

New Software Capabilities and Experiences Through Innovation in Storage Architecture

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SSDS005

Agenda

- Storage Interface Evolved
- Cores and Queues
- Unleashing Performance with NVM Express™
- Software Opportunities
- System Integration Guidance
- Demonstration
- Summary and Q&A

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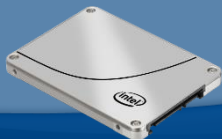
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Storage Interface Evolved

Moving to NVMe Express™ (NVMe) is required to extract the value of 3D XPoint™ technology. NVMe is designed from the ground up for non-volatile storage.

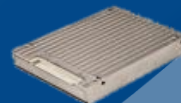
- Limited to 6Gb/s
- Limited to AHCI; single Queue
- Slowest Link in the PC platform

Yesterday



Today

nvm
EXPRESS

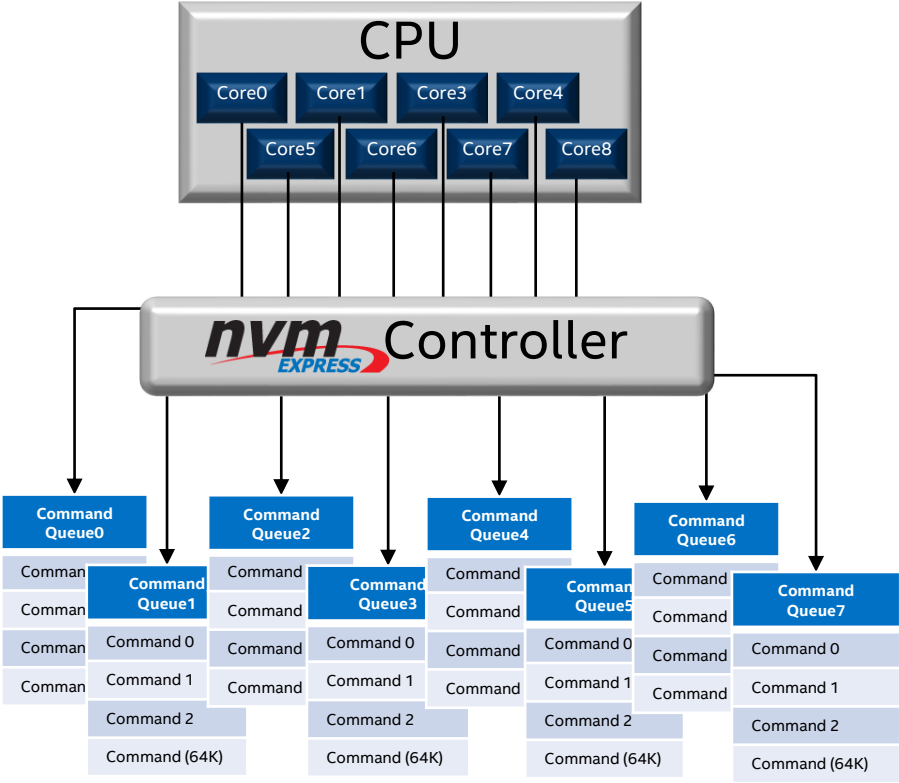
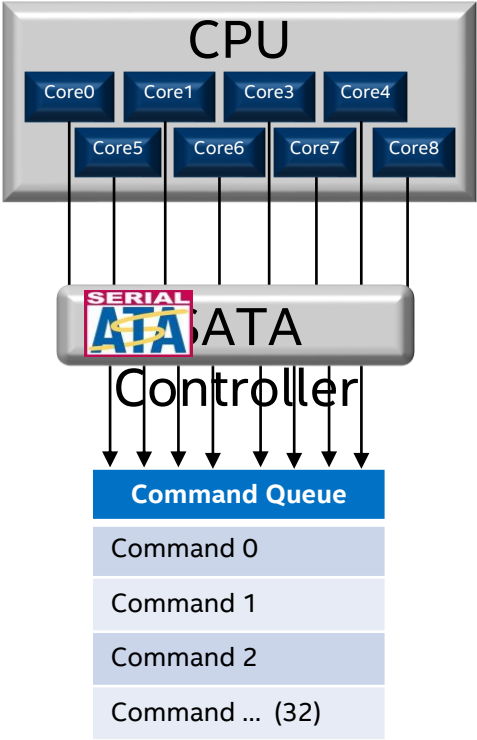


