



THE ERA OF DATA-CENTRIC COMPUTING

Vipul Shah - Regional Director
Intel Asia Pacific

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DATA DEFINES THE FUTURE


The Economist

Obama the warrior
Misgoverning Argentina
The economic shift from West to East
Genetically modified crops blossom
The right to eat cats and dogs

FEBRUARY 27TH-MARCH 5TH 2010
Economist.com

The data deluge

AND HOW TO HANDLE IT: A 14-PAGE SPECIAL REPORT



THE ECONOMIST

The Economist

Crunch time in France
Ten years on: banking after the crisis
South Korea's unfinished revolution
Biology, but without the cells

JULY 19TH 2010

The world's most valuable resource



Data and the new rules of competition

THE ECONOMIST

POPULAR SCIENCE

THE FUTURE NOW

THE CONTROL CENTERS

Using Data to Feed the World, Solve Cold Cases, Battle Malware, Predict Our Fate

OFFICER ALGORITHM

Can a Crime Be Prevented Before It Begins?

NEW WAYS OF SEEING

A Gallery of Extraordinary Infographics

SPECIAL ISSUE

DATA IS POWER

HOW INFORMATION IS DRIVING THE FUTURE

PLUS
Juan Enriquez: Reprograms Life
James Gleick: Unspliffs the Bit
AND Lawrence Weschler: Questions the Cloud

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Steven Pinker on the new peace

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Will politics jeopardise a cure?

FRAUDS AND FAKES

Science's biggest scams

GENIUS OF DOGS

Inside the canine brain



IS data THE NEW GOD?

How tracking your digital trail could predetermine your future - and why you'll benefit from today's data deluge.

Preventing cybercrime

GALAXIES AND NEBULAE • CANCER VACCINES • WHALES • FICTION • REVIEWS

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DECREASING COST OF TECHNOLOGY¹

