ТЕХНОЛОГИИ INTEL®
ДЛЯ РАБОЧИХ СТАНЦИЙ FUJITSU

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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.

Configurations: System configurations, SSD configurations and performance tests conducted are discussed in detail within the body of this paper. For more information go to intel.com/performance.

For more complete information about performance and benchmark results, visit www.intel.com/benchmarks. Benchmark results were obtained prior to implementation of recent software patches and firmware updates intended to address exploits referred to as “Spectre” and “Meltdown.” Implementation of these updates may make these results inapplicable to your device or system.

Intel technologies’ features and benefits depend on system configuration and may require enabled hardware, software or service activation. Performance varies depending on system configuration. No computer system can be absolutely secure. Check with your system manufacturer or retailer or learn more at intel.com.

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Рабочие станции в мире облаков

Архитектура и строительство

Медиа и развлечения

Финансы

Энергетика

Наука

Искусственный интеллект

2020 TAM ~6Mu

Source: IDC

Персональный суперкомпьютер: мощный, надежный и универсальный

Для профессиональных приложений

Сертифицированы для большинства профессиональных программных пакетов

Максимальная производительность

Спроектированы для максимальной скорости решения бизнес-задач с минимумом простоя

Для алгоритмов будущего

Готов к нагрузкам завтрашнего дня – созданию VR и 4K/8K контента.

Творчество

Процессоры Intel® Xeon® позволяют творить и экспериментировать без ограничений.

Сертифицировано производителями ПО

Процессоры Intel® Xeon®

ptc* SIEMENS* Adobe* AUTODESK* DASSAULT SYSTEMES*

МОДЕЛИРОВАНИЕ

Ansys* Solvers, Solidworks* Simulation, Creo* Simulate

РЕНДЕРИНГ/3D МОДЕЛИ, 3D ДИЗАЙН

Adobe Dimension*, Keysho*t, Arnold Renderer*, Maya*/3ds Max*, Autodesk Maya*, Unity*, Unreal Engine*

ИСКУССТВЕННЫЙ ИНТЕЛЛЕКТ & АНАЛИТИКА

Фреймворки как TensorFlow* и Caffe*

CAE, CAD & MCAD

Autodesk AutoCAD*, Inventor*, Revit*, Solidworks*, Creo*, Siemens* NX PLM*, PLM TcVIs*, PLM* Solid Edge, Autodesk Cinema 4D*

VISUAL EFFECTS/MOTION GRAPHICS

Adobe After Effects*. Autodesk Smoke*, Blackmagic Fusion*, The Foundry Nuke*

CONTENT & VIDEO EDITING

Adobe Lightroom*, Photoshop*, Premiere Pro*, Phase One Capture One*

ПРОИЗВОДИТЕЛЬНОСТЬ

Ansys*, Autodesk* VRED, Spin* Digital Decoder

intel

Технологии Intel для Рабочих Станций

Меньше времени на простой и больше на работу – функции CPU

Процессор Intel® Xeon®

Один или два сокета для быстрой визуализации, моделирования и рендеринга

ТЕХНОЛОГИЯ INTEL® DEEP LEARNING BOOST

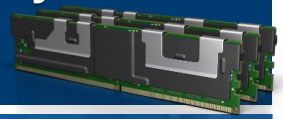
Увеличивает производительность алгоритмов Машинного Обучения

Intel® Virtual RAID on CPU (VROC)

Connect more SSDs off the Processor without Compromising Bandwidth

Intel® Optane™ DC Persistent Memory

Больше данных
Больше пользы



Память с коррекцией ошибок (ECC)

Защищает систему от сбоев и ошибок

Технология Intel® vPro™

Безопасность,
Надежность,
Управляемость

Семейства INTEL® XEON® для рабочих станций

INTEL® XEON® SCALABLE

INTEL® XEON® W

Intel® Xeon® **W**-3200 Processors
Intel® Xeon® **W**-2200 Processors

INTEL® XEON® E

NEW 2ND GENERATION INTEL® XEON® SCALABLE PROCESSORS IN Q1'2020
DELIVERING ENHANCED PERFORMANCE AND VALUE

BUILT-IN AI ACCELERATION
WITH INTEL® DL BOOST

MORE MAINSTREAM PERFORMANCE

AVG OF **36%**

GEN OVER GEN PERFORMANCE IMPROVEMENT [3]

INDUSTRY LEADING FREQUENCY FOR PEAK PERFORMANCE

UP TO **3.9 GHZ**

UP TO 4.5 GHZ TURBO
UP TO 44% MORE CACHE †
UP TO 4S SYSTEM SCALABILITY

IMPRESSIVE MAINSTREAM PERFORMANCE/$

AVG OF **42%**

GEN OVER GEN PERFORMANCE/$ IMPROVEMENT [3]

DELIVERING RAPID ENHANCEMENTS
TO SUPPORT IMMEDIATE CUSTOMER NEEDS

ALL DELIVERED AT EQUAL OR LOWER PRICING

3 - **36% more performance & 42% more performance/dollar:** Geomean of Integer Throughput, Floating Point Throughput, Stream Triad, and Linpack across 62xxR SKUs vs 61xx. performance metric based on increase in frequency and core counts. Performance metric combined with pricing to build performance/$. For more complete information about performance and benchmark results, visit www.intel.com/benchmarks. See configuration slide 46 for details. For more information regarding performance and optimization choices in Intel software products., please visit https://software.intel.com/en-us/articles/optimization-notice.
† - Comparing new 2nd Gen Intel® Xeon Scalable processors to current 2nd Gen Intel® Xeon Scalable processors

NEW 2ND GENERATION INTEL® XEON® SCALABLE PROCESSORS

INTEL® XEON® GOLD 6250 И INTEL® XEON® GOLD 6256

UP TO 7%
INCREASE IN BASE FREQUENCY
Comparing Intel® Xeon® Gold 6256 Processor to the Intel® Xeon® Gold 6246 Processor

UP TO 9%
INCREASE IN TURBO FREQUENCY
Comparing Intel® Xeon® Gold 6256 Processor to the Intel® Xeon® Gold 6246 Processor

UP TO 33%
INCREASE IN PROCESSOR CACHE
Comparing Intel® Xeon® Gold 6256 Processor to the Intel® Xeon® Gold 6246 Processor

BREAKTHROUGH PROCESSOR FREQUENCIES FOR HIGH PERFORMANCE USAGES

FINANCIAL SERVICES/HFT • HPC • CDN/MEDIA STREAMING • EDGE/IO CLOUD GAMING • VM PERFORMANCE

Intel® Xeon® Gold 6256 Processor
12 Cores, Up to 4.5 GHz Turbo, 3.6 GHz Base
33MB Cache, 205W

Intel® Xeon® Gold 6250 Processor
8 Cores, Up to 4.5 GHz Turbo, 3.9 GHz Base
35.75MB Cache, 185W

Turbo: Highest available Intel® Turbo Boost Technology 2.0 frequency (per processor). Base: Base processor frequency for each core

NEW 2ND GENERATION INTEL® XEON® SCALABLE PROCESSORS
ENHANCED PERFORMANCE FOR MAINSTREAM USAGES

MORE CORES MORE THREADS
Comparing all Intel® Xeon® Gold 6200R processors to current Intel® Xeon® Gold 6200 processors

HIGHER BASE FREQUENCIES
Comparing most Intel® Xeon® Gold 6200R processors to current Intel® Xeon® Gold 6200 processors

HIGHER TURBO FREQUENCIES
Comparing all Intel® Xeon® Gold 6200R processors to Intel® Xeon® Gold 6200 processors

MORE PROCESSOR CACHE
Comparing all Intel® Xeon® Gold 6200R processors to Intel® Xeon® Gold 6200 processors

Intel® Xeon® Gold 6258R Processor†
28 Cores, Up to 4.0 GHz Turbo, 2.7 GHz Base
38.5MB Cache, 205W