- Scales with PCI Express™ (Gen3X4 today)
- Bandwidth increase of 540%
- One queue per core
- Direct Attach Storage options
- Reduced Latency

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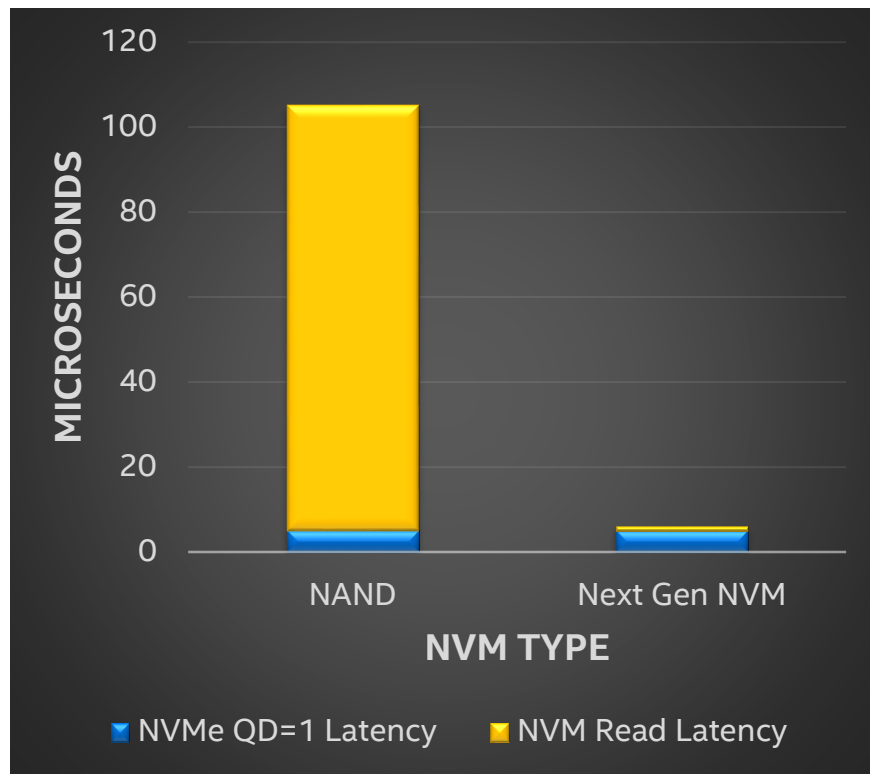
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Cores and Queues