COST OF COMPUTE

56%

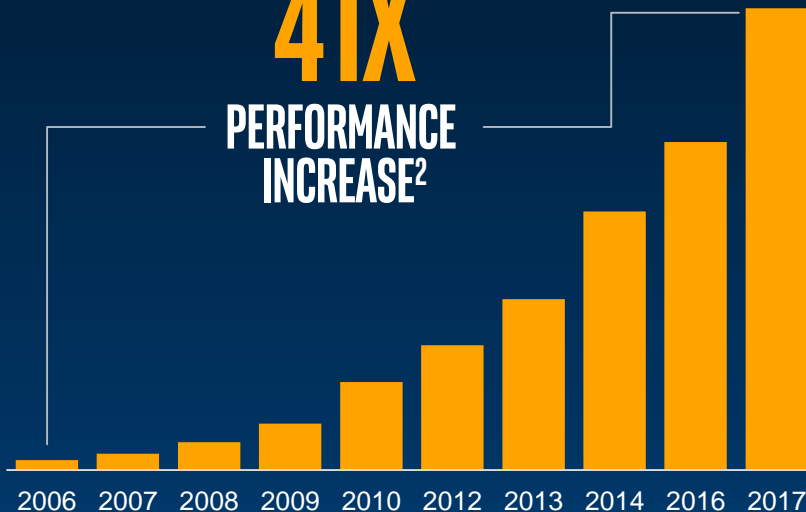
2012-2017

COST OF STORAGE

77%

2012-2017

41X
PERFORMANCE INCREASE²



1 Source: Amalgamation of analyst data and Intel analysis.

2 Source: Intel

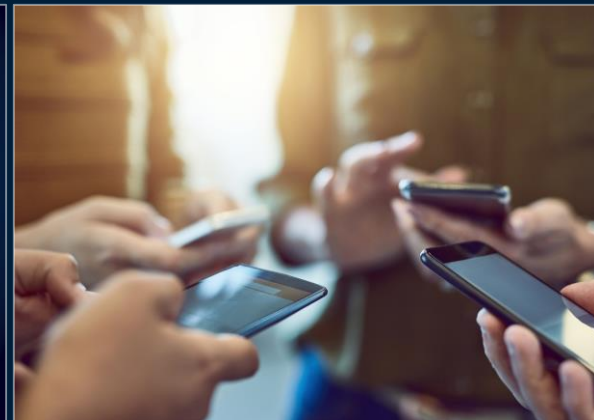
INNOVATION ACROSS INDUSTRIES



**FLEXIBLE CLOUD
SERVICES**



**HIGH CAPACITY
NETWORKS**




**DEEPER INSIGHTS
WITH AI**

NEW ERA OF DATA CENTER TECHNOLOGY

DATA-CENTRIC INFRASTRUCTURE

MOVE FASTER

 SILICON PHOTONICS

 OMNI-PATH FABRIC

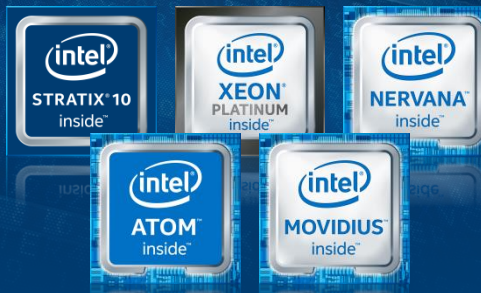
 ETHERNET

STORE MORE

 OPTANE DC 
SOLID STATE DRIVE

 OPTANE DC 
PERSISTENT MEMORY

PROCESS EVERYTHING



SOFTWARE & SYSTEM-LEVEL **OPTIMIZED**

NEW ERA OF DATA CENTER TECHNOLOGY

DATA-CENTRIC INFRASTRUCTURE

MOVE FASTER

intel SILICON PHOTONICS

intel OMNI-PATH FABRIC

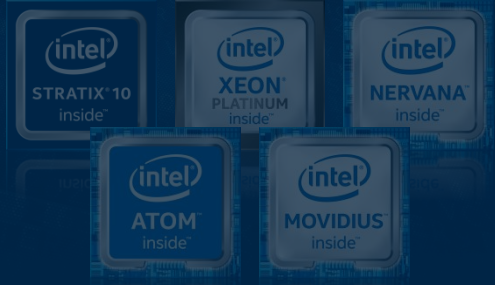
intel ETHERNET

STORE MORE

intel OPTANE DC 
SOLID STATE DRIVE

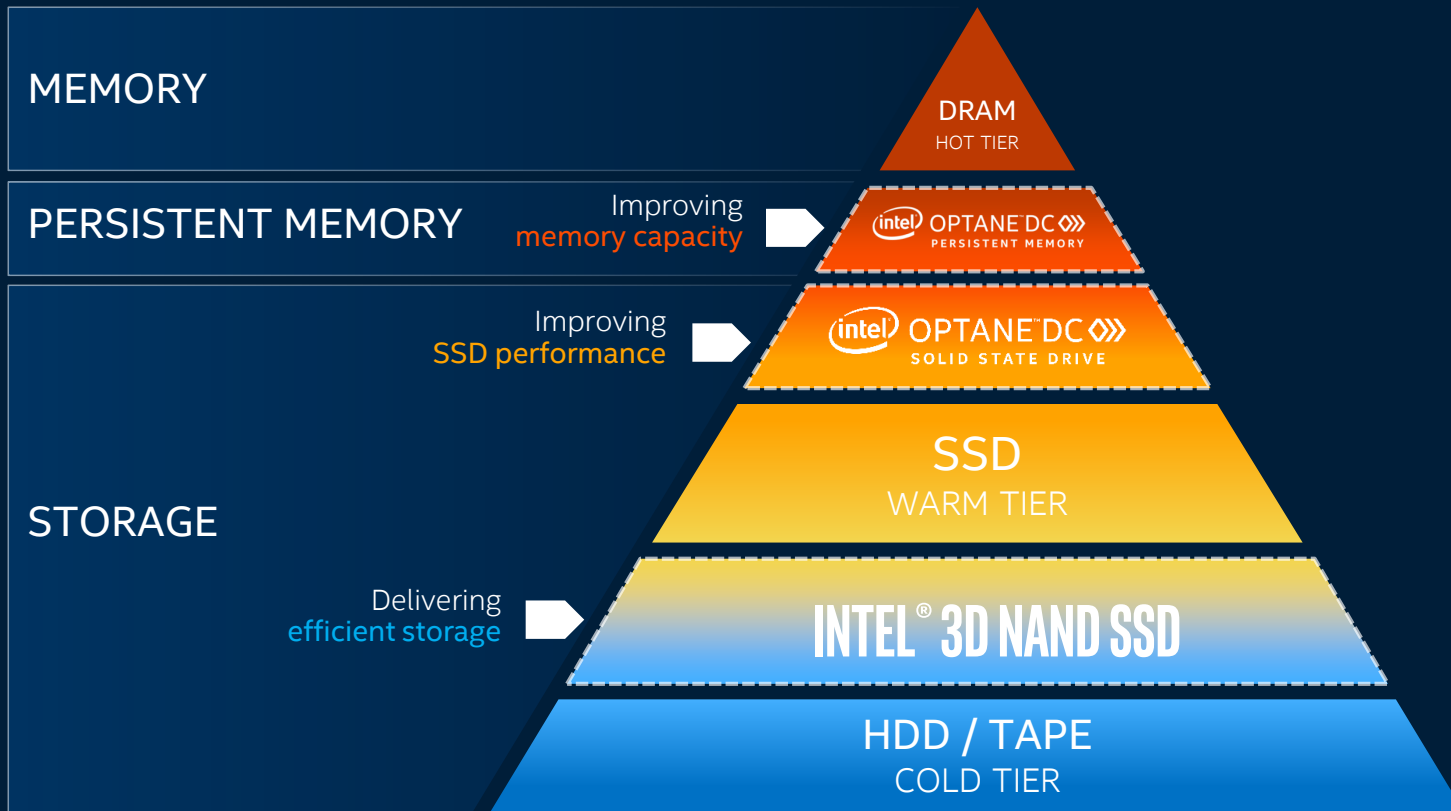
intel OPTANE DC 
PERSISTENT MEMORY

PROCESS EVERYTHING



SOFTWARE & SYSTEM-LEVEL **OPTIMIZED**

RE-ARCHITECTING THE MEMORY / STORAGE HIERARCHY





intel[®] OPTANE™ DC