Intel® Xeon® Gold 6248R Processor†
24 Cores, Up to 4.0 GHz Turbo, 3.0 GHz Base
35.75MB Cache, 205W

Intel® Xeon® Gold 6246R Processor†
16 Cores, Up to 4.1 GHz Turbo, 3.4 GHz Base
35.75MB Cache, 205W

Intel® Xeon® Gold 6242R Processor†
20 Cores, Up to 4.1 GHZ Turbo, 3.1 GHz Base
35.75MB Cache, 205W

Intel® Xeon® Gold 6240R Processor
24 Cores, Up to 4.0 GHZ Turbo, 2.4 GHz Base
35.75MB Cache, 165W

Intel® Xeon® Gold 6238R Processor
28 Cores, Up to 4.4 GHZ Turbo, 2.2 GHz Base
38.5MB Cache, 165W

Intel® Xeon® Gold 6230R Processor
26 Cores, Up to 4.0 GHZ Turbo, 2.1 GHz Base
35.75MB Cache, 150W

Intel® Xeon® Gold 6226R Processor
16 Cores, Up to 3.9 GHz Turbo, 2.9 GHz Base
22MB Cache, 150W

AVAILABLE AT SIMILAR OR LOWER PRICES‡

† – For optimal operation and long-term reliability of Intel processor-based systems, the processor must remain within the minimum and maximum case temperature (TCASE) specifications as defined by the applicable thermal profile. Thermal solutions with insufficient cooling capability may affect the long-term reliability of the processor and system. For more information about processor TCASE requirements, visit www.intel.com.
‡ - Comparing all Intel Xeon Gold 62XXR processors to existing Intel Xeon Gold 62XX processors.
Turbo: Highest available Intel® Turbo Boost Technology 2.0 frequency (per processor). Base: Base processor frequency for each core.

NEW AND FEATURED XEON W TECHNOLOGIES

NEW

- **Up to 4.8 GHz**
- **Up to 1 TB DDR4-2933 support[1]**
- **Intel® Turbo Boost Max Technology 3.0**
- **Intel® Deep Learning Boost**
- **2.5G Intel® Ethernet Controller i225 support[2]**
- **Intel® Wi-Fi 6 AX200 (Gig+) support**

FEATURED

- Up to 18 cores with Intel® Hyper-Threading Technology
- Up to 72 platform PCIe* lanes on all SKUs
- Error-correcting code (ECC) support
- Built-in reliability, availability, and serviceability (RAS)
- Intel® Virtual RAID On CPU (Intel® VROC) support
- Thunderbolt™ 3 support
- Intel® Optane™ SSD 905P support
- Intel® vPro™ platform support

For more complete information about performance and benchmark results, visit intel.com/benchmarks.
Performance results are based on testing as of the date set forth in the configurations and may not reflect all publicly available security updates.
See configuration disclosure for details. No product or component can be absolutely secure.

ОШИБКИ ПАМЯТИ: НАСКОЛЬКО ЭТО РЕАЛЬНО

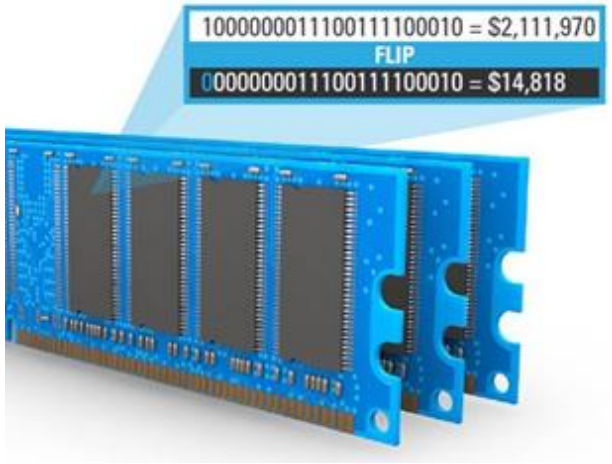
*Обычно битовые ошибки приводят к "Синим Экранам", но иногда могут пройти незамеченными и изменить данные – например **$2,111,970** станет **$14,818***

99%

Получить ошибку в non-ECC RAM памяти в течении 3 лет[1,3]

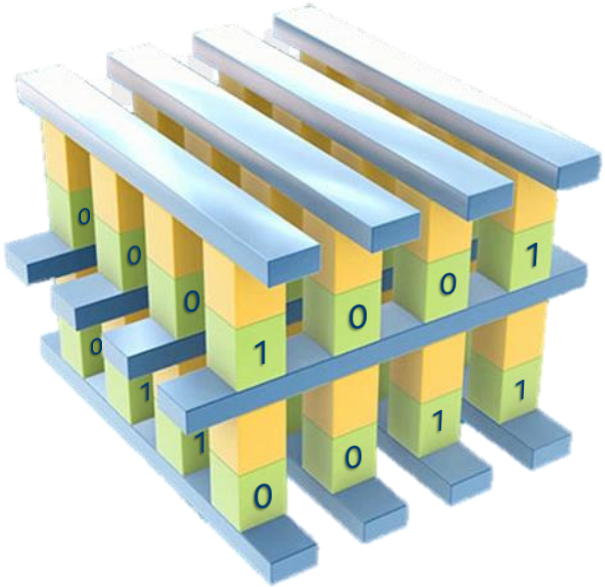
99%

Поймать и исправить ошибку в ECC RAM- памяти[2,3]



1Source: X, Li, K, Shen, M. Huang, and L. Chu "A memory soft error measurement on production systems." https://www.cs.rochester.edu/~kshen/papers/usenix2007-li.pdf
[2]"A Reaslstic Evaluation of memory hardware erors and Software Systems Susceptibility." https://www.cs.rochester.edu/~kshen/papers/usenix2010-li.pdf
Source: http://lambda-diode.com/opinion/ecc-memory

ЧТО ТАКОЕ ТЕХНОЛОГИЯ INTEL® OPTANE™?



НОВАЯ ФИЗИКА ХРАНЕНИЯ
ПОБИТОВАЯ ЗАПИСЬ ДАННЫХ
КАК В DRAM

Технология Intel® Optane™ принципиально отличается от NAND FLASH

intel OPTANE™ DC PERSISTENT MEMORY

intel XEON® PLATINUM inside™

Большая и Доступная память

128GB, 256GB, 512GB

Высокопроизводительное хранилище

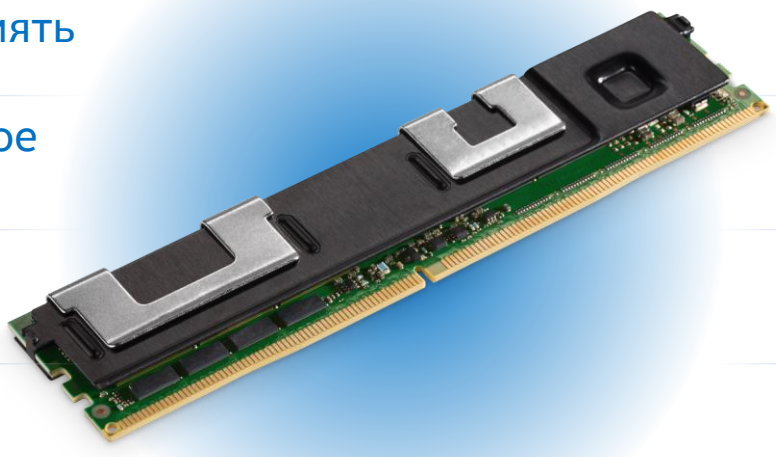
DDR4 DIMM

Прямой Load/Store

Безопасность

Энергонезависимая

Высокая надежность



Технологии Intel для Рабочих Станций

Меньше времени на простой и больше на работу – компоненты

Intel® Optane™ SSD 905P

Intel® NAND NVMe SSD

Thunderbolt™ 3

More **Protocols** — THUNDERBOLT, SUPERSPEED USB, DisplayPort, PCI EXPRESS

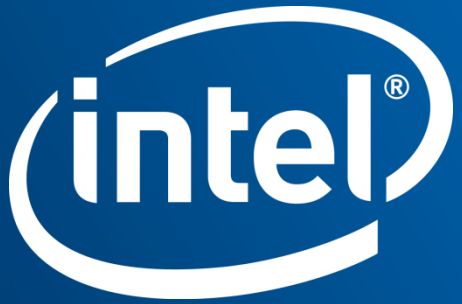
More **Speed** — **40 Gbps**—fastest connection**

More **Pixels** —  **Dual 4K displays** 60 Hz

More **Power** — **100 W** charging, **15 W** device

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.

