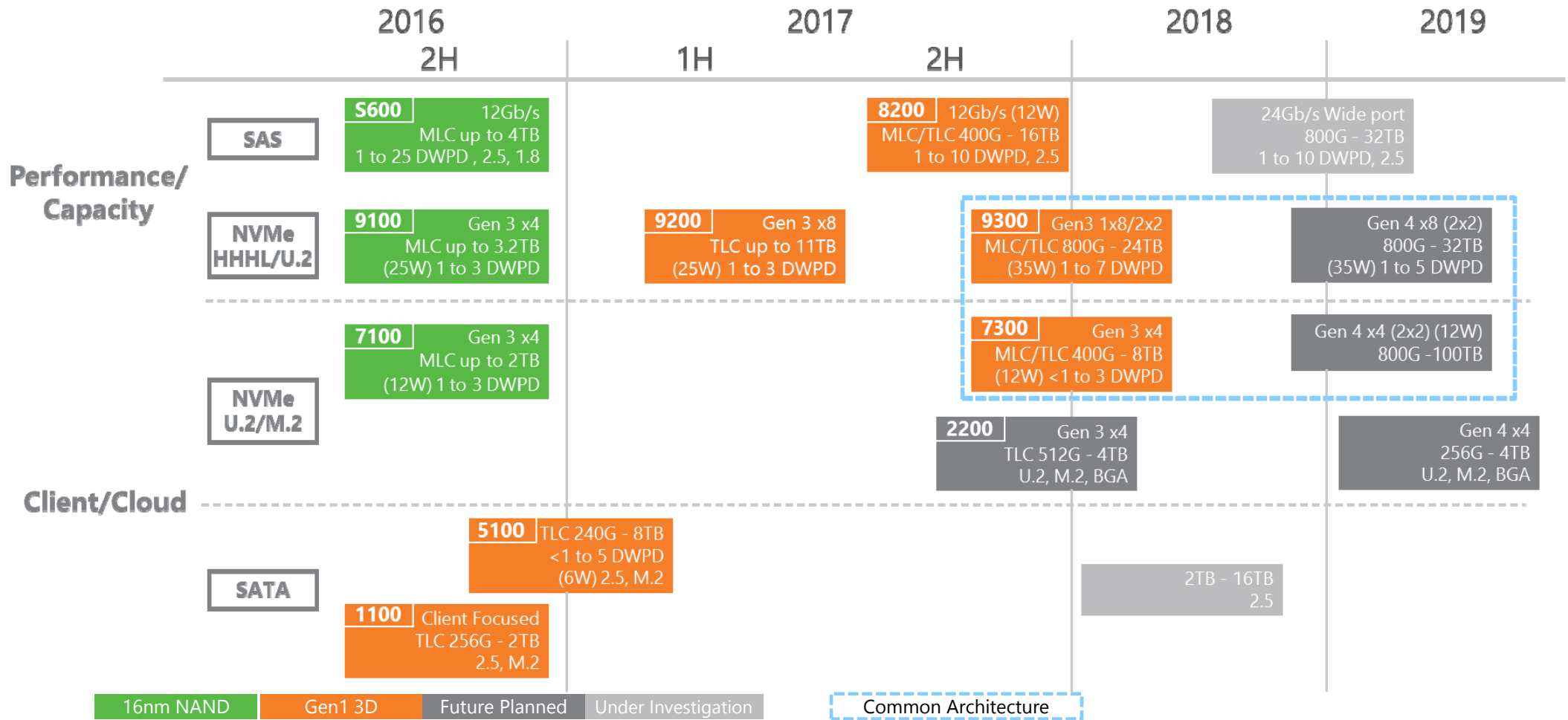


Micron® SSDs Deliver Data at the Speed of Now



Micron's 9200 NVMe PCIe SSDs: Blazing performance to revolutionize how you compute
Micron 5100 Series SSDs: flexibility for deployment and redeployment + security piece of mind

Micron Storage Portfolio Roadmap



HPC and Grid farms

- Checkpointing
 - Is it cheaper for me to lose the data than store it?
 - Store to central location, NAS or SAN, or do it on the compute node.
 - Can NVMe SSDs or/and NVDIMM help speed up the checkpoint process through lower latency and higher throughput.

- Boot from local drive
 - Does the speed of recovery of a node matter?
 - Reboots and reimage takes time. Speed it up with SSD.