PERSISTENT MEMORY

BIG AND AFFORDABLE MEMORY

128, 256, 512GB

HIGH PERFORMANCE STORAGE

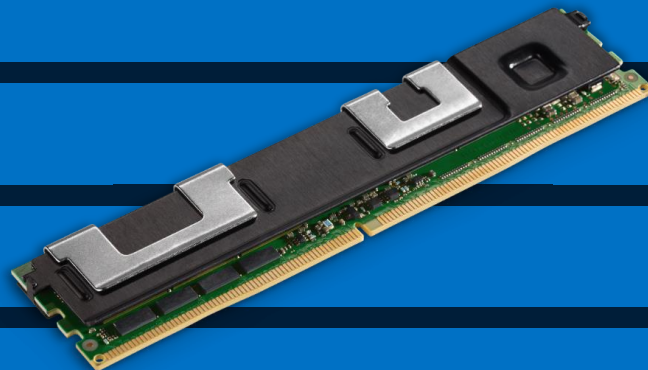
DDR4 PIN COMPATIBLE

DIRECT LOAD/STORE ACCESS

HARDWARE ENCRYPTION

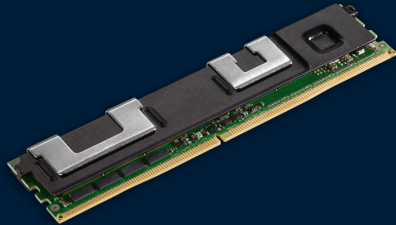
NATIVE PERSISTENCE

HIGH RELIABILITY



DELIVERING BREAKTHROUGH VALUE...

intel[®] OPTANE™ DC PERSISTENT MEMORY



SPARK* SQL DS

8X more performance

VS. DRAM AT 2.6TB DATA SCALE

APACHE CASSANDRA*

9X more read transactions

11X more users per system

VS. COMPARABLE SERVER SYSTEM WITH DRAM & NAND NVME DRIVES

SAP HANA*

12.5X faster start times

VS. DRAM WITH SSD STORAGE

Note: Intel Optane DC Persistent Memory opportunity equals 2022 data center memory SAM. Performance results are based on testing: 8X (8/2/2018), 9X Reads/11X Users (5/24/2018), Minutes to Seconds (5/30/2018) and may not reflect all publicly available security updates. No product can be absolutely secure. See configuration disclosure for details. Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more information go to www.intel.com/benchmarks. *Other names and brands may be claimed as the property of others.

