



INTEL INNOVATION IN DATA PROCESSING

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IT Challenges: What to Worry About Next?



Intel Data Center Hardware Building Blocks

Processing & Memory



Intel® Xeon® Processor E5



2 Socket
DDR4 with Large Mem.
Capacity

Intel® Xeon® Processor E7



4+ sockets
Intel® RunSure™
DDR3/DDR4 with
Largest Mem. Capacity

Intel® Xeon® Processor E3



1S
DDR4
& EDRAM
option

Intel® Xeon Phi™ Processor



1S
GDDR &
MCDRAM (future)

Intel® Xeon® Processor D



1S
DDR4

Intel Atom™ Processor



1S
DDR4

Accelerators

Intel® Quick Assist
Technology

FPGA
(Future)

Intel® HD
Graphics

Intel® Graphics
Media Accelerator

IO



Boards & Chassis



Integrated PCI Express 3.0



1/10/40 GbE Controllers
Ethernet Switches



Intel® Rackscale
Architecture (Future)

Cloud Ethernet
(Red Rock Canyon,
Future)



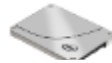
Fabrics

Intel® True Scale Fabric
Intel® Omni-Path
Fabric (Future)



Intel® Silicon
Photonics
Technology (Future)

NVM Storage



Intel® Solid State Drives
Enterprise SATA SSDs



Intel® Solid-State Drive Data
Center Family for PCIe

3D XPoint Technology
(Future)

Server Roadmap

Intel® Xeon Phi™ - Optimized for new highly-parallel oriented applications that utilize scale out clusters & highly integrated power-dense cores

Intel® Xeon® E7 & Itanium® (not shown) - Targeted at mission critical & storage applications that value a scale up system with large memory capacity and advanced RAS. Itanium for additional OSes (HP-UX).

Intel® Xeon® E5 - Targeted at a wide variety of server, storage, and networking applications that value a balanced system and performance/watt/cost

Intel® Xeon® E3 - Utilized for a variety of workloads that value entry capabilities or integrated graphics including SMB servers, network security, storage archival, & media streaming

Intel® Xeon® D - Targeted at mid-range network, storage, and embedded IoT & lightweight web applications that value fast cores & density

Intel Atom™ - Targeted at entry networking, entry storage, & lightweight web applications that value low power & density

Shipping

61 cores

Intel® Xeon Phi™ Coprocessor

Co-processor, 1+ TFLOPs, 16GB GDDR

Future

Knights Landing

Bootable, 3+ TFLOPs, Integrated Omni-Path

Brickland Platform

18 cores

E7-8800/4800 v3

45+, AVX2, DDR3/4, 9.6 GT/s, 22nm

Future Xeon E7

Grantley-EP Platform

E5-4600 v3 (4S)

18 cores

E5-2600 v3

AVX2, DDR4, 9.6 GT/s, 22nm

Future Xeon E5 (4S)

Future Xeon E5

Denlow Platform

4 cores

Broadwell

AVX2, DDR4, GT3 Gfx, 14nm

Future Xeon E3 Platform

Future Xeon E3

Grangeville Platform

8 cores

Xeon-D 1500

Integrated 10 GbE & chipset, 14nm

Future Xeon D Platform

Future Xeon D

Edisonville Platform

8 cores

Atom C2000

Integrated GbE & chipset, Quick Assist, 14nm

Future Atom Platform

Future Atom



Intel® Xeon Phi™ Product Family



Available Today Knights Corner (KNC)

Intel® Xeon Phi™
x100 Product Family

- 22 nm process
- Coprocessor only
- >1 TF DP Peak
- Up to 61 Cores
- Up to 16GB GDDR5



-OR-

TBA

Knights Landing (KNL)

Intel® Xeon Phi™
x200 Product Family

- 14 nm process
- Host Processor & Coprocessor
- >3 TF DP Peak¹
- Up to 72 Cores
- Up to 16GB HBM
- Up to 384GB DDR4²
- High BW memory
- Integrated Fabric

Future

Knights Hill (KNH)

3rd generation

- 10 nm process
- Integrated Fabric (2nd Generation)
- In Planning...

