DATA CENTRIC BUSINESS UPDATE
MEDIA BRIEFING

Lisa Spelman
VICE PRESIDENT & GENERAL MANAGER
INTEL® XEON® PRODUCTS AND DATA CENTER MARKETING
NEW: CASCADE LAKE ADVANCED PERFORMANCE
NEW: XEON E PROCESSOR – ENTRY 1S SERVER SOLUTION
NEW: OPTANE DC PERSISTENT MEMORY UPDATE
DATA DEFINES THE FUTURE

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

The world's most valuable resource
Data and the new rules of competition

DATA IS POWER

The Control Centers

Popular Science

Cosmos

Other names and brands may be claimed as the property of others.
NEW ERA OF DATA-CENTRIC INNOVATION

MOVE FASTER
- SILICON PHOTONICS
- OMNI-PATH FABRIC
- ETHERNET

STORE MORE
- OPTANE DC
- SOLID STATE DRIVE
- PERSISTENT MEMORY

PROCESS EVERYTHING

OVER 20 YEARS OF XEON PLATFORM LEADERSHIP
WORLD RECORDS AND COUNTING…

PROCESS EVERYTHING
DATA-CENTRIC MOMENTUM

INTEL® XEON® PROCESSOR AI WINS

95 WORLD RECORDS AND COUNTING…
8M CPUS SHIPPED INTO A GROWING 30M UNIT TAM SPANNING SERVER, STORAGE, NETWORK

IN Q3’18

Alibaba Cloud
aws
Baidu
bluedata
cdhi
CRAY
DataRobot
DELL EMC
GIGASOURCES
Google Cloud
Hikvision
KINGSOFT
KYOTO UNIVERSITY
MTC
Novartis
NYU Langone Medical Center
Rollei
ROYCE
Tata
Taboola
Telefonica
Toutiao
UCLOUD
UnionPay

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NEXT GEN INTEL® XEON® SCALABLE PROCESSOR

CASCADE LAKE
WITH INTEL® OPTANE™ DC PERSISTENT MEMORY

Leadership Performance
Optimized Cache Hierarchy
Higher Frequencies
Security Mitigations
Intel Deep Learning Boost (VNNI)
Optimized Frameworks & Libraries

BUILDING ON 20 YEARS OF XEON INNOVATION
NEW CLASS OF INTEL® XEON® SCALABLE PROCESSORS

ANNOUNCING

CASCADE LAKE ADVANCED PERFORMANCE

PERFORMANCE LEADERSHIP
ARCHITECTED FOR DEMANDING HPC, AI & IAAS WORKLOADS

UNPRECEDENTED MEMORY BANDWIDTH
MORE MEMORY CHANNELS THAN ANY OTHER CPU

PERFORMANCE OPTIMIZED MULTI CHIP PACKAGE
HIGH SPEED INTERCONNECT

CASCADE LAKE ADVANCED PERFORMANCE
2-SOCKET SERVER

CASCADE LAKE MCP
48 CORES

CASCADE LAKE MCP
48 CORES

DDR4 12 channels

LINPACK
STREAM TRIAD
DL INFERERENCE

UP TO 3.4X
UP TO 1.3X
UP TO 17X IMAGES
PER SECOND

vs AMD EPYC 7601

vs Intel® Xeon® Platinum Processor at launch

Performance Leadership: Based on our current understanding of the Linpack performance of general purpose processors, commercially available in 2019. Unprecedented Memory Bandwidth: Native DDR memory bandwidth. 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 this product when combined with other products. For more complete information visit www.intel.com/benchmarks. Results have been estimated or simulated using internal Intel analysis or architecture simulation or modeling, and provided to you for informational purposes. Any differences in your system hardware, software, or configuration may affect your actual performance.

Performance results are based on testing or projections as of 6/2017 to 10/2018 (Stream Triad), 7/31/2018 to 10/3/2018 (LINPACK) and 7/11/2017 to 10/7/2018 (DL inference) and may not reflect all publicly available security updates. See configuration disclosure in backup for details. No product can be absolutely secure. Intel compilers may or may not optimize to the same degree for non-intel microprocessors for optimizations that are not unique to Intel microprocessors. These optimizations include SSE2, SSE3, and SSSE3 instruction sets and other optimizations. Intel does not guarantee the availability, functionality, or effectiveness of any optimization on microprocessors not manufactured by Intel. Microprocessor-dependent optimizations in this product are intended for use with Intel microprocessors. Certain optimizations not specific to Intel microarchitecture are reserved for Intel microprocessors. Please refer to the applicable product User and Reference Guides for more information regarding the specific instruction sets covered by this notice (Notice Revision #20110804). Other names and brands may be claimed as the property of others.
## New Intel® Xeon® E Processor