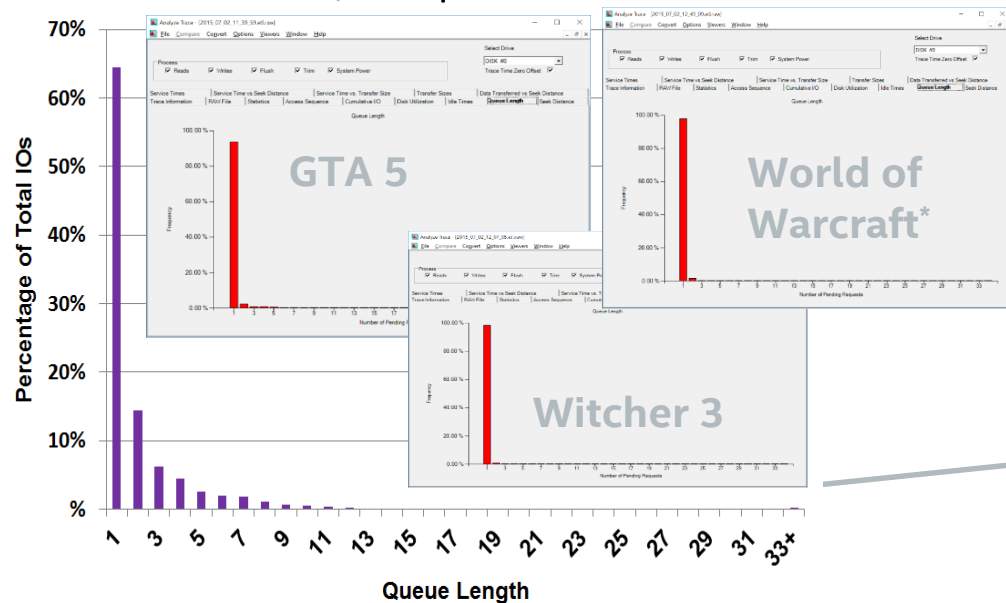
Low Latency, Low Queue Depth

- Client workloads are typically low queue depth and primarily random
- Typical read-write mix is about 70/30
- Bandwidth is also important for large file operations
- Ideal client profile
 - Good bandwidth
 - High random read **and** write performance at low QD

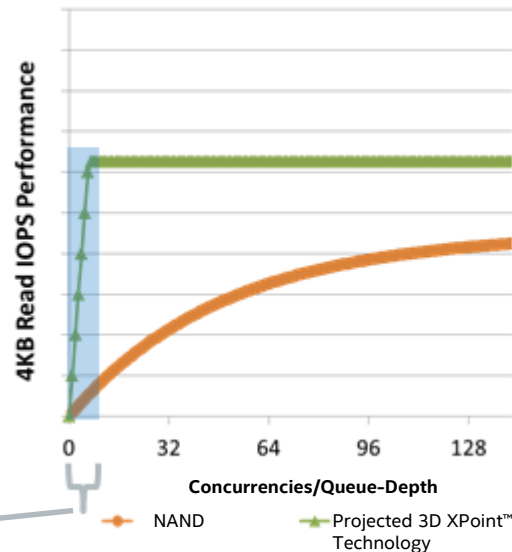


NVM Express™ + 3D XPoint™ Technology Related to Queue Depth

Windows® Queue Depth Distribution



800GB SSD Read IOPs using 16GB die



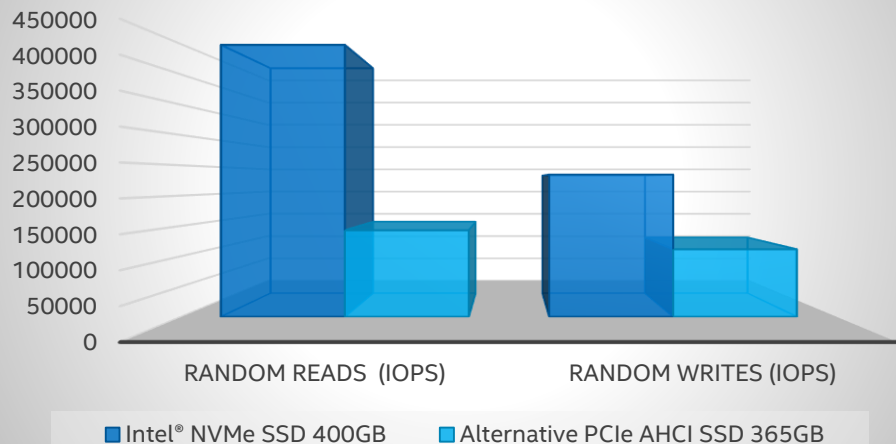
- Client Workloads are heavily weighted to low queue depths
- NVMe™ ensures low queue depths by providing a queue for each CPU core
- 3D XPoint technology delivers full performance @ low queue depth

