

Why NVMe Will Replace SATA SSDs in the Data Center

Michael Smullen

Enterprise & Cloud SSD Marketing

Samsung Semiconductor Inc.

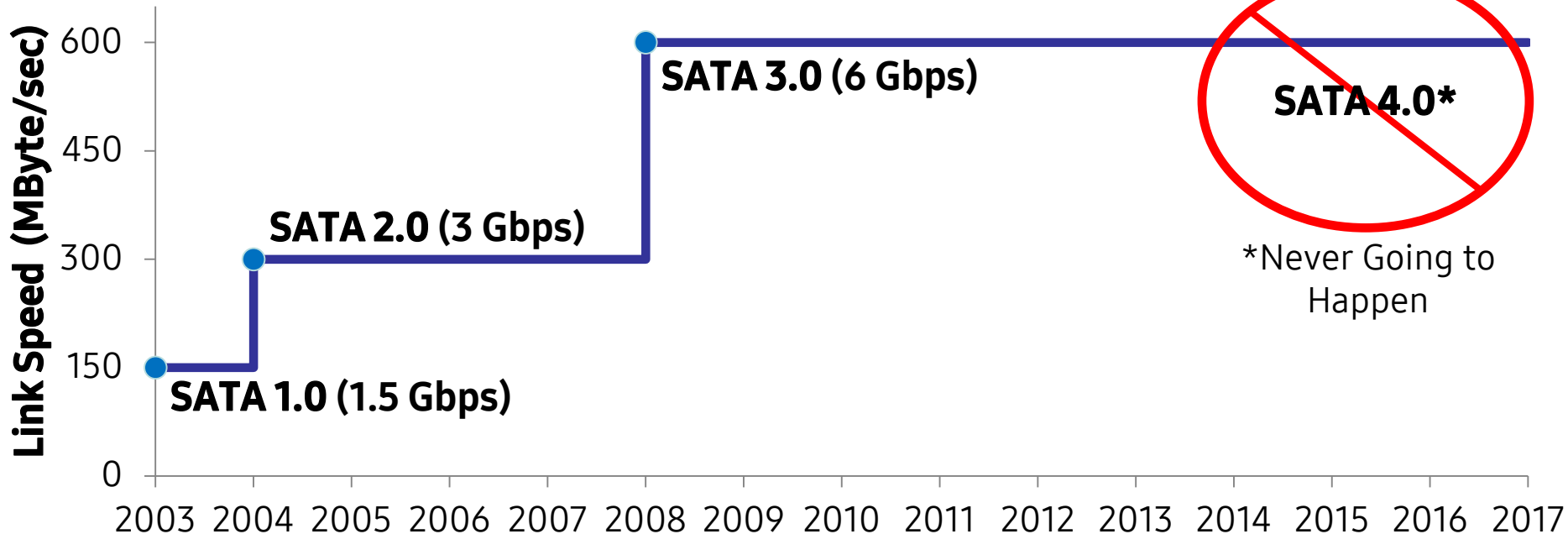


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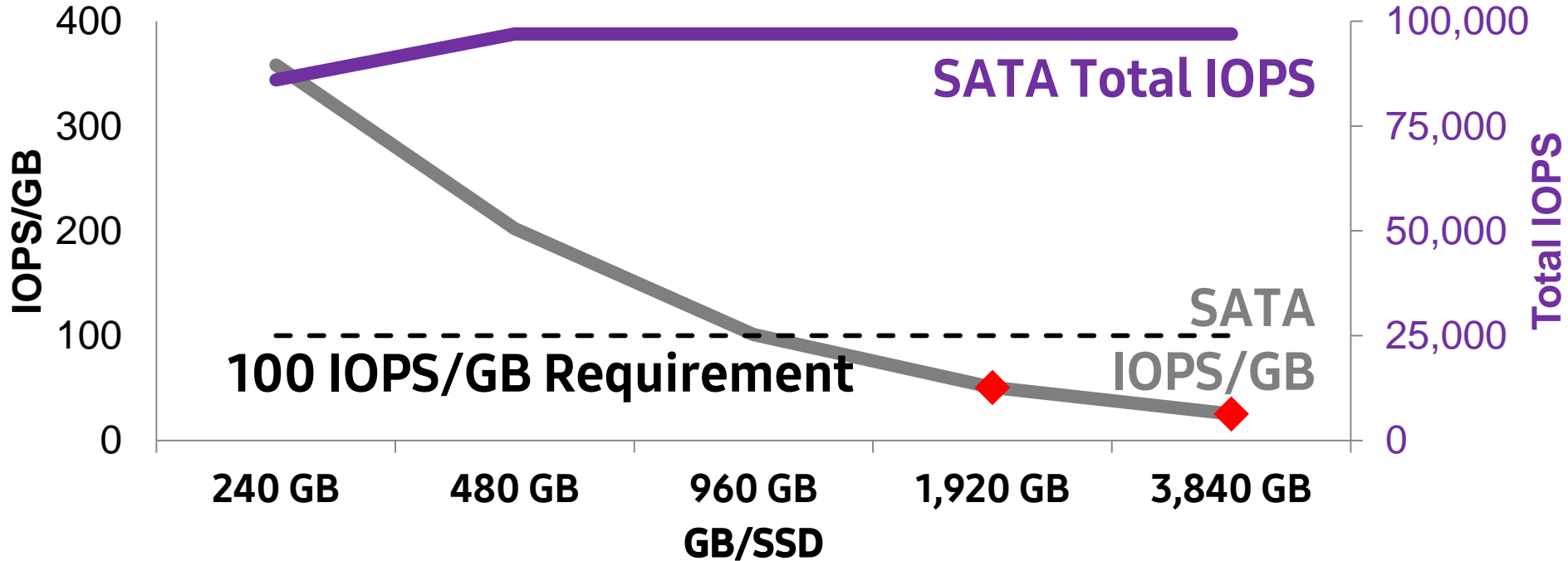