VIDEO

NEW ERA OF DATA CENTER TECHNOLOGY

DATA-CENTRIC INFRASTRUCTURE

MOVE FASTER

intel SILICON PHOTONICS

intel OMNI-PATH FABRIC

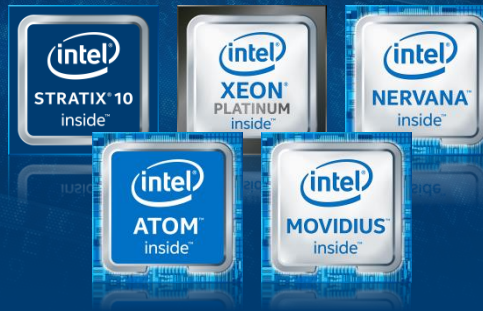
intel ETHERNET

STORE MORE

intel OPTANE DC
SOLID STATE DRIVE

intel OPTANE DC
PERSISTENT MEMORY

PROCESS EVERYTHING



SOFTWARE & SYSTEM-LEVEL **OPTIMIZED**

NEXT-GEN INTEL® XEON® SCALABLE PROCESSOR WITH INTEL® OPTANE™ DC PERSISTENT MEMORY

INTEL® DEEP LEARNING BOOST

LEADERSHIP PERFORMANCE

HIGHER FREQUENCIES

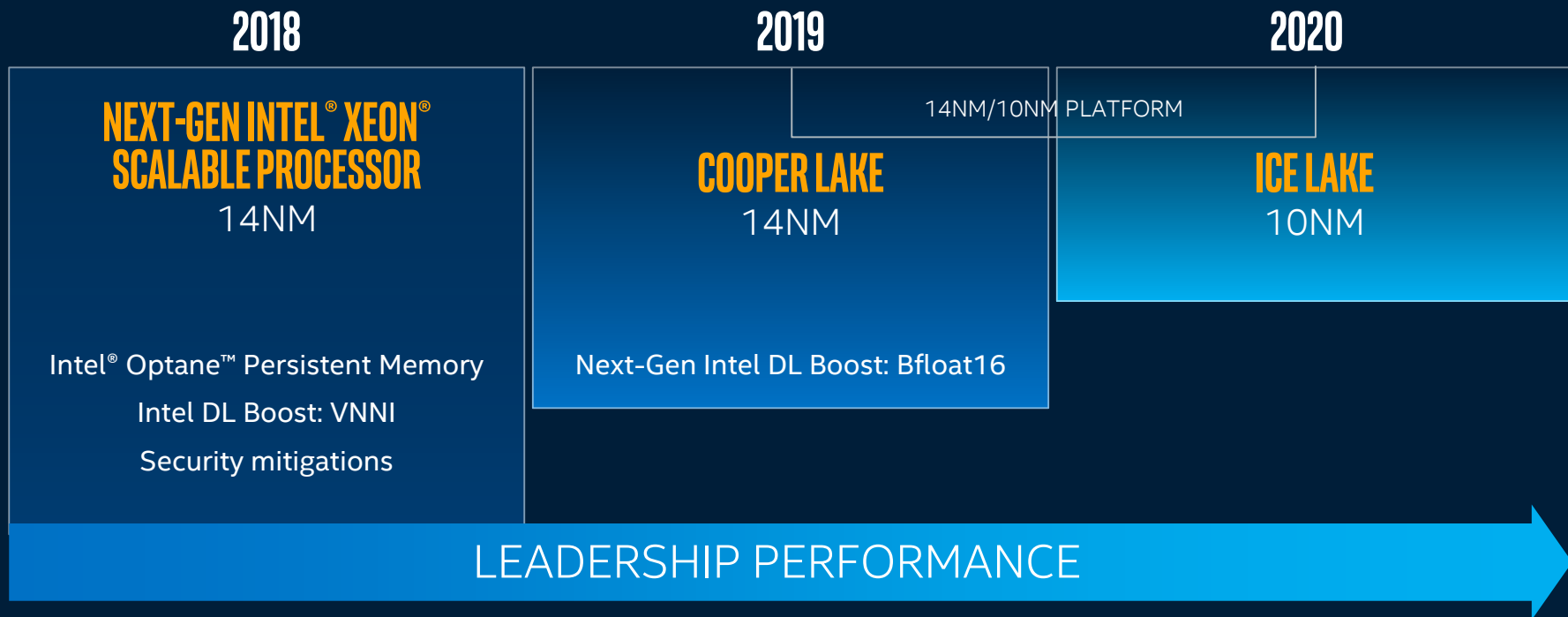


SUPPORT FOR  OPTANE™ DC PERSISTENT MEMORY

SECURITY MITIGATIONS

OPTIMIZED FRAMEWORKS & LIBRARIES

THE FUTURE OF INTEL® XEON® SCALABLE PROCESSORS



AI COMPUTE FROM CLOUD TO DEVICE

ALL PURPOSE



Intel® Xeon®
Scalable Processor Family

FOUNDATION FOR AI

FLEXIBLE ACCELERATION



Intel®
FPGA

ENHANCED DL INFERENCE

TRAINING & INFERENCE

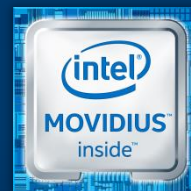


COMING 2019

Intel® Nervana™
Neural Network Processor

DEEP LEARNING BY DESIGN

EDGE INFERENCE



Intel® Movidius™
Myriad™ Technology

EDGE OPTIMIZED

100s WATTS

mWATTS

CISCO & INTEL: DRIVING DATACENTER MODERNIZATION

UCS

Cohesive next-gen datacenter platform combining Compute, network, storage, and virtualization to reduce TCO and increase business agility

ACI

