



# SSD Form Factor Working Group

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

Gary Kotzur, Technology Strategist - Dell

Jim Pappas, Director of Technology Initiatives - Intel



# Customer Benefits Goals

Increased Performance of PCIe

High Availability and Serviceability

Compatibility: SAS/SATA/PCIe

Improved Power Efficiency

Reduced TCO

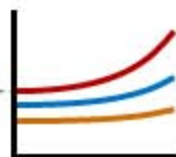
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# Why PCIe Storage Standards?

## Areas to Address

### Performance Trends

Processor vs. Storage  
Gap Increasing



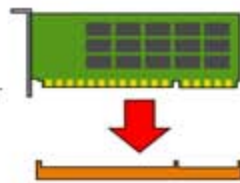
### Serviceability

Internal Access  
Cold-Plug



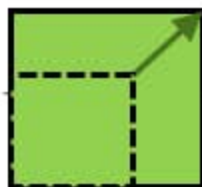
### Interoperability

Card Form Factor  
Varying Card Sizes



### Scalability

Performance  
& Capacity



## PCIe 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



# Working Group Charter

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:**

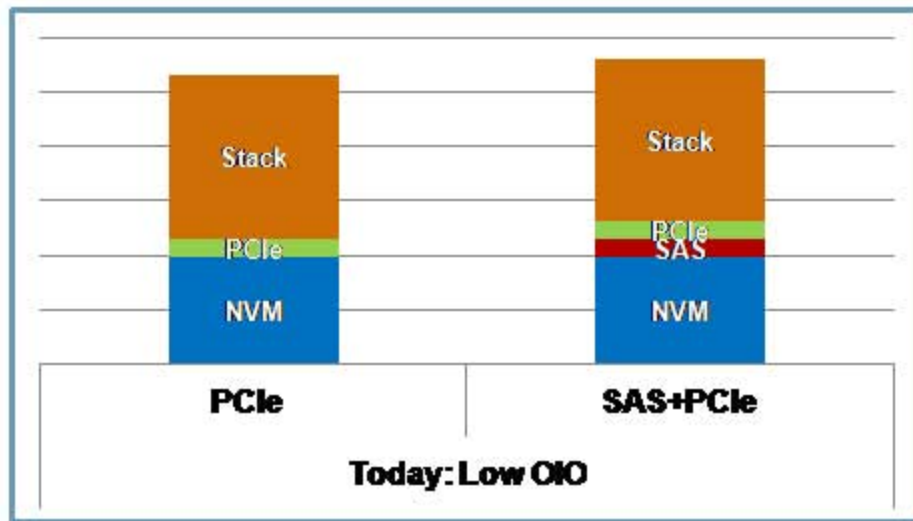
Providing highest IOPs and lowest latency for demanding applications

## **Obvious advantages: Reduced path components**

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

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# More on Latency ...



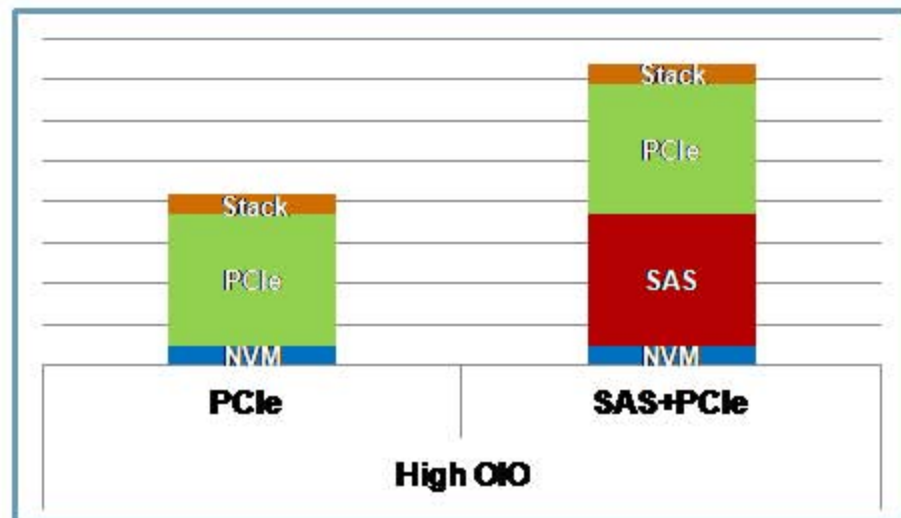
## Today: Low OIO (Outstanding IO)