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Serial ATA Performance “Flat-line”



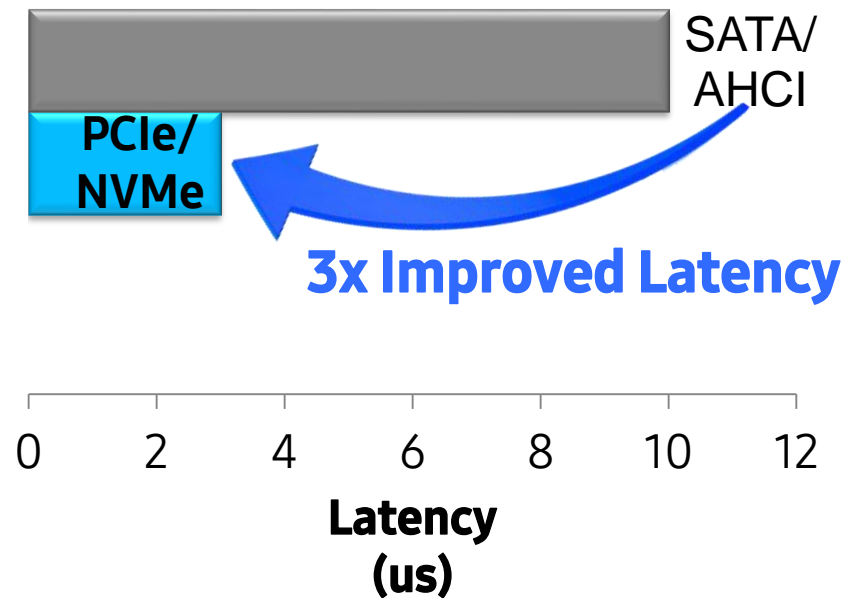
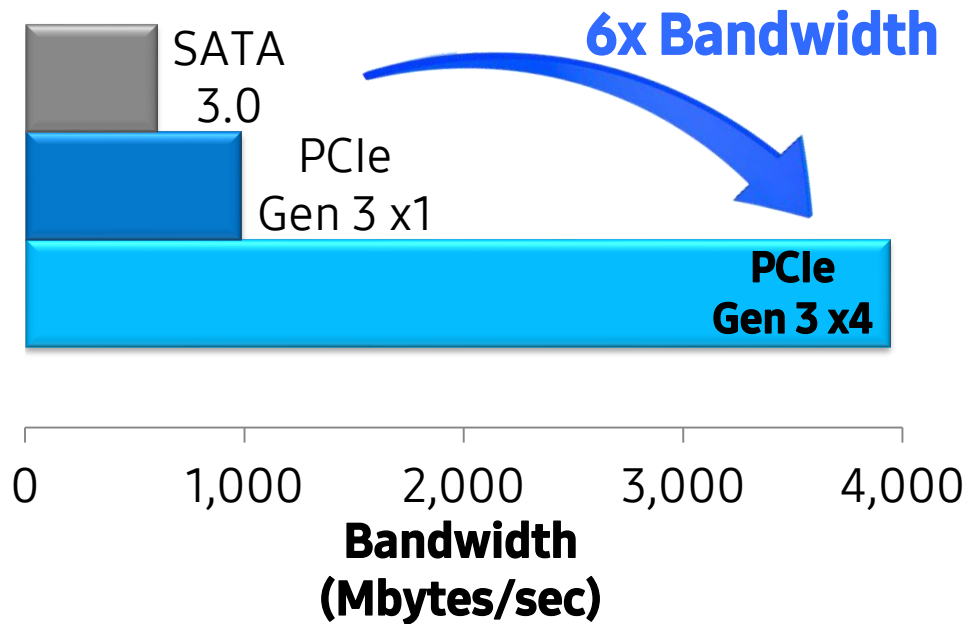
*HDD Protocol Does Not Scale
With SSD Performance*