1. As compared to any other connection to the PC


intel®

2ND GENERATION INTEL® XEON® SCALABLE PROCESSORS

PROCESSOR SKU STRUCTURE

INTEL® XEON® PLATINUM # 2 # # α α PROCESSOR

PROCESSOR LEVEL
9 PLATINUM
8 PLATINUM
6 GOLD
5 GOLD
4 SILVER
3 BRONZE

PROCESSOR GENERATION
2 SECOND GENERATION
1 FIRST GENERATION

PROCESSOR SKU
E.G. 20, 34, ...

PROCESSOR OPTIONS
L LARGE DDR MEMORY TIER SUPPORT (UP TO 4.5TB)
N NETWORKING & NFV SPECIALIZED (INCL. SST-BF)
R REFRESH
S SEARCH VALUE SPECIALIZED
T THERMAL & LONG-LIFE CYCLE SUPPORT
V VM DENSITY VALUE SPECIALIZED
Y INTEL® SPEED SELECT TECHNOLOGY (SST-PP, "3 CPUS IN 1")

NFV: NETWORK FUNCTION VIRTUALIZATION
SST-BF: INTEL® SPEED SELECT TECHNOLOGY-BASE FREQUENCY)
SST-PP: INTEL® SPEED SELECT TECHNOLOGY-PERFORMANCE PROFILE
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CONTACT YOUR INTEL REPRESENTATIVE TO OBTAIN THE LATEST INTEL PRODUCT SPECIFICATIONS.

SECOND GENERATION INTEL® XEON® SCALABLE PROCESSORS

INTEL® XEON® PLATINUM 9200 PROCESSORS

INTEL® XEON® PLATINUM 8200 PROCESSORS

INTEL® XEON® GOLD 6200 & 5200 PROCESSORS

INTEL® XEON® SILVER 4200 PROCESSORS

INTEL® XEON® BRONZE 3200 PROCESSORS

AVAILABLE PROCESSOR OPTIONS

L	LARGE DDR MEMORY TIER SUPPORT (UP TO 4.5TB)
N	NETWORKING & NFV SPECIALIZED (INCL. SST-BF) (UP TO 2TB)
R	REFRESH
S	SEARCH VALUE SPECIALIZED
T	THERMAL & LONG-LIFE CYCLE SUPPORT
U	SINGLE-SOCKET VALUE OPTIMIZED
V	VM DENSITY VALUE SPECIALIZED
Y	INTEL® SPEED SELECT TECHNOLOGY-PP ("3 IN 1")

TURBO	MAXIMUM INTEL® TURBO BOOST TECHNOLOGY 2.0 FREQUENCY (IN GHz) PER PROCESSOR
BASE	BASE FREQUENCY (IN GHz)
CACHE	PROCESSOR CACHE (IN MB)
TDP	THERMAL DESIGN POWER (IN WATTS)
SST-PP	INTEL® SPEED SELECT TECH-PERFORMANCE PROFILE
SST-BF	INTEL® SPEED SELECT TECH-BASE FREQUENCY
RCP	RECOMMENDED CUSTOMER PRICING ($ US DOLLARS)
NFV	NETWORK FUNCTION VIRTUALIZATION
VM	VIRTUAL MACHINE
NEBS	NETWORK EQUIPMENT-BUILDING SYSTEM

ADVANCED PERFORMANCE

SKU	CORES	TURBO	BASE	CACHE	TDP	Support for Intel® Optane™ Persistent Memory
9282	56	3.8	2.6	77	400	
9242	48	3.8	2.3	71.5	350	
9222	32	3.7	2.3	71.5	250	
9221	32	3.7	2.3	71.5	250	

OPTIMIZED FOR HIGHEST PER-CORE SCALABLE PERFORMANCE

SKU	CORES	TURBO	BASE	CACHE	TDP	Support for Intel® Optane™ Persistent Memory	
8280	28	4.0	2.7	38.5	205	Yes	L
8270	26	4.0	2.7	35.75	205	Yes	
8268	24	3.9	2.9	35.75	205	Yes	
8256	4	3.9	3.8	16.5	105	Yes	
6258R	28	4.0	2.7	38.5	205	Yes	
6256	12	4.5	3.6	33	205	Yes	
6254	18	4.0	3.1	24.75	200	Yes	
6250	8	4.5	3.9	35.75	185	Yes	L
6246R	16	4.1	3.4	35.75	205	Yes	
6246	12	4.2	3.3	24.75	165	Yes	
6244	8	4.4	3.6	24.75	150	Yes	
6242R	20	4.1	3.1	35.75	205	Yes	
6242	16	3.9	2.8	22	150	Yes	
6234	8	4.0	3.3	24.75	130	Yes	
6226R	16	3.9	2.9	22	150	Yes	
6226	12	3.7	2.7	19.25	125	Yes	
5222	4	3.9	3.8	16.5	105	Yes	
5217	8	3.7	3.0	16.5	115	Yes	
5215	10	3.4	2.5	16.5	85	Yes	L
4215R	8	4.0	3.2	11	130	Yes	
4215	8	3.5	2.5	16.5	85	Yes	

SCALABLE PERFORMANCE

SKU	CORES	TURBO	BASE	CACHE	TDP	Support for Intel® Optane™ Persistent Memory	
8276	28	4.0	2.2	38.5	165	Yes	L
8260	24	3.9	2.4	35.7	165	Yes	L
8253	16	3.0	2.2	35.7	165	Yes	
6252	24	3.7	2.1	35.75	150	Yes	
6248R	24	4.0	3.0	35.75	205	Yes	
6248	20	3.9	2.5	27.5	150	Yes	
6240R	24	4.0	2.4	35.75	165	Yes	
6240	18	3.9	2.6	24.75	150	Yes	L
6238R	28	4.0	2.2	38.5	165	Yes	
6238	22	3.7	2.1	30.25	140	Yes	L
6230R	26	4.0	2.1	35.75	150	Yes	
6230	20	3.9	2.1	27.5	125	Yes	
5220R	24	4.0	2.2	35.75	150	Yes	
5220	18	3.9	2.2	24.75	125	Yes	
5218R	20	4.0	2.1	27.5	125	Yes	
5218	16	3.9	2.3	22	125	Yes	
4216	16	3.2	2.1	16.5	100		
4214R	12	3.5	2.4	16.5	100		
4214	12	3.2	2.2	16.5	85		
4210R	10	3.2	2.4	13.75	100		
4210	10	3.2	2.2	13.75	85		
4208	8	3.2	2.1	11	85		
3206R	8	1.9	1.9	11	85		
3204	6	1.9	1.9	8.25	85		

FEATURING INTEL® SPEED SELECT TECH-PERFORMANCE PROFILE (SST-PP, "3 IN 1")

SKU	CORES	TURBO	BASE	CACHE	TDP	Support for Intel® Optane™ Persistent Memory
8260Y	24	3.9	2.4	35.75	165	Yes
6240Y	18	3.9	2.6	24.75	150	Yes
4214Y	12	3.2	2.2	16.5	85	

NETWORKING/NFV SPECIALIZED (INCL. INTEL® SPEED SELECT TECH -BF)

