SSD Form Factor Working Group

Driving industry standardization, innovation, and performance for the benefit of our customers.

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Customer Benefit Goals

Increased Performance of PCIe

High Availability and Serviceability

Compatibility: SAS/SATA/PCIe

Improved Power Efficiency

Reduced TCO
Why PCIe Storage Standards?

**Areas to Address**

- **Performance Trends**
  - Processor vs. Storage Gap Increasing

- **Serviceability**
  - Internal Access
  - Cold-Plug

- **Interoperability**
  - Card Form Factor
  - Varying Card Sizes

- **Scalability**
  - Performance & Capacity

**PCle SSD Benefits**

- **Minimize Gap**
  - Improved Latency
  - Improved IOPs

- **Remove Constraints**
  - External Access
  - Hot-Pluggable

- **Common Form Factor**
  - Drive Form Factor
  - Multi-protocol

- **Increased Slots**
  - External Slots
  - “Live” Scaling

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Broad Industry Collaboration

Promoters

Contributors
Promote enterprise storage usage of PCIe SSDs, by enabling serviceability, high-availability, ease of integration, interoperability and scalability of Solid-State Storage.

**Key Focus Areas:**

- **Form Factor**
- **Connector**
- **Hot-Plug**

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Working Group Key Elements

**Form Factor**
- Benefit from current 2.5” HDD form factor
- Expand power envelope

**Connector**
- Multiple protocols: PCIe 3.0, SAS 3.0, SATA 3.0
- Management Bus
- Dual port (PCIe)
- Multi-lane capability (PCIe/SAS)
- Power pins
- SAS Drive Backward Compatibility

**Hot-Plug**
- Hot-Plug Connector
- Identify desired drive behavior
- Define required system behavior

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PCIe Storage Strengths

Current PCIe SSD cards:
Well received by customers, have attained highest performance to date.

Complement existing storage protocols:
Providing highest IOPs and lowest latency for demanding applications

Obvious advantages: Reduced path components

- Lower costs
- Less real estate
- Less power
- Higher reliability
- Lower latency

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More on Latency …

Today: Low OIO (Outstanding IO)
- High latency NVM and legacy stack can diminish interface latency benefits

Today: High OIO
Future: Upcoming advances
- Parallelism reduces NVM and stack aggregate latency, seen today in database work loads
- Future NVM can achieve low latency even at low OIO
- Path latency of a PCIe solution can be much lower than SAS solution, providing significant performance improvement

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Customer Benefits Summary

Increased Performance of PCIe
- High Throughput
- Low latency

High Availability and Serviceability
- Extended RAS capability in a common form factor
- Known drive replacement behavior

Compatibility
- Standardization reduces issues
- Single connector for SAS/SATA/PCIe

Improved Power Efficiency
- Higher performance from same media
- Improved IOPs/Watt

Reduced TCO
- Reduce component complexity
- Improved $/IOPs

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**Scope Definition**
- Form Factor/Connector/Hot-Plug

**Connector: Signals/Pinout**
- Drive: Thermal/Mechanicals
- Hot-plug Support

**Rev 0.7 Spec.**
- Connector: Signals/Pinout
- Drive: Thermal/Mechanicals
- Hot-plug Support

**Rev 0.9 Spec.**
- Complete SI Requirements
- Connector Mechanical Requirements
- Specification Ratification
For More Information

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