Performance Limits SATA Capacity

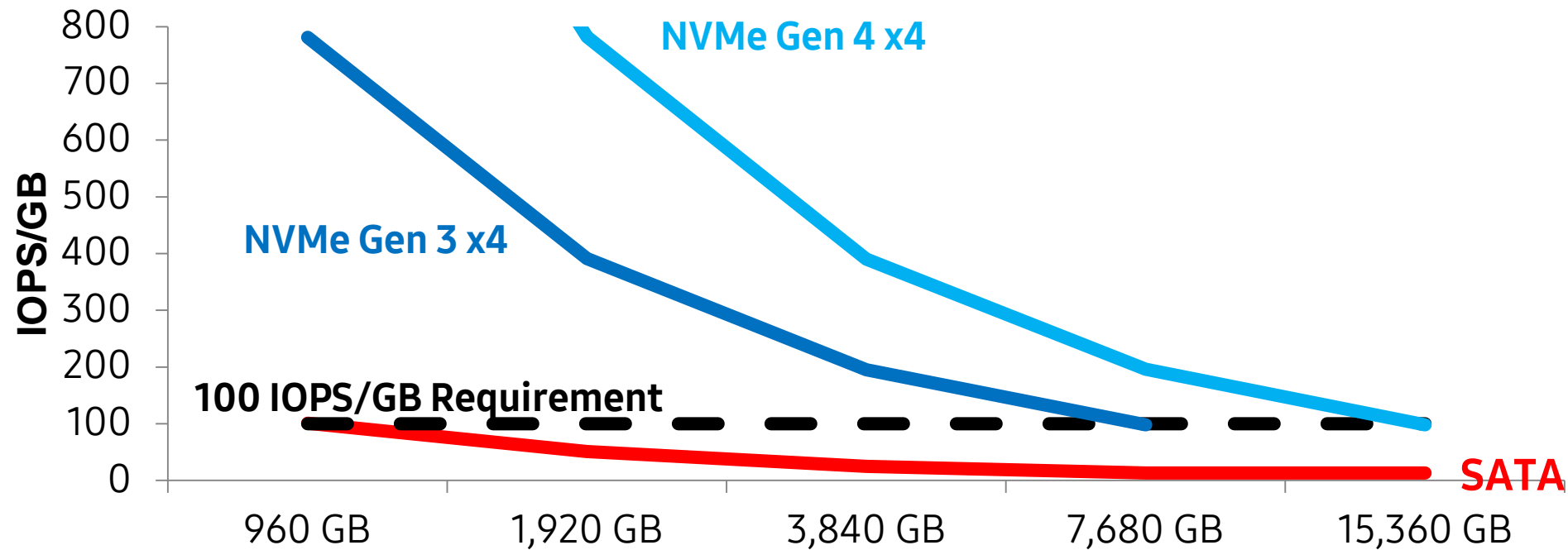


***100 IOPS/GB Requirement
Limits SATA Capacity to 960GB***

PCI-Express & NVMe Advantages



NVMe Extends SSD Capacity



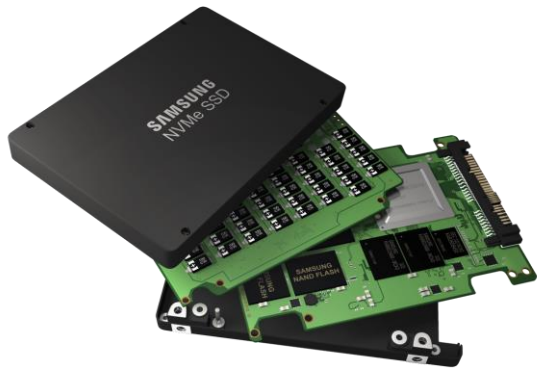
NVMe Retains IOPS Density at High Capacity