SKU	CORES	TURBO	BASE	CACHE	TDP	Support for Intel® Optane™ Persistent Memory
6252N	24	3.6	2.3	35.75	150	Yes
6230N	20	3.5	2.3	27.5	125	Yes
5218N	16	3.9	2.3	22	105	Yes

VM DENSITY VALUE SPECIALIZED

SKU	CORES	TURBO	BASE	CACHE	TDP	Support for Intel® Optane™ Persistent Memory
6262V	24	3.6	1.9	33	135	Yes
6222V	20	3.6	1.8	27.5	115	Yes

LONG-LIFE CYCLE AND NEBS-THERMAL FRIENDLY

SKU	CORES	TURBO	BASE	CACHE	TDP	Support for Intel® Optane™ Persistent Memory
6238T	22	3.7	1.9	30.25	125	Yes
6230T	20	3.9	2.1	27.5	125	Yes
5220T	18	3.9	1.9	24.75	105	Yes
5218T	16	3.8	2.1	22	105	Yes
4210T	10	3.2	2.3	13.75	95	
4209T	8	3.2	2.2	11	70	

SEARCH APPLICATION VALUE SPECIALIZED

SKU	CORES	TURBO	BASE	CACHE	TDP	Support for Intel® Optane™ Persistent Memory
5220S	18	3.9	2.7	24.75	125	Yes

SINGLE-SOCKET VALUE SPECIALIZED

SKU	CORES	TURBO	BASE	CACHE	TDP	Support for Intel® Optane™ Persistent Memory
6212U	24	3.9	2.4	35.75	165	Yes
6210U	20	3.9	2.5	27.5	150	Yes
6209U	20	3.9	2.1	27.5	125	Yes
6208U	16	3.9	2.9	22	150	Yes

NEW PROCESSORS

INTEL.COM/XEONSCALABLE

INTEL® XEON® E-2200 PROCESSOR DETAILS

PROCESSOR NUMBER	BASE CLOCK SPEED (GHZ)	INTEL® TURBO BOOST TECHNOLOGY 2.0 FREQUENCY (GHZ)	CORES/ THREADS	INTEL® SMART CACHE	TOTAL PLATFORM PCIE* 3.0 LANES	TDP	MEMORY SUPPORT	INTEL® PROCESSOR GRAPHICS	ERROR CORRECTING CODE (ECC)	INTEL® VPRO™ TECHNOLOGY SUPPORT	INTEL® OPTANE™ TECHNOLOGY SUPPORT
STATIONARY WORKSTATIONS											
Intel® Xeon® E-2288G processor	3.7	5.0	8 / 16	16 MB	Up to 40	95 W	Two channels DDR4-2666	Intel® UHD Graphics P630	✔	✔	✔
Intel® Xeon® E-2286G processor	4.0	4.9	6 / 12	12 MB	Up to 40	95 W	Two channels DDR4-2666	Intel® UHD Graphics P630	✔	✔	✔
Intel® Xeon® E-2278G processor	3.4	5.0	8 / 16	16 MB	Up to 40	80 W	Two channels DDR4-2666	Intel® UHD Graphics P630	✔	✔	✔
Intel® Xeon® E-2276G processor	3.8	4.9	6 / 12	12 MB	Up to 40	80 W	Two channels DDR4-2666	Intel® UHD Graphics P630	✔	✔	✔
Intel® Xeon® E-2274G processor	4.0	4.9	4 / 8	8 MB	Up to 40	83 W	Two channels DDR4-2666	Intel® UHD Graphics P630	✔	✔	✔
Intel® Xeon® E-2246G processor	3.6	4.8	6 / 12	12 MB	Up to 40	80 W	Two channels DDR4-2666	Intel® UHD Graphics P630	✔	✔	✔
Intel® Xeon® E-2244G processor	3.8	4.8	4 / 8	8 MB	Up to 40	71 W	Two channels DDR4-2666	Intel® UHD Graphics P630	✔	✔	✔
Intel® Xeon® E-2236 processor	3.4	4.8	6 / 12	12 MB	Up to 40	80 W	Two channels DDR4-2666	N/A	✔	✔	✔
Intel® Xeon® E-2234 processor	3.6	4.8	4 / 8	8 MB	Up to 40	71 W	Two channels DDR4-2666	N/A	✔	✔	✔
Intel® Xeon® E-2226G processor	3.4	4.7	6 / 6	12 MB	Up to 40	80 W	Two channels DDR4-2666	Intel® UHD Graphics P630	✔	✔	✔
Intel® Xeon® E-2224G processor	3.5	4.7	4 / 4	8 MB	Up to 40	71 W	Two channels DDR4-2666	Intel® UHD Graphics P630	✔	✔	✔
Intel® Xeon® E-2224 processor	3.4	4.6	4 / 4	8 MB	Up to 40	71 W	Two channels DDR4-2666	N/A	✔	✔	✔
MOBILE WORKSTATIONS											
Intel® Xeon® E-2286M processor	2.4	5.0	8 /16	16 MB	Up to 40	45 W	Two channels DDR4-2666	Intel® UHD Graphics P630	✔	✔	✔
Intel® Xeon® E-2276M processor	2.8	4.7	6 / 12	12 MB	Up to 40	45 W	Two channels DDR4-2666	Intel® UHD Graphics P630	✔	✔	✔

Intel® processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families.
All processors are lead-free (per EU RoHS directive July 2006) and halogen free (residual amounts of halogens are below November 2007 proposed IPC/JEDEC J-STD-709 standards).
All processors support Intel® Virtualization Technology (Intel® VT-x).
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INTEL® XEON® W-2200 PROCESSOR DETAILS

PROCESSOR NUMBER	BASE CLOCK SPEED (GHZ)	INTEL® TURBO BOOST TECHNOLOGY MAXIMUM SINGLE CORE TURBO FREQUENCY (GHZ)	ALL CORE TURBO FREQUENCY (GHZ)	INTEL® TURBO BOOST MAX TECHNOLOGY 3.0 FREQUENCY (GHZ)	CORES/ THREADS PER SOCKET	INTEL® SMART CACHE	TOTAL PLATFORM PCIE* 3.0 LANES	TDP	MEMORY CAPACITY	MEMORY SUPPORT[1]	ERROR CORRECTING CODE (ECC)	RELIABILITY, AVAILABILITY, AND SERVICEABILITY (RAS)	INTEL® VPRO™ PLATFORM SUPPORT	INTEL® OPTANE™ SSD SUPPORT***
Intel® Xeon® W-2295 processor	3.0	4.6	3.8	4.8	18 / 36	24.75 MB	Up to 72	165 W	1 TB	Four Channels DDR4-2933	✓	✓	✓	✓
Intel® Xeon® W-2275 processor	3.3	4.6	4.1	4.8	14 / 28	19.25 MB	Up to 72	165 W	1 TB	Four Channels DDR4-2933	✓	✓	✓	✓
Intel® Xeon® W-2265 processor	3.5	4.6	4.3	4.8	12 / 24	19.25 MB	Up to 72	165 W	1 TB	Four Channels DDR4-2933	✓	✓	✓	✓
Intel® Xeon® W-2255 processor	3.7	4.5	4.3	4.7	10 / 20	19.25 MB	Up to 72	165 W	1 TB	Four Channels DDR4-2933	✓	✓	✓	✓
Intel® Xeon® W-2245 processor	3.9	4.5	4.5	4.7	8 / 16	16.5 MB	Up to 72	155 W	1 TB	Four Channels DDR4-2933	✓	✓	✓	✓
Intel® Xeon® W-2235 processor	3.8	4.6	4.3	N/A	6 / 12	8.25 MB	Up to 72	130 W	1 TB	Four Channels DDR4-2933	✓	✓	✓	✓
Intel® Xeon® W-2225 processor	4.1	4.6	4.5	N/A	4 / 8	8.25 MB	Up to 72	105 W	1 TB	Four Channels DDR4-2933	✓	✓	✓	✓
Intel® Xeon® W-2223 processor	3.6	3.9	3.7	N/A	4 / 8	8.25 MB	Up to 72	120 W	1 TB	Four Channels DDR4-2666	✓	✓	✓	✓