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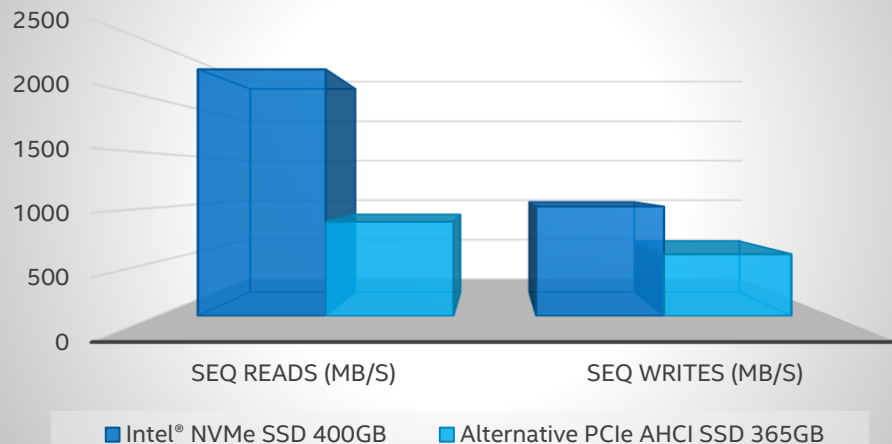
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Performance Implications – Current Products

4K Random Comparison



128K Sequential Comparison



PCI Express® (PCIe) | NVMe Express™ (NVMe)

Tests document performance of components on a particular test, in specific systems. Differences in hardware, software, or configuration will affect actual performance. Consult other sources of information to evaluate performance as you consider your purchase. Performance measured by Intel using IOMeter* 1.1.0 with queue depth 32. Measurements are performed on 8 GB of Logical Block Address (LBA) range on a full SSD. System configuration: Intel® Core i7-5960X processor, Intel® X99 chipset, 32GB DDR4 2133, Windows® 8.1. For more complete information

10 about performance and benchmark results, visit <http://www.intel.com/performance>.

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Gaming Usages – Unparalleled Realism

High Res In-Game Video Streams



In-Game Features Unlocked

Hard Drive



Intel® SSD



BLACKLIGHT
RETRIBUTION



Gaming Usages – Uninterrupted Game Play

Eliminate Game zones and level loading screens



(With 3D XPoint™ technology) "Loading screens will be a thing of the past."

- Chris Roberts, CEO Cloud Imperium Games

Gaming Usages – Unparalleled Realism

Ultra High Definition and Uncompressed Texture, Unique Textures per surface



“4K resolution is going to create a resurgence for PC gaming”

– Kelt Reeves, CEO Falcon Northwest PC

Workstation Usages

High Speed compositing of 4K 360 degree video for Virtual Reality



[Grand Canyon 4K 360° Video by 360 Labs](#)

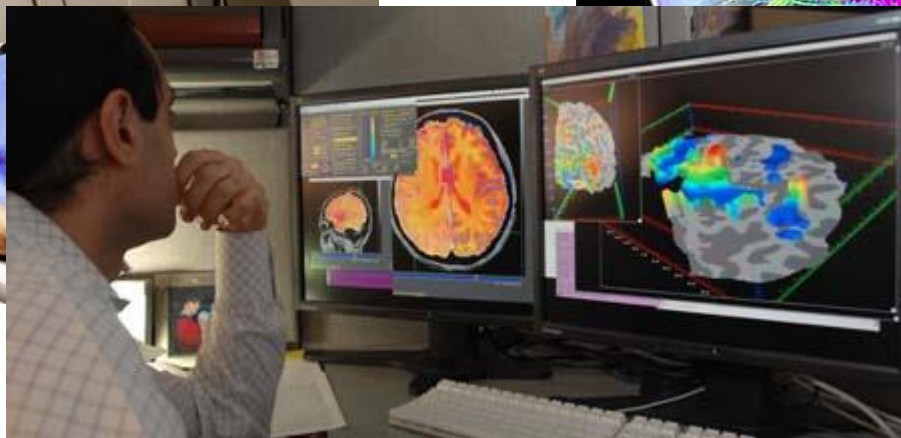
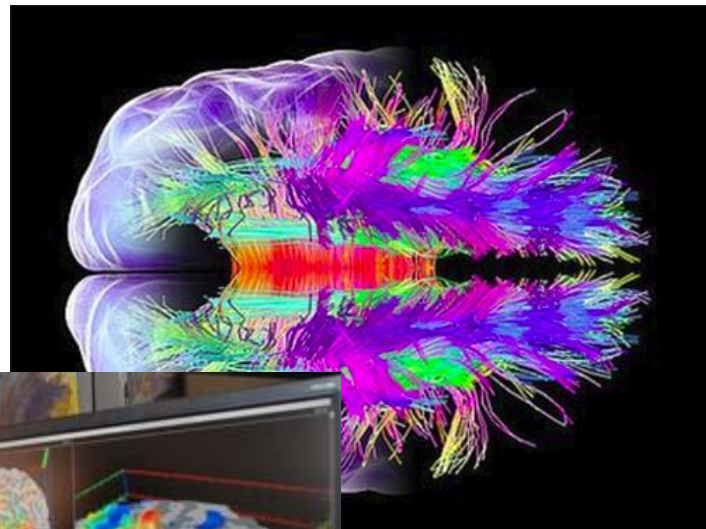
Workstation Usages