Innovative architecture to simplify, optimize, & accelerate the application deployment lifecycle

Big Data

Highly efficient infrastructure built to deliver big data and analytics solutions at the network core, network edge, and in the cloud

Cloud/SDI

Suite of solutions to accelerate SDI and build and deploy secure private cloud infrastructures

HyperFlex

Next-gen hyperconvergence offering with robust, fabric-centric infrastructure that scales efficiently & supports a broad range of applications

Tetration

Real-time data center analytics, combines network and server sensors to simplify SDN, migration to the cloud, and white-list security.

NFVi


Carrier-class Network Functions Virtualization infrastructure that allows Service Providers deploy new services faster, reduce TCO & maintain service availability

Leading Edge Intel Xeon Benefits

- Performance Leadership
- Works closely with storage and networking to reach new solutions
- Delivers features enabling better virtualization experience

INTRODUCING ALL NVME HYPERFLEX



 All NVMe with 40 GbE Integrated Fabric Networking

 RAS with Intel VMD for Hot-Plug, Surprise Removal etc.

 NVMe Optane Cache 375 GB Capacity , NVMe Capacity (up to 32TB/Node)

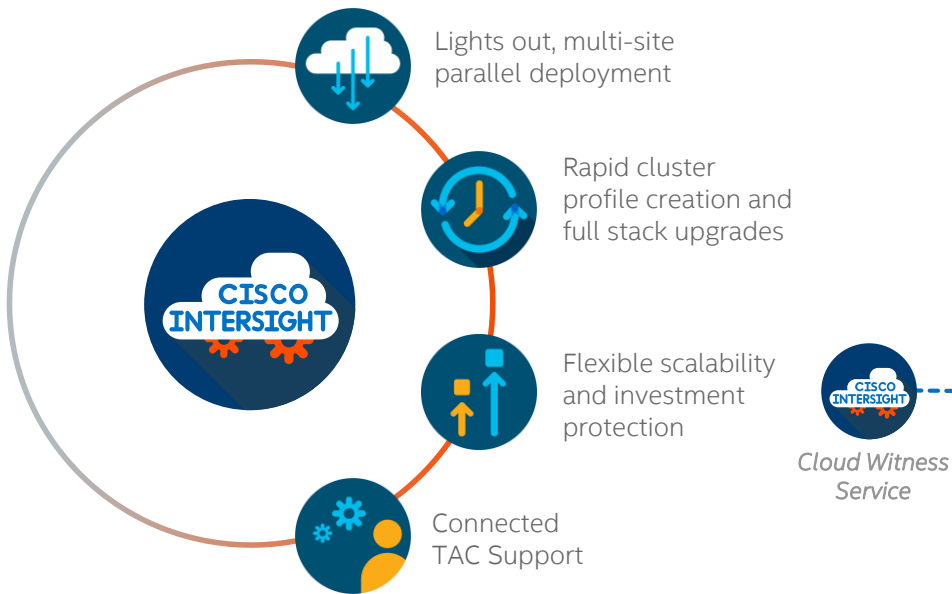


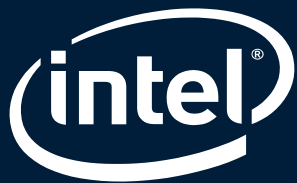
Cisco Hyperflex™ Systems with Intel® Xeon® Platinum processor