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All processors support Intel® Virtualization Technology (Intel® VT-x)

INTEL® XEON® W-2100 PROCESSOR DETAILS

PROCESSOR NUMBER[1]	BASE CLOCK SPEED (GHZ)	INTEL® TURBO BOOST TECHNOLOGY 2.0 FREQUENCY (GHZ)	CORES/ THREADS	INTEL® AVX-512	L3 CACHE (MB)	PCI EXPRESS 3.0 LANES	MEMORY SUPPORT	THERMAL DESIGN POWER (TDP)	SOCKET (LGA)
Intel® Xeon® W-2195 Processor	2.3	4.3	18/36	2 512-bit FMA	24.75	48	Four channels DDR4-2666	140W	2066
Intel® Xeon® W-2175 Processor	2.5	4.3	14/28	2 512-bit FMA	19.25	48	Four channels DDR4-2666	140W	2066
Intel® Xeon® W-2155 Processor	3.3	4.5	10/20	2 512-bit FMA	13.75	48	Four channels DDR4-2666	140W	2066
Intel® Xeon® W-2145 Processor	3.7	4.5	8/16	2 512-bit FMA	11	48	Four channels DDR4-2666	140W	2066
Intel® Xeon® W-2135 Processor	3.7	4.5	6/12	2 512-bit FMA	8.25	48	Four channels DDR4-2666	140W	2066
Intel® Xeon® W-2133 Processor	3.6	3.9	6/12	2 512-bit FMA	8.25	48	Four channels DDR4-2666	140W	2066
Intel® Xeon® W-2125 Processor	4.0	4.5	4/8	2 512-bit FMA	8.25	48	Four channels DDR4-2666	120W	2066
Intel® Xeon® W-2123 Processor	3.6	3.9	4/8	2 512-bit FMA	8.25	48	Four channels DDR4-2666	120W	2066
Intel® Xeon® W-2195 Processor	2.3	4.3	18/36	2 512-bit FMA	24.75	48	Four channels DDR4-2666	140W	2066

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All processors are lead-free (per EU RoHS directive July 2006) and halogen free (residual amounts of halogens are below November 2007 proposed IPC/JEDEC J-STD-709 standards).
All processors support Intel® Virtualization Technology (Intel® VT-x).
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INTEL® XEON® W-3200 PROCESSOR DETAILS

PROCESSOR NUMBER	BASE CLOCK SPEED (GHZ)	INTEL® TURBO BOOST TECHNOLOGY MAXIMUM SINGLE CORE TURBO FREQUENCY (GHZ)	INTEL® TURBO BOOST MAX TECHNOLOGY 3.0 FREQUENCY (GHZ)	CORES/ THREADS PER SOCKET	INTEL® SMART CACHE	TOTAL PLATFORM PCIE* 3.0 LANES	TDP	MEMORY CAPACITY	MEMORY SUPPORT	ERROR CORRECTING CODE (ECC)	RELIABILITY, AVAILABILITY, AND SERVICEABILITY (RAS)	INTEL® VPRO™ PLATFORM SUPPORT	INTEL® OPTANE™ SSD SUPPORT**
Intel® Xeon® W-3275M processor	2.5	4.4	4.6	28 / 56	38.5 MB	Up to 88	205 W	2 TB	Six channels DDR4-2933++	✓	✓	✓	✓
Intel® Xeon® W-3275 processor	2.5	4.4	4.6	28 / 56	38.5 MB	Up to 88	205 W	1 TB	Six channels DDR4-2933++	✓	✓	✓	✓
Intel® Xeon® W-3265M processor	2.7	4.4	4.6	24 / 48	33 MB	Up to 88	205 W	2 TB	Six channels DDR4-2933++	✓	✓	✓	✓
Intel® Xeon® W-3265 processor	2.7	4.4	4.6	24 / 48	33 MB	Up to 88	205 W	1 TB	Six channels DDR4-2933++	✓	✓	✓	✓
Intel® Xeon® W-3245M processor	3.2	4.4	4.6	16 / 32	22 MB	Up to 88	205 W	2 TB	Six channels DDR4-2933++	✓	✓	✓	✓
Intel® Xeon® W-3245 processor	3.2	4.4	4.6	16 / 32	22 MB	Up to 88	205 W	1 TB	Six channels DDR4-2933++	✓	✓	✓	✓
Intel® Xeon® W-3235 processor	3.3	4.4	4.5	12 / 24	19.25 MB	Up to 88	180 W	1 TB	Six channels DDR4-2933++	✓	✓	✓	✓
Intel® Xeon® W-3225 processor	3.7	4.3	4.4	8 / 16	16.5 MB	Up to 88	160 W	1 TB	Six channels DDR4-2666	✓	✓	✓	✓
Intel® Xeon® W-3223 processor	3.5	4.0	4.2	8 / 16	16.5 MB	Up to 88	140 W	1 TB	Six channels DDR4-2666	✓	✓	✓	✓

