PCI Express® Architecture: Driving the Future of Storage I/O

Ramin Neshati, Ph.D.
Member, PCI-SIG Board of Directors
Chair, PCI-SIG Marketing Workgroup
Agenda

- Recent Storage Industry Trends
- PCIe™ Technology as Storage Interconnect
- Summary & Call to Action
Storage Industry Trends

- Massive growth in data driving SSD adoption
  - Anticipated growth to $10B by 2018

- Robust growth in Data Center Storage TAM
  - SSD adoption growing at faster than 40%

- Accelerating NVMe* adoption in Data Center
  - Over half of Data Center SSDs by 2017

Source: Forward Insights Q1'15
Storage Industry Trends

- PCIe adoption pace makes it the interconnect for storage
- Outpacing other interconnects in both units and bandwidth/capacity

Source: Forward Insights Q1'15
Agenda

- Recent Storage Industry Trends
- PCIe™ Technology as Storage Interconnect
- Summary & Call to Action
PCle I/O for Storage – Performance

- PCIe 4.0 specification
  - 16GT/s performance w/ high-volume manufacturability
  - Backwards compatible to PCIe 1/2/3
  - Standardized repeater for long channels (>10”, 1 connector)
  - Base spec on track for rev0.7 maturity by 4Q’15-1Q’16

- Near-0 link idle power
  - L1 Sub-states ECN published in 2014

- ½ swing spec for lower link active power
  - Available since PCIe 1.1 (circa 2004)

- M-PCle™ for PCIe functionality where M-PHY* exists
PCIe I/O for Storage – CEM++ Expansion

- **SFF-8639 (U.2)**
  - Dense packing 2.5” SSDs, hot-plug, serviceable, x1/x2/x4, multi-topology, compliancy

- **M.2**
  - 42/80/110mm, boot or max storage density, client & server compliancy, compliancy

- **BGA**
  - For volume-constrained mobile platforms, saves 0.5-1.5mm on Z-height and ~20% on area

- **OCuLink w/ SRIS**
  - Low-cost, low EMI, x1/x2/x4, internal cabling for SATA transition
PCle I/O for Storage – Compliance

- Industry-leading compliance program
  - MB & AIC test fixtures – Test channels for silicon validation
  - Sigtest – Jitter/voltage noise separation for signal integrity
  - CV – Configuration space verifier

- SFF-8639 (U.2) & M.2 also supported
  - PCI-SIG extending its C&I program to SFF (U.2) & M.2
  - Initial SFF (U.2) C&I testing completed in August 2015
  - Future C&I workshops will integrate M.2 testing
Agenda

- Recent Storage Industry Trends
- PCIe™ Technology as Storage Interconnect
- Summary & Call to Action
Summary

- SSD attach is transitioning to PCIe interconnect

- PCIe architecture is all you need for storage applications in any device or system topology
  - PCI-SIG has numerous form factors for increased flexibility in storage I/O expansion
  - PCI-SIG has robust compliance program for end-to-end interoperability

- PCIe 4.0 architecture provides unbeatable performance headroom with low power features

Visit [www.pcisig.com](http://www.pcisig.com) for more info on PCIe technology!