Real-time uncompressed 4K video editing



Workstation Usages

Medical



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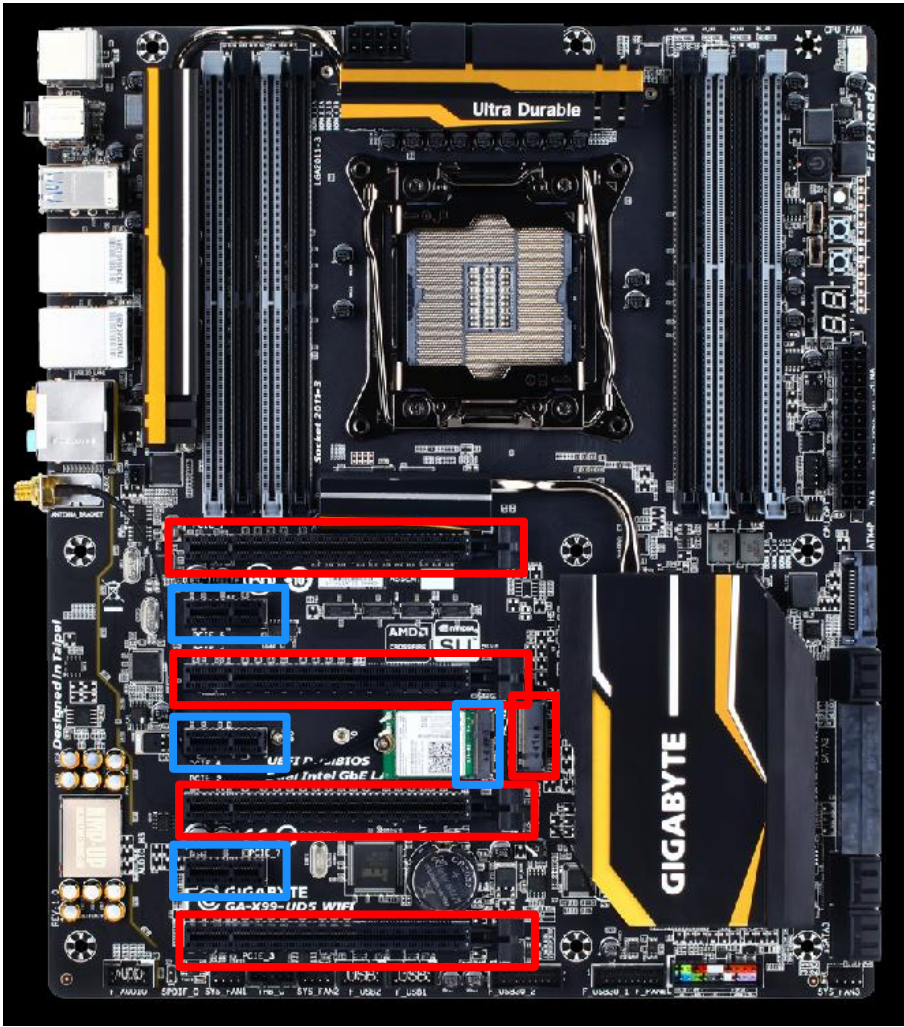
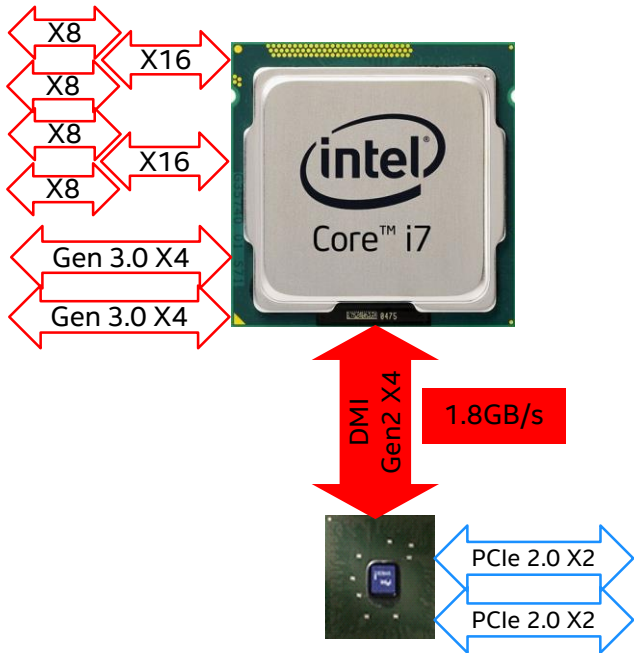
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Integration Guidance