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All processors support Intel® Virtualization Technology (Intel® VT-x)
++ With 1 DIMM per channel. Additional DIMM loading on any channel may impact maximum memory speed by one bin.
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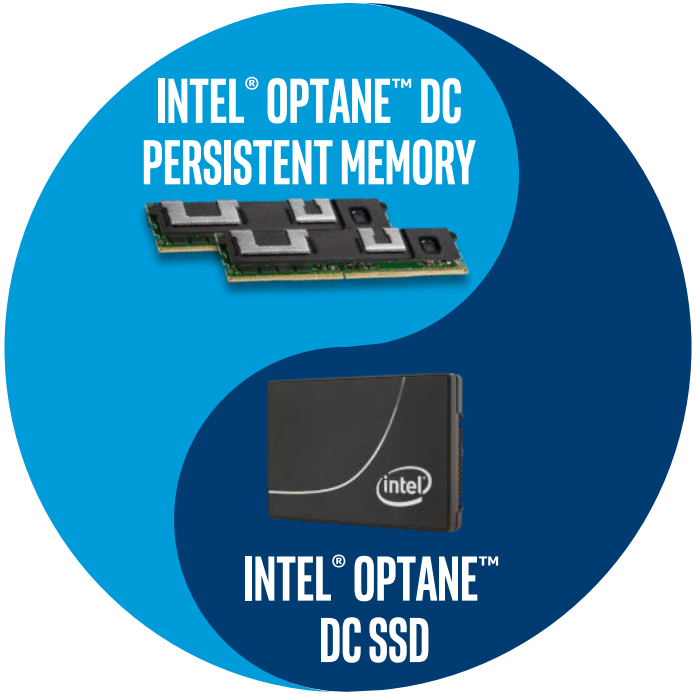
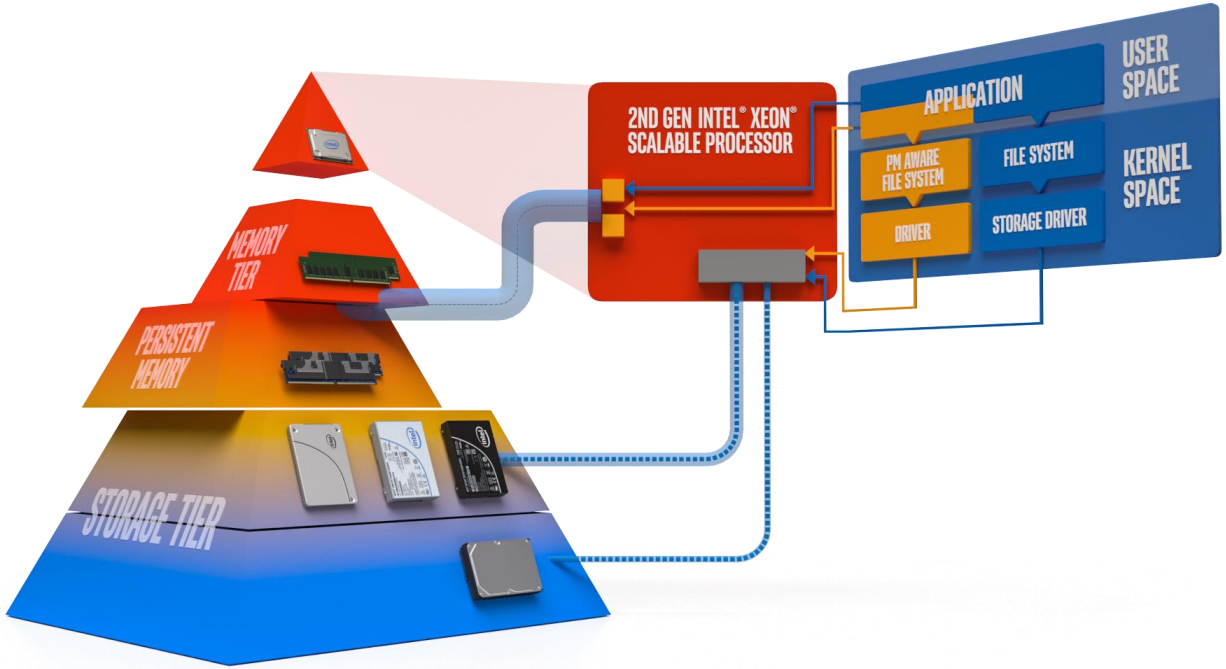
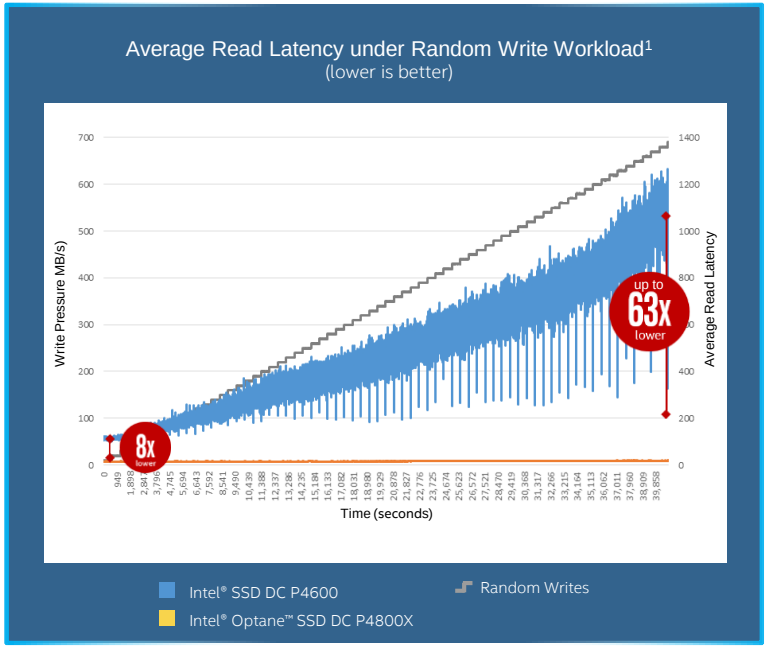
ТЕХНОЛОГИЯ INTEL® OPTANE™ DC СУЩЕСТВУЕТ В ДВУХ ПРОДУКТАХ



ПЯТЬ УРОВНЕЙ ДАННЫХ СОВРЕМЕННОГО СЕРВЕРА



ЗАДЕРЖКИ ДОСТУПА К INTEL® OPTANE™ DC НЕ РАСТУТ ПОД НАГРУЗКОЙ



[1] Source – Intel-tested: Response Time refers to average read latency measured at queue depth 1 during 4k random write workload. Measured using FIO 3.1. Common Configuration - Intel 2U Server System, OS CentOS 7.5, kernel 4.17.6-1.el7.x86_64, CPU 2 x Intel® Xeon® 6154 Gold @ 3.0GHz (18 cores), RAM 256GB DDR4 @ 2666MHz. Configuration – Intel® Optane™ SSD DC P4800X 375GB and Intel® SSD DC P4600 1.6TB. Latency – Average read latency measured at QD1 during 4K Random Write operations using FIO 3.1. Intel Microcode: 0x2000043; System BIOS: 00.01.0013; ME Firmware: 04.00.04.294; BMC Firmware: 1.43.91f76955; FRUSDR: 1.43. SSDs tested were commercially available at time of test. The benchmark results may need to be revised as additional testing is conducted. Performance results are based on testing as of July 24, 2018 and may not reflect all publicly available security updates. See configuration disclosure for details. No product can be absolutely secure. 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.

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1 - 2x Average Performance Improvement compared with Intel® Xeon® Platinum 8180 processor. Geomean of est SPECrate2017_int_base, est SPECrate2017_fp_base, Stream Triad, Intel Distribution of Linpack, server side Java. Platinum 92xx vs Platinum 8180: 1-node, 2x Intel® Xeon® Platinum 9282 cpu on Walker Pass with 768 GB (24x 32GB 2933) total memory, ucode 0x400000A on RHEL7.6, 3.10.0-957.el7.x86_65, IC19u1, AVX512, HT on all (off Stream, Linpack), Turbo on all (off Stream, Linpack), result: est int throughput=635, est fp throughput=526, Stream Triad=407, Linpack=6411, server side java=332913, test by Intel on 2/16/2019. vs. 1-node, 2x Intel® Xeon® Platinum 8180 cpu on Wolf Pass with 384 GB (12 X 32GB 2666) total memory, ucode 0x200004D on RHEL7.6, 3.10.0-957.el7.x86_65, IC19u1, AVX512, HT on all (off Stream, Linpack), Turbo on all (off Stream, Linpack), result: est int throughput=307, est fp throughput=251, Stream Triad=204, Linpack=3238, server side java=165724, test by Intel on 1/29/2019.

2 - **Up to 30X AI performance with Intel® DL Boost** compared to Intel® Xeon® Platinum 8180 processor (July 2017). Tested by Intel as of 2/26/2019. Platform: Dragon rock 2 socket Intel® Xeon® Platinum 9282(56 cores per socket), HT ON, turbo ON, Total Memory 768 GB (24 slots/ 32 GB/ 2933 MHz), BIOS:SE5C620.86B.0D.01.0241.112020180249, Centos 7 Kernel 3.10.0-957.5.1.el7.x86_64, Deep Learning Framework: Intel® Optimization for Caffe version: https://github.com/intel/caffe d554cbf1, ICC 2019.2.187, MKL DNN version: v0.17 (commit hash: 830a10059a018cd2634d94195140cf2d8790a75a), model: https://github.com/intel/caffe/blob/master/models/intel_optimized_models/int8/resnet50_int8_full_conv.prototxt, BS=64, No datalayer DummyData:3x224x224, 56 instance/2 socket, Datatype: INT8 vs Tested by Intel as of July 11th 2017: 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/), revision f96b759f71b2281835f690af267158b82b150b5c. 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 (ResNet-50),. Intel C++ compiler ver. 17.0.2 20170213, Intel MKL small libraries version 2018.0.20170425. Caffe run with "numactl -l".