THE NEW HYPERFLEX EDGE

The Power of Cloud-Managed Computing





WE ARE IN A NEW ERA OF DATA-CENTRIC COMPUTING

IT MUST MOVE FASTER, STORE MORE, & PROCESS EVERYTHING

**CISCO / INTEL ARE COLLABORATING DEEP & WIDE TO
DELIVER DATA-CENTRIC PLATFORMS FOR YOUR NEEDS**

BENCHMARK & CONFIGURATION DETAILS

INTEL® XEON® SCALABLE PROCESSOR CONFIGURATION DETAILS

1.48x: Per Core Performance

Intel Xeon Platinum 8180: Intel Xeon-based Reference Platform with 2 Intel Xeon 8180 (2.5GHz, 28 core) processors, BIOS ver SE5C620.86B.00.01.0014.070920180847, 07/09/2018, microcode: 0x200004d, HT ON, Turbo ON, 12x32GB DDR4-2666, 1 SSD, Ubuntu 18.04.1 LTS (4.17.0-041700-generic Retpoline), 1-copy SPEC CPU 2017 integer rate base benchmark compiled with Intel Compiler 18.0.2 -O3, executed on 1 core using taskset and numactl on core 0. Estimated score = 6.59, as of 8/2/2018 tested by Intel

AMD EPYC 7601: Supermicro AS-2023US-TR4 with 2 AMD EPYC 7601 with 2 AMD EPYC 7601 (2.2GHz, 32 core) processors, BIOS ver 1.1a, 4/26/2018, microcode: 0x8001227, SMT ON, Turbo ON, 16x32GB DDR4-2666, 1 SSD, Ubuntu 18.04.1 LTS (4.17.0-041700-generic Retpoline), 1-copy SPEC CPU 2017 integer rate base benchmark compiled with AOCC ver 1.0 -Ofast, -march=znver1, executed on 1 core using taskset and numactl on core 0. Estimated score = 4.45, as of 8/2/2018 tested by Intel

3.20x: High Performance Linpack

Intel Xeon Platinum 8180: Intel Xeon-based Reference Platform with 2 Intel Xeon 8180 (2.5GHz, 28 core) processors, BIOS ver SE5C620.86B.00.01.0014.070920180847, 07/09/2018, microcode: 0x200004d, HT ON (1 thread per core), Turbo ON, 12x32GB DDR4-2666, 1 SSD, Ubuntu 18.04.1 LTS (4.17.0-041700-generic Retpoline), High Performance Linpack v2.1, compiled with Intel(R) Parallel Studio XE 2018 for Linux, Intel MPI and MKL Version 18.0.0.128, Benchmark Config: Nb=384, N=203136, P=1, Q=2, Q=4, Score = 3507.38GFs, as of July 31, 2018 tested by Intel

AMD EPYC 7601: Supermicro AS-2023US-TR4 with 2 AMD EPYC 7601 (2.2GHz, 32 core) processors, SMT OFF, Turbo ON, BIOS ver 1.1a, 4/26/2018, microcode: 0x8001227, 16x32GB DDR4-2666, 1 SSD, Ubuntu 18.04.1 LTS (4.17.0-041700-generic Retpoline), High Performance Linpack v2.2, compiled with Intel(R) Parallel Studio XE 2018 for Linux, Intel MPI version 18.0.0.128, AMD BLIS ver 0.4.0, Benchmark Config: Nb=232, N=168960, P=4, Q=4, Score = 1095GFs, as of July 31, 2018 tested by Intel

1.85x: Database

Intel Xeon Platinum 8180: Intel Xeon-based Reference Platform with 2 Intel Xeon 8180 (2.5GHz, 28 core) processors, BIOS ver SE5C620.86B.0X.01.0115.012820180604, microcode: 0x2000043, HT ON, Turbo ON, 24x32GB DDR4-2666, 1 x Intel DC P3700 PCI-E SSD (2TB, 1/2 Height PCIe 3.0, 20nm, MLC), Red Hat Enterprise Linux 7.4 (3.10.0-693.11.6.el7.x86_64 IBRS), HammerDB ver 2.3, PostgreSQL ver 9.6.5, Score = 2,250,481 tpm, as of 3/15/2018 tested by Intel