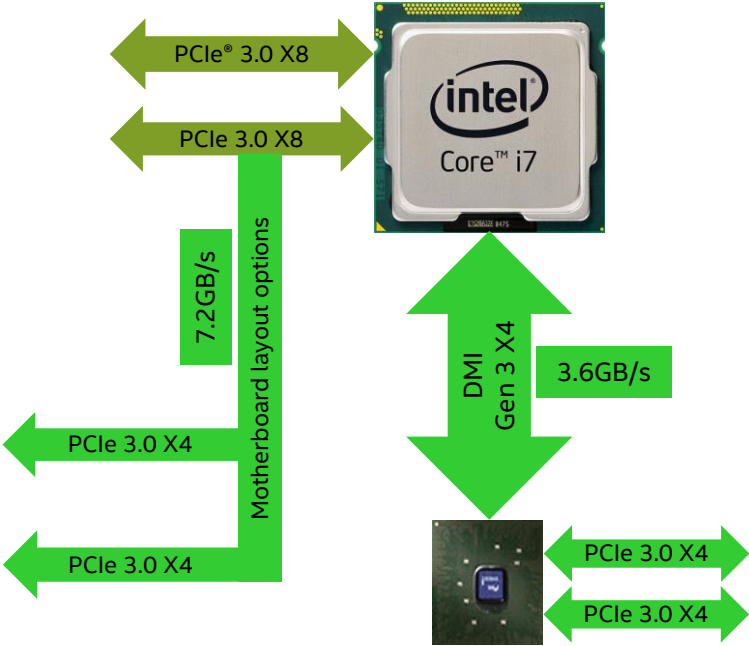
X99

CPU Direct Attach PCIe®
PCIe 3.0

PCH Attach Storage
PCIe 2.0



Integration Guidance – Z170



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Demo

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Summary and Next Steps

- Storage no longer has to be the bottleneck
- Exciting new usages are possible
- Potential benefits exist across the software spectrum
 - Gaming Experience/Development
 - Content Creation
 - Engineering
 - Medical

You are only limited by your imagination

Additional Sources of Information

- A PDF of this presentation is available from our Technical Session Catalog: www.intel.com/idfsessionsSF. This URL is also printed on the top of Session Agenda Pages in the Pocket Guide.
- More web based info: www.intel.com/ssd
- NVM Express™ Working Group: www.nvmexpress.org

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