3 -36% more performance & 42% more performance/dollar: Geomean of Integer Throughput, Floating Point Throughput, Stream Triad, and Linpack across ten new 2-socket 2nd Gen Gold processors vs first generation. 2nd Gen Gold R processors: 1-node, 2x 2nd Gen Intel Xeon Gold cpu on Intel Reference platform with 384 GB (12 slots / 32 GB / 2933) total memory, ucode 0x500002c, HT on for all except off for Stream, Linpack, Turbo on, with Ubuntu19.10, 5.3.0-24-generic, 6258R/$3950: int=323, fp=262, stream=224, Linpack=3305, 6248R/$2700: int=299, fp=248, stream=224, Linpack=3010, 6246R/$3286: int=238, fp=217, stream=225, Linpack=2394, 6242R/$2529: int=265, fp=231, stream=227, Linpack=2698, 6240R/$2200: int=268, fp=228, stream=223, Linpack=2438, 6238R/$2612: int=287, fp=240, stream=222, Linpack=2545, 6230R/$1894: int=266, fp=227, stream=222, Linpack=2219, 6226R/$1300: int=208, fp=192, stream=200, Linpack=2073, 5220R/$1555: int=257, fp=220, stream=210, Linpack=1610, 5218R/$1273: int=210, fp=188, stream=199, Linpack=1290 test by Intel on 12/25/2019. First Gen Gold processor: 1-node, 2x Intel Xeon Gold cpu on Intel Reference platform with 384 GB (12 slots / 32 GB / 2933) total memory, ucode 0x2000065, HT on for all except off for Stream, Linpack, Turbo on, with Ubuntu19.10, 5.3.0-24-generic, 6152/$3655: int=224, fp=198, stream=200, Linpack=19886148/$3072: int=225, fp=198, stream=197, Linpack=2162, 6146/$3286: int=161, fp=175, stream=185, Linpack=1896, 6142/$2946: int=193, fp=176, stream=185, Linpack=1895, 6140/$2445: int=202, fp=183, stream=188, Linpack=1877, 6138/$2612: int=189, fp=195, stream=189, Linpack=1976, 6130/$1894: int=172, fp=165, stream=185, Linpack=1645, 6126/$1776: int=141, fp=157, stream=170, Linpack=1605, 5120/$1555: int=133, fp=148, stream=159, Linpack=924, 5118/$1273: int=134, fp=132, stream=149, Linpack=818 test by Intel on 2/18/2020.

FOOTNOTES AND CONFIGURATION DETAILS

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4 – **Up to 3.50X 5-Year Refresh Performance Improvement** VM density compared to Intel® Xeon® E5-2600 v2 processor: 1-node, 2x E5-2697 v2 on Canon Pass with 256 GB (16 slots / 16GB / 1600) total memory, ucode 0x42c on RHEL7.6, 3.10.0-957.el7.x86_65, 1x Intel 400GB SSD OS Drive, 2x P4500 4TB PCIe, 2*82599 dual port Ethernet, Virtualization Benchmark, VM kernel 4.19, HT on, Turbo on, score: VM density=74, test by Intel on 1/15/2019. vs. 1-node, 2x 8280 on Wolf Pass with 768 GB (24 slots / 32GB / 2666) total memory, ucode 0x2000056 on RHEL7.6, 3.10.0-957.el7.x86_65, 1x Intel 400GB SSD OS Drive, 2x P4500 4TB PCIe, 2*82599 dual port Ethernet, Virtualization Benchmark, VM kernel 4.19, HT on, Turbo on, score: VM density=21, test by Intel on 1/15/2019.

5 – Up to 14X AI Performance Improvement with Intel® DL Boost compared to Intel® Xeon® Platinum 8180 Processor (July 2017). Tested by Intel as of 2/20/2019. 2 socket Intel® Xeon® Platinum 8280 Processor, 28 cores HT On Turbo ON Total Memory 384 GB (12 slots/ 32GB/ 2933 MHz), BIOS: SE5C620.86B.0D.01.0271.120720180605 (ucode: 0x200004d), Ubuntu 18.04.1 LTS, kernel 4.15.0-45-generic, SSD 1x sda INTEL SSDSC2BA80 SSD 745.2GB, nvme1n1 INTEL SSDPE2KX040T7 SSD 3.7TB, Deep Learning Framework: Intel® Optimization for Caffe version: 1.1.3 (commit hash: 7010334f159da247db3fe3a9d96a3116ca06b09a) , ICC version 18.0.1, MKL DNN version: v0.17 (commit hash: 830a10059a018cd2634d94195140cf2d8790a75a, model: https://github.com/intel/caffe/blob/master/models/intel_optimized_models/int8/resnet50_int8_full_conv.prototxt, BS=64, DummyData, 4 instance/2 socket, Datatype: INT8 vs Tested by Intel as of July 11th 2017: 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/), revision f96b759f71b2281835f690af267158b82b150b5c. 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 (ResNet-50),. Intel C++ compiler ver. 17.0.2 20170213, Intel MKL small libraries version 2018.0.20170425. Caffe run with "numactl -l".

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6 - 1x inference throughput improvement in July 2017 (baseline): Tested by Intel as of July 11th 2017: 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/), revision f96b759f71b2281835f690af267158b82b150b5c. 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 (ResNet-50),and 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".

7 - 5.7x inference throughput improvement in December 2018 vs baseline: Tested by Intel as of November 11th 2018 :2 socket Intel(R) Xeon(R) Platinum 8180 CPU @ 2.50GHz / 28 cores HT ON , Turbo ON Total Memory 376.46GB (12slots / 32 GB / 2666 MHz). CentOS Linux-7.3.1611-Core, kernel: 3.10.0-862.3.3.el7.x86_64, SSD sda RS3WC080 HDD 744.1GB,sdb RS3WC080 HDD 1.5TB,sdc RS3WC080 HDD 5.5TB , Deep Learning Framework Intel® Optimization for caffe version: 551a53d63a6183c233abaa1a19458a25b672ad41 Topology::ResNet_50_v1 BIOS:SE5C620.86B.00.01.0014.070920180847 MKLDNN: 4e333787e0d66a1dca1218e99a891d493dbc8ef1 instances: 2 instances socket:2 (Results on Intel® Xeon® Scalable Processor were measured running multiple instances of the framework. Methodology described here: https://software.intel.com/en-us/articles/boosting-deep-learning-training-inference-performance-on-xeon-and-xeon-phi) NoDataLayer. Datatype: INT8 Batchsize=64 vs Tested by Intel as of July 11th 2017:2S 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/), revision f96b759f71b2281835f690af267158b82b150b5c. 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 (ResNet-50). Intel C++ compiler ver. 17.0.2 20170213, Intel MKL small libraries version 2018.0.20170425. Caffe run with "numactl -l".

8 – 14x inference throughput improvement vs baseline: Tested by Intel as of 2/20/2019. 2 socket Intel® Xeon® Platinum 8280 Processor, 28 cores HT On Turbo ON Total Memory 384 GB (12 slots/ 32GB/ 2933 MHz), BIOS: SE5C620.86B.0D.01.0271.120720180605 (ucode: 0x200004d), Ubuntu 18.04.1 LTS, kernel 4.15.0-45-generic, SSD 1x sda INTEL SSDSC2BA80 SSD 745.2GB, nvme1n1 INTEL SSDPE2KX040T7 SSD 3.7TB, Deep Learning Framework: Intel® Optimization for Caffe version: 1.1.3 (commit hash: 7010334f159da247db3fe3a9d96a3116ca06b09a) , ICC version 18.0.1, MKL DNN version: v0.17 (commit hash: 830a10059a018cd2634d94195140cf2d8790a75a, model: https://github.com/intel/caffe/blob/master/models/intel_optimized_models/int8/resnet50_int8_full_conv.prototxt, BS=64, DummyData, 4 instance/2 socket, Datatype: INT8 vs Tested by Intel as of July 11th 2017: 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/), revision f96b759f71b2281835f690af267158b82b150b5c. 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 (ResNet-50),. Intel C++ compiler ver. 17.0.2 20170213, Intel MKL small libraries version 2018.0.20170425. Caffe run with "numactl -l".