- 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

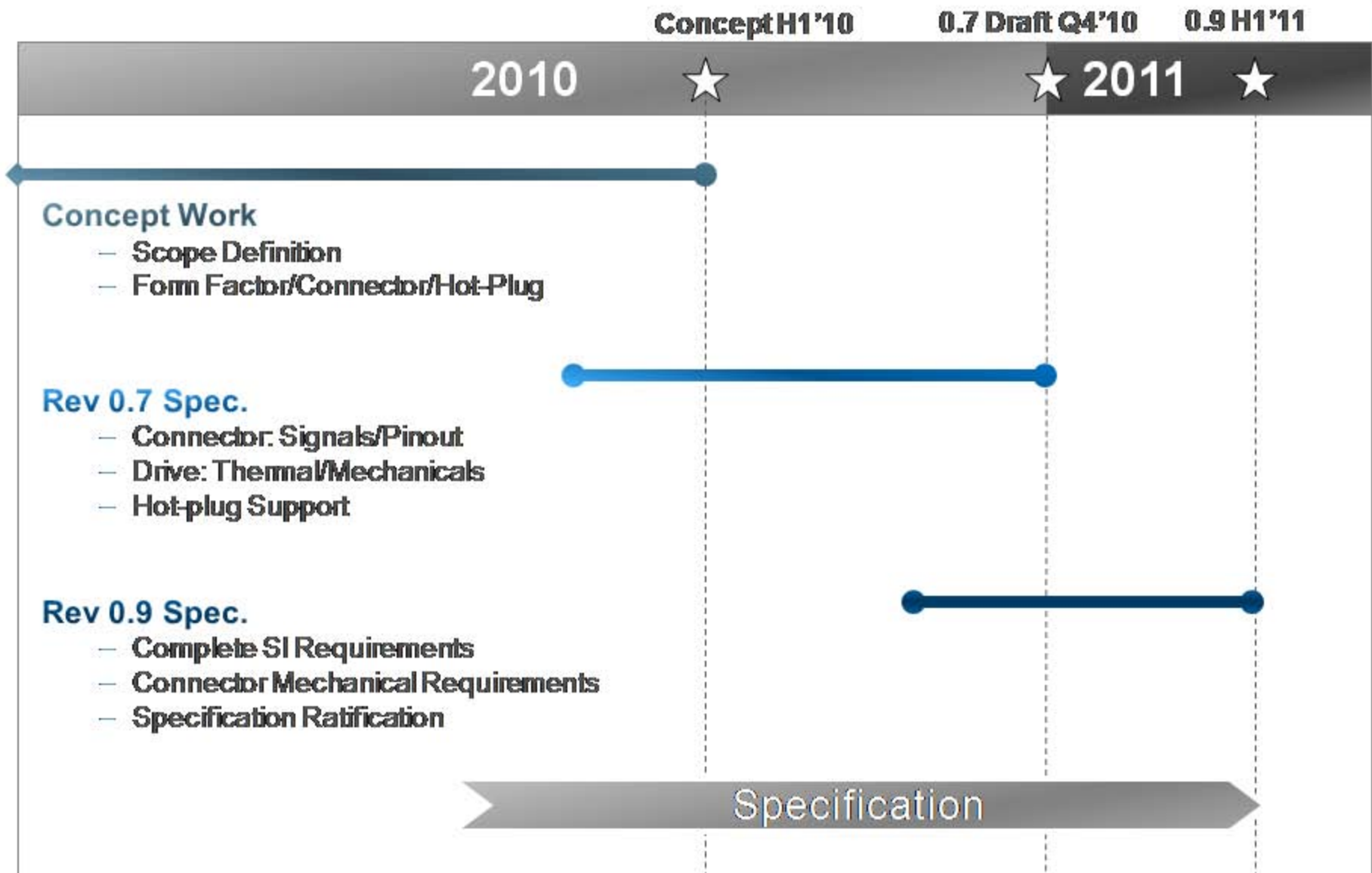
- Higher performance from same media
- Improved IOPs/Watt

## Reduced TCO

- Reduce component complexity
- Improved \$/IOPs

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# Timeline



# For More Information

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