All projections are provided for informational purposes only. Any difference in system hardware or software design or configuration may affect actual performance.

¹ Over 3 Teraflops of peak theoretical double-precision performance is preliminary and based on current expectations of cores, clock frequency and floating point operations per cycle.

INTEL® OMNI-PATH ARCHITECTURE IS CHANGING FABRIC ECONOMICS

Higher Performance



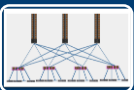
- 100Gb/s per port, 25GB/s fabric bandwidth
- Up to 60% switch latency reduction over other InfiniBand* solutions¹

Lower Cost



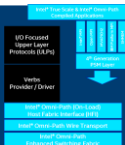
- CPU-fabric integration drives outstanding price-performance
- 48-port switch ASIC delivers up to 50% reduction in switch chip²

Greater Scalability



- Unique host architecture designed for massive cluster scaling
- Over 27,000 nodes in a 2-tier/5-hop FBB fabric – over 2.3x vs. InfiniBand³
- Management support enhanced to maintain extreme scale clusters

Open Source



- Host software integrated into OpenFabrics Alliance* (OFA) infrastructure
- OFA-compliant applications supported without modification
- Fabric management and management toolkit open sourced

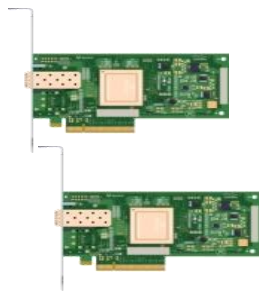
Minimizes fabric cost, maximizes cluster compute capability

¹ Latency reductions based on Mellanox CS7500 Director Switch and Mellanox SB7700/SB7790 Edge switch product briefs posted on www.Mellanox.com as of July 1, 2015 compared to, compared to Intel measured port-to-port latency (100ns) calculated from difference between back to back osu_latency test and osu_latency test through one switch hop. 10ns variation due to “near” and “far” ports on an Intel® OPA edge switch. All tests performed using Intel® Xeon® E5-2697v3 with Turbo Mode enabled. Cluster configuration is a 1024-node full bisectional bandwidth (FBB) Fat-Tree configuration (3-tier, 5 total switch hops), using a 48-port switch for Intel® Omni-Path cluster and 36-port switch ASIC for either Mellanox or Intel® True Scale clusters. ² Reduction in up to ½ fewer switches claim based on a 1024-node full bisectional bandwidth (FBB) Fat-Tree configuration, using a 48-port switch for Intel® Omni-Path cluster and 36-port switch ASIC for either Mellanox or Intel® True Scale clusters. ³ A 2.3X based on 27,648 nodes based on a cluster configured with the Intel® Omni-Path Architecture using 48-port switch ASICs, as compared with a 36-port switch chip that can support up to 11,664 nodes.

INTEL® OMNI-PATH ARCHITECTURE PRODUCT LINE COVERAGE

HFI Adapters

Single port
x8 and x16 HFI Adapters



x16 Adapter
(100Gb/s)

x8 Adapter
(58Gb/s)

Edge Switches

1U Form Factor
24 and 48 port Edge Switches



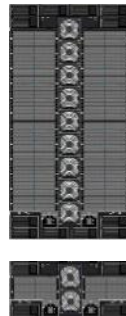
48-port
Edge Switch



24-port
Edge Switch

Director Switches

QSFP-based
192 and 768 port Director Switches

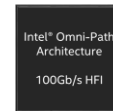


768-port
Director Switch
(20U chassis)

192-port
Director Switch
(7U chassis)