9 - 30x inference throughput improvement with CascadeLake-AP vs baseline: Tested by Intel as of 2/26/2019. Platform: Dragon rock 2 socket Intel® Xeon® Platinum 9282(56 cores per socket), HT ON, turbo ON, Total Memory 768 GB (24 slots/ 32 GB/ 2933 MHz), BIOS:SE5C620.86B.0D.01.0241.112020180249, Centos 7 Kernel 3.10.0-957.5.1.el7.x86_64, Deep Learning Framework: Intel® Optimization for Caffe version: https://github.com/intel/caffe d554cbf1, ICC 2019.2.187, MKL DNN version: v0.17 (commit hash: 830a10059a018cd2634d94195140cf2d8790a75a), model: https://github.com/intel/caffe/blob/master/models/intel_optimized_models/int8/resnet50_int8_full_conv.prototxt, BS=64, No datalayer DummyData:3x224x224, 56 instance/2 socket, Datatype: INT8 vs Tested by Intel as of July 11th 2017: 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/), revision f96b759f71b2281835f690af267158b82b150b5c. 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 (ResNet-50),. Intel C++ compiler ver. 17.0.2 20170213, Intel MKL small libraries version 2018.0.20170425. Caffe run with "numactl -l".

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10 – Up to 1.25 to 1.58X NVF Workload Performance Improvement comparing Intel® Xeon® Gold 6230N processor to Intel® Xeon® Gold 6130 processor.

VPP IP Security: Tested by Intel on 1/17/2019 1-Node, 2x Intel® Xeon® Gold 6130 Processor on Neon City platform with 12x 16GB DDR4 2666MHz (384GB total memory), Storage: 1x Intel® 240GB SSD, Network: 6x Intel XXV710-DA2, Bios: PLYDCRB1.86B.0155.R08.1806130538, ucode: 0x200004d (HT= ON, Turbo= OFF), OS: Ubuntu* 18.04 with kernel: 4.15.0-42-generic, Benchmark: VPP IPSec w/AESNI (AES-GCM-128) (Max Gbits/s (1420B)), Workload version: VPP v17.10, Compiler: gcc7.3.0, Results: 179. Tested by Intel on 1/17/2019 1-Node, 2x Intel® Xeon® Gold 6230N Processor on Neon City platform with 12x 16GB DDR4 2999MHz (384GB total memory), Storage: 1x Intel® 240GB SSD, Network: 6x Intel XXV710-DA2, Bios: PLYXCRB1.PFT.0569.D08.1901141837, ucode: 0x4000019 (HT= ON, Turbo= OFF), OS: Ubuntu* 18.04 with kernel: 4.20.0-042000rc6-generic, Benchmark: VPP IPSec w/AESNI (AES-GCM-128) (Max Gbits/s (1420B)), Workload version: VPP v17.10, Compiler: gcc7.3.0, Results: 225

VPP FIB: Tested by Intel on 1/17/2019 1-Node, 2x Intel® Xeon® Gold 6130 Processor on Neon City platform with 12x 16GB DDR4 2666MHz (384GB total memory), Storage: 1x Intel® 240GB SSD, Network: 6x Intel XXV710-DA2, Bios: PLYDCRB1.86B.0155.R08.1806130538, ucode: 0x200004d (HT= ON, Turbo= OFF), OS: Ubuntu* 18.04 with kernel: 4.15.0-42-generic, Benchmark: VPP FIB (Max Mpackets/s (64B)), Workload version: VPP v17.10 in ipv4fib configuration, Compiler: gcc7.3.0, Results: 160. Tested by Intel on 1/17/2019 1-Node, 2x Intel® Xeon® Gold 6230N Processor on Neon City platform with 12x 16GB DDR4 2999MHz (384GB total memory), Storage: 1x Intel® 240GB SSD, Network: 6x Intel XXV710-DA2, Bios: PLYXCRB1.PFT.0569.D08.1901141837, ucode: 0x4000019 (HT= ON, Turbo= OFF), OS: Ubuntu* 18.04 with kernel: 4.20.0-042000rc6-generic, Benchmark: VPP FIB (Max Mpackets/s (64B)), Workload version: VPP v17.10 in ipv4fib configuration, Compiler: gcc7.3.0, Results: 212.9

Virtual Firewall: Tested by Intel on 10/26/2018 1-Node, 2x Intel® Xeon® Gold 6130 Processor on Neon City platform with 12x 16GB DDR4 2666MHz (384GB total memory), Storage: 1x Intel® 240GB SSD, Network: 4x Intel X710-DA4, Bios: PLYDCRB1.86B.0155.R08.1806130538, ucode: 0x200004d (HT= ON, Turbo= OFF), OS: Ubuntu* 18.04 with kernel: 4.15.0-42-generic, Benchmark: Virtual Firewall (64B Mpps), Workload version: opnfv 6.2.0, Compiler: gcc7.3.0, Results: 38.9. Tested by Intel on 2/04/2019 1-Node, 2x Intel® Xeon® Gold 6230N Processor on Neon City platform with 12x 16GB DDR4 2999MHz (384GB total memory), Storage: 1x Intel® 240GB SSD, Network: 6x Intel XXV710-DA2, Bios: PLYXCRB1.PFT.0569.D08.1901141837, ucode: 0x4000019 (HT= ON, Turbo= OFF), OS: Ubuntu* 18.04 with kernel: 4.20.0-042000rc6-generic, Benchmark: Virtual Firewall (64B Mpps), Workload version: opnfv 6.2.0, Compiler: gcc7.3.0, Results: 52.3

Virtual Broadband Network Gateway: Tested by Intel on 11/06/2018 1-Node, 2x Intel® Xeon® Gold 6130 Processor on Neon City platform with 12x 16GB DDR4 2666MHz (384GB total memory), Storage: 1x Intel® 240GB SSD, Network: 6x Intel XXV710-DA2, Bios: PLYDCRB1.86B.0155.R08.1806130538, ucode: 0x200004d (HT= ON, Turbo= OFF), OS: Ubuntu* 18.04 with kernel: 4.15.0-42-generic, Benchmark: Virtual Broadband Network Gateway (88B Mpps), Workload version: DPDK v18.08 ip_pipeline application, Compiler: gcc7.3.0, Results: 56.5. Tested by Intel on 1/2/2019 1-Node, 2x Intel® Xeon® Gold 6230N Processor on Neon City platform with 12x 16GB DDR4 2999MHz (384GB total memory), Storage: 1x Intel® 240GB SSD, Network: 6x Intel XXV710-DA2, Bios: PLYXCRB1.PFT.0569.D08.1901141837, ucode: 0x4000019 (HT= ON, Turbo= OFF), OS: Ubuntu* 18.04 with kernel: 4.20.0-042000rc6-generic, Benchmark: Virtual Broadband Network Gateway (88B Mpps), Workload version:DPDK v18.08 ip_pipeline application, Compiler: gcc7.3.0, Results: 78.7

VCMTS: Tested by Intel on 1/22/2019 1-Node, 2x Intel® Xeon® Gold 6130 Processor on Supermicro*-X11DPH-Tq platform with 12x 16GB DDR4 2666MHz (384GB total memory), Storage: 1x Intel® 240GB SSD, Network: 4x Intel XXV710-DA2, Bios: American Megatrends Inc.* version: '2.1', ucode: 0x200004d (HT= ON, Turbo= OFF), OS: Ubuntu* 18.04 with kernel: 4.20.0-042000rc6-generic, Benchmark: Virtual Converged Cable Access Platform (iMIX Gbps), Workload version: vcmts 18.10, Compiler: gcc7.3.0 , Other software: Kubernetes* 1.11, Docker* 18.06, DPDK 18.11, Results: 54.8. Tested by Intel on 1/22/2019 1-Node, 2x Intel® Xeon® Gold 6230N Processor on Neon City platform with 12x 16GB DDR4 2999MHz (384GB total memory), Storage: 1x Intel® 240GB SSD, Network: 6x Intel XXV710-DA2, Bios: PLYXCRB1.PFT.0569.D08.1901141837, ucode: 0x4000019 (HT= ON, Turbo= OFF), OS: Ubuntu* 18.