Enterprise NVMe SSD Proliferation

2013

2014

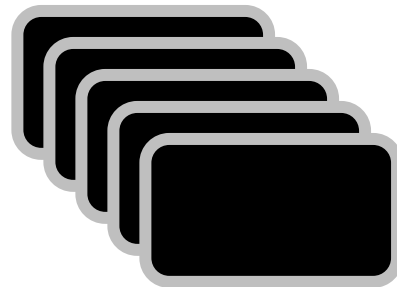
2015+



Samsung XS1715



Intel DC P3x00





Everyone Else

Enterprise NVMe vs. SATA SSDs

	Enterprise NVMe SSDs	SATA SSDs
Performance	=====	=
Power Consumption	~25 Watts	< 10 Watts
Physical Size	2.5" 15mm, HHHL	2.5" 7mm
Acquisition Cost	\$\$\$	\$

Data Center Optimized NVMe SSDs

Enterprise NVMe SSDs	Data Center NVMe SSDs	Data Center SSD Score Card
=====	=====	Good Performance
~25 Watts	< 10 Watts	60%+ Power Savings
HHHL 	M.2 	Dramatically Smaller
2.5" 15 mm	2.5" 7 mm	Half the Size
\$\$\$	\$	Similar to SATA SSD

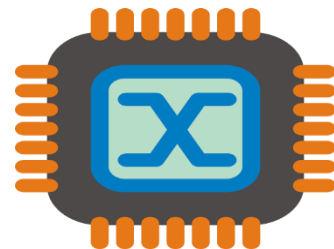
Enterprise Ecosystem: Challenges



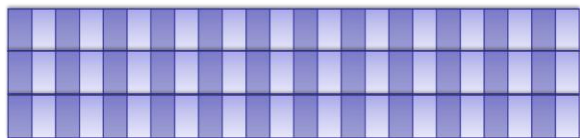
O/S Drivers



BIOS



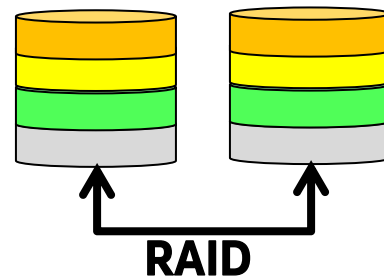
PCIe Lane Count



Server U.2 Drive Bays



Encryption

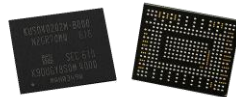


Enterprise Ecosystem: Scorecard

		Ecosystem Status
Drivers	Green	Current Windows/Linux OK
BIOS	Green	Hot Plug BIOS Support
PCIe Switch Chips	Green	2+ Vendors
Server CPU PCIe Lanes	Yellow	x2 Link Training, PCIe Switching, CPUs Lane
Server U.2 Drive Bays	Yellow	Up to 48x U.2 Drives per Server
Encryption	Yellow	Software/TPM in Cloud; Self-Encrypting Drives
NVMe RAID Solutions	Red	Data Replication, Software RAID, Tri-Mode HBA

NVMe Adoption Waves

	Wave 1: PC	Wave 2: Mega Data Center	Final Wave: Traditional Enterprise
SATA Market Driver	HDD Compatibility, Low Price	High Volume/Low Price (Driven by PC Demand)	Enterprise Ecosystem Dependencies
NVMe Market Driver	Thin, Light, Responsive (Required M.2 and BGA SSDs)	High Capacity w/IOPS Density	Low Latency/TCO



Conclusion: NVMe Proliferates in Data Centers

- **IOPS/GB of NVMe Needed for High Capacity SSD**
- **No Need to Wait for Complete Enterprise Ecosystem**
 - **Not Dependent on Legacy Technologies (e.g. RAID)**
 - **Scale to Develop custom solutions**
- **PC Transition to M.2/NVMe Shrinks SATA SSD Economy of Scale**