Silicon

OEM custom designs
HFI and Switch ASICs



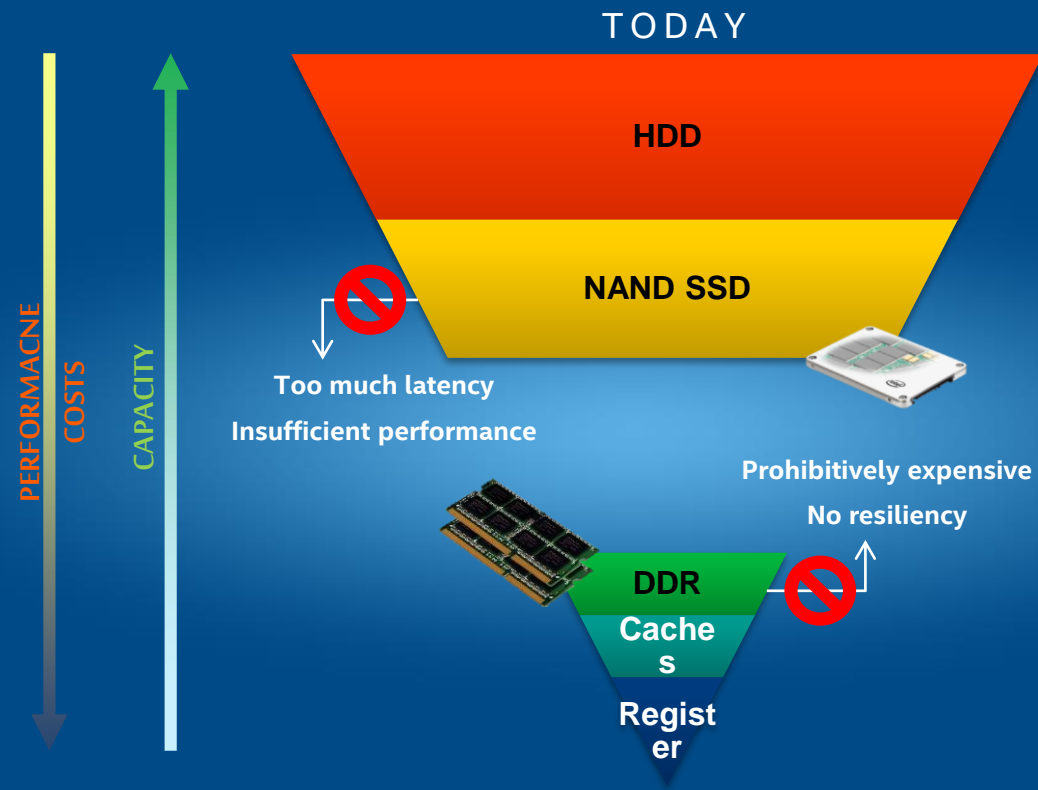
HFI silicon supports
up to 2 ports
(50 GB/s total b/w)



Switch silicon supports
up to 48 ports
(1200GB/s total b/w)