AMD EPYC 7601: HPE Proliant DL385 Gen10 with 2 AMD EPYC 7601 (2.2GHz, 32 core) processors, ROM ver 1.06, microcode: 0x8001227, SMT ON, Turbo ON, 16x32GB DDR4-2666, 1 x Intel DC P3700 PCI-E SSD (2TB, 1/2 Height PCIe 3.0, 20nm, MLC), Red Hat Enterprise Linux 7.4 (3.10.0-693.21.1.el7.x86_64 Retpoline), HammerDB ver 2.3, PostgreSQL ver 9.6.5, Score = 1,210,575 tpm, as of 4/12/2018 tested by Intel

1.45x: Memcached (Memory Object Caching)

Intel Xeon Platinum 8180: Intel Reference Platform with 2 Intel Xeon 8180 (2.5GHz, 28C) processors, BIOS ver SE5C620.86B.00.01.0014.070920180847, 07/09/2018, microcode: 0x200004d, HT ON, Turbo ON, 12x32GB DDR4-2666, 1SSD, 1 40GbE PCIe XL710 Adapter, Ubuntu 18.04.1 LTS (4.17.0-041700-generic Retpoline), Memcached using YCSB benchmark Workloadc, YCSB 0.16.0, Memcached v1.5.9, Max throughput (ops/sec) with P99 latency < 1ms, Score: 2711265 ops/sec, as of 8/2/2018 tested by Intel

AMD EPYC 7601: Supermicro AS-2023US-TR4 with 2 AMD EPYC 7601 (2.2GHz, 32C) processors, BIOS ver 1.1a, 4/26/2018, microcode: 0x8001227, SMT ON, Turbo ON, 16x32GB DDR4-2666, 1SSD, 1 40GbE PCIe XL710 Adapter, Ubuntu 18.04 LTS, (4.17.0-041700-generic Retpoline), Memcached using YCSB benchmark Workloadc, YCSB 0.16.0, Memcached v1.5.9, Max throughput (ops/sec) with P99 latency < 1ms, Score: 1862841 ops/sec, as of 8/2/2018 tested by Intel

1.72x: L3 Packet Forwarding

Intel Xeon Platinum 8180: Supermicro X11DPG-QT with 2 Intel Xeon-SP 8180 (2.5GHz, 28C) processors, BIOS ver 2.0b, microcode: 0x2000043, 12x32GB DDR4-2666, 1 SSD, 2x Intel XXV710-DA2 PCI Express (2x25GbE), DPDK L3fwd sample application (IPv4 LPM, 256B packet size, 625000 flows), DPDK 17.11, Ubuntu 17.10, (4.13.0-31-generic IBRS), HT ON, Turbo OFF, Score= 42.22 Million Packets / second, as of 8/2/2018 tested by Intel

AMD EPYC 7601: Supermicro AS-2023US-TR4 with 2 AMD EPYC 7601 (2.2GHz, 32C) processors, BIOS ver 1.1a, microcode: 0x8001227, 16x32GB DDR4-2666, 1 SSD, 2x Intel XXV710-DA2 PCI Express (2x25GbE), DPDK L3fwd sample application (IPv4 LPM, 256B packet size, 625000 flows), DPDK 17.11, Ubuntu 17.10 (4.13.0-36-generic Retpoline), SMT ON, Turbo (core boost) OFF, Score= 24.52 Million Packets / second, as of 8/2/2018 tested by Intel

INTEL® OPTANE™ PERSISTENT MEMORY CONFIGURATION DETAILS

Performance results are based on testing: 8X (8/2/2018), 9X Reads/11X Users (5/24/2018), Minutes to Seconds (5/30/2018) and may not reflect all publicly available security updates. No product can be absolutely secure.

Results have been estimated based on tests conducted on pre-production systems: 8x (running OAP with 2.6TB scale factor on IO intensive queries), 9X Reads/11X Users (running Cassandra optimized for persistent memory), and Minutes to Seconds (running Aerospike* Hybrid Memory Architecture optimized for persistent memory), and provided to you for informational purposes.

SAP HANA 12.5X start-up time: <https://blogs.saphana.com/2018/06/12/harnessing-hyperscale-processing-more-data-at-speed-with-persistent-memory>