### Essential Performance for 1S Entry Server Solutions

**Up to 1.48X Performance Improvement 4-Year Refresh**

**Up to 1.39X Performance Improvement GEN-ON-GEN**

**Up to 64GB-128GB**

**Turbo Boost Technology 2.0**

**6 Cores**

**Enhanced Intel® Software Guard Extensions**

**Performance and visuals with expandability, reliability, security**

### Performance and Visuals with Expandability, Reliability, Security

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Improvement</td>
<td>Up to 1.48X</td>
</tr>
<tr>
<td>4-Year Refresh</td>
<td>Up to 1.39X</td>
</tr>
<tr>
<td>DDR4</td>
<td>2666 MHz</td>
</tr>
<tr>
<td>Turbo Boost Technology 2.0</td>
<td></td>
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<tr>
<td>Cores</td>
<td>Up to 6</td>
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<tr>
<td>Enhanced Intel® Software Guard Extensions</td>
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</tbody>
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*Support for up to 128GB system memory capacity available in Q1 2019 through a BIOS update. Please contact your hardware provider for availability and support. 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 complete information, visit www.intel.com/benchmarks. Performance results are based on testing as of 10/12/2018 and may not reflect all publicly available security updates. See configuration disclosure for details. No product can be absolutely secure. Results have been estimated or simulated using internal Intel analysis or architecture simulation or modeling, and provided to you for informational purposes. Any differences in your system hardware, software or configuration may affect your actual performance. Please see Slide 17 for complete details on the performance claims and configurations.*
**INTEL® SGX**
*INTEL® SOFTWARE GUARD EXTENSIONS*

**ENCLAVES PROTECT CODE AND DATA**
EVEN IF ATTACKER HAS CONTROL OF THE PLATFORM

**Fortanix**
Fortanix provides Runtime Encryption® software to protect keys, data, and x86 applications

**IBM**
IBM Cloud Data Shield powered by Fortanix protects run time data at scale on Kubernetes Service

**Microsoft**
Azure Confidential Computing protects customer’s most sensitive data while it’s processed in the cloud

**R3**
R3 Corda’s approach to privacy and security shares data only with those who need to see it, enabling strict confidentiality for enterprise blockchain applications
NEW ERA OF DATA-CENTRIC INNOVATION

MOVE FASTER
- SILICON PHOTONICS
- OMNI-PATH FABRIC
- ETHERNET

STORE MORE
- OPTANE DC
- PERSISTENT MEMORY

PROCESS EVERYTHING
- XEON
- STRATIX 10
- NERVANA

OVER 20 YEARS OF XEON PLATFORM LEADERSHIP
**BIG AND AFFORDABLE MEMORY**

**HIGH PERFORMANCE STORAGE**

**DIRECT LOAD/STORE ACCESS**

**NATIVE PERSISTENCE**

**128, 256, 512GB**

**DDR4 PIN COMPATIBLE**

**HARDWARE ENCRYPTION**

**HIGH RELIABILITY**

**SHIPPING FOR REVENUE SINCE AUG. 8**
SUPPORT FOR BREADTH OF APPLICATIONS

APP DIRECT MODE
PERSISTENT PERFORMANCE & MAXIMUM CAPACITY

MEMORY MODE
AFFORDABLE MEMORY CAPACITY FOR MANY APPLICATIONS

APPLICATION

OPTANE PERSISTENT MEMORY

DRAM

APPLICATION

VOLATILE MEMORY POOL

DRAM AS CACHE

OPTANE PERSISTENT MEMORY
NEW ERA OF DATA-CENTRIC INNOVATION

MOVE FASTER
- Intel® Silicon Photonics
- OMNI-Path Fabric
- Intel® Ethernet

STORE MORE
- Intel® Optane® DC Solid State Drive
- Intel® Optane® DC Persistent Memory

PROCESS EVERYTHING
- Intel® Xeon® Platinum Processor
- Intel® Stratix® 10 FPGA
- Intel® Nervana™ Neural Network Processor

OVER 20 YEARS OF XEON PLATFORM LEADERSHIP
**LINPACK:** 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, tested by Intel as of July 31, 2018. compared to 1-node, 2-socket 48-core Cascade Lake Advanced Performance processor projections by Intel as of 10/3/2018.


DL Inference: Platform: 2S Intel® Xeon® Platinum 8180 CPU @ 2.50GHz (28 cores), HT disabled, turbo disabled, scaling governor set to “performance" via intel_pstate driver, 384GB DDR4-2666 ECC RAM. CentOS Linux release 7.3.1611 (Core), Linux kernel 3.10.0-514.10.2.el7.x86_64. SSD: Intel® SSD DC S3700 Series (800GB, 2.5in SATA 6Gb/s, 25nm, MLC). Performance measured with: Environment variables: KMP_AFFINITY='granularity=fine,compact', OMP_NUM_THREADS=56, CPU Freq set with cpupower frequency-set -d 2.5G -u 3.8G -g performance. Caffe: [http://github.com/intel/caffe/](http://github.com/intel/caffe/), revision f96b759f71b2281835f690af267158b2b150b5c. Inference measured with “caffe time --forward_only” command, training measured with “caffe time” command. For “ConvNet” topologies, dummy dataset was used. For other topologies, data was stored on local storage and cached in memory before training. Topology specs from [https://github.com/intel/caffe/tree/master/models/intel_optimized_models](https://github.com/intel/caffe/tree/master/models/intel_optimized_models) (ResNet-50), and [https://github.com/soumith/convnet-benchmarks/tree/master/caffe/imagenet_winners](https://github.com/soumith/convnet-benchmarks/tree/master/caffe/imagenet_winners) (ConvNet benchmarks; files were updated to use newer Caffe prototxt format but are functionally equivalent). Intel C++ compiler ver. 17.0.2 20170213, Intel MKL small libraries version 2018.0.20170425. Caffe run with “numactl -l”. Tested by Intel as of July 11th 2017 -. compared to 1-node, 2-socket 48-core Cascade Lake Advanced Performance processor projections by Intel as of 10/7/2018.