**Top-to-bottom Intel® OPA product line coverage
HFI and switch ASICs that enable custom OEM solutions**

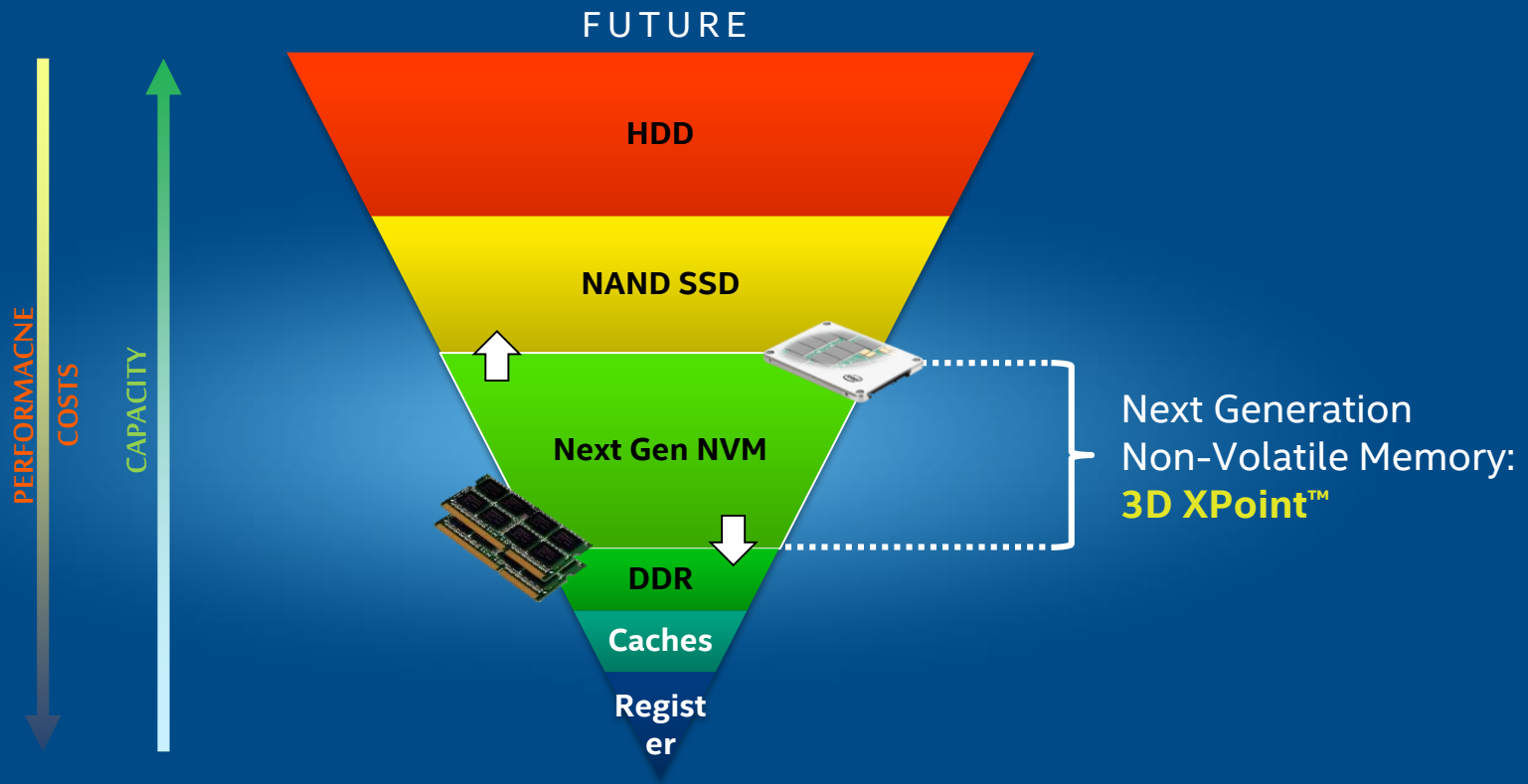
CURRENT MEMORY HIERARCHY



For illustration only.

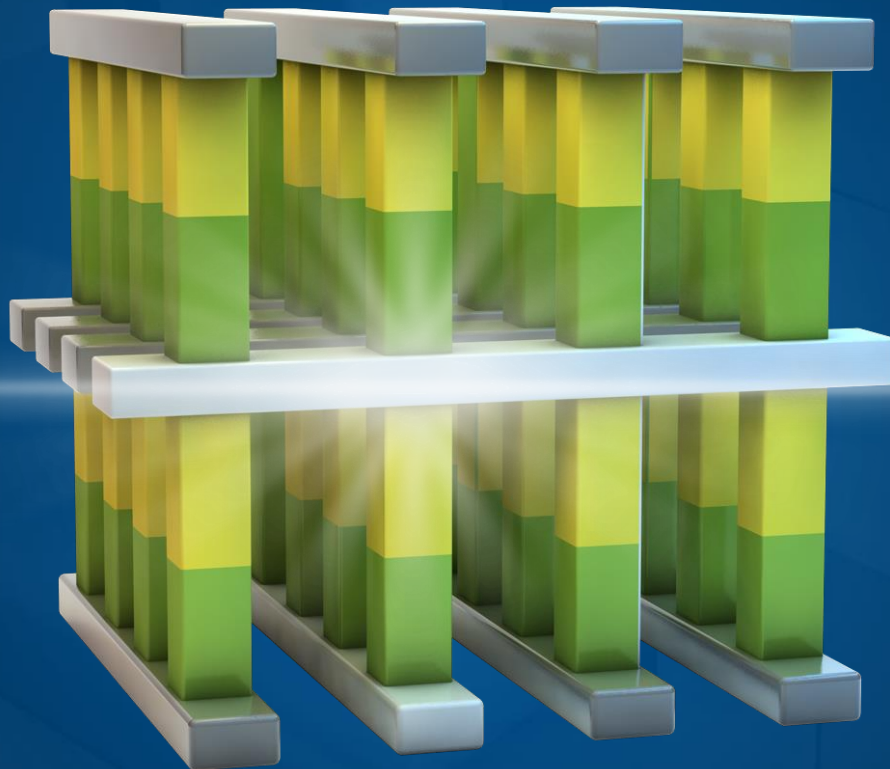
NEW

NEW MEMORY HIERARCHY



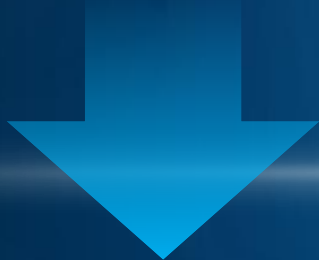
For illustration only, potential future options are targets, subject to change without further notification.

WHAT IS 3D XPOINT™?



Crosspoint Structure

Selectors allow dense packing and individual access to bits

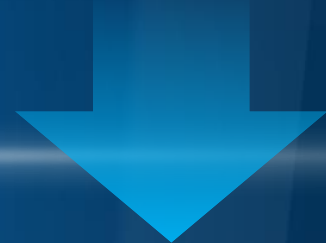


Scalable

Memory layers can be stacked in a 3D manner

Breakthrough Material Advances

Compatible switch and memory cell materials



High Performance

Cell and array architecture that can switch states 1000x faster than NAND

INTEL® OPTANE™ PRODUCTS

BASED ON INTEL 3D XPOINT™ TECHNOLOGY

YESTERDAY

TODAY

NEAR FUTURE

MEMORY
&
STORAGE

N/A

N/A

INTEL DIMMs

based on 3D XPoint™ Technology



NVMe SSDs
based on NAND

INTEL SSDs

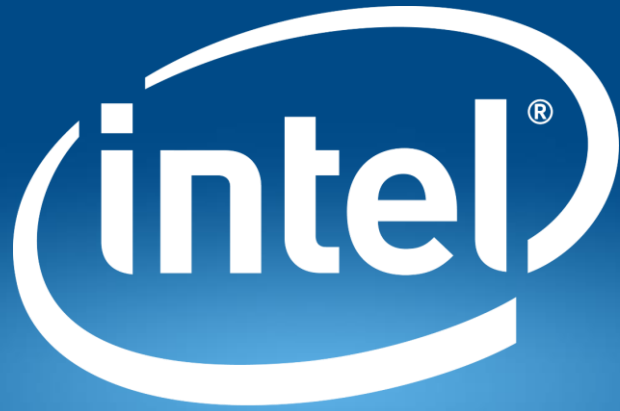
based on 3D XPoint™ Technology



STORAGE



**3D XPOINT ENABLES WORLD'S FASTEST SSD AND
REVOLUTIONARY STORAGE CLASS MEMORY**



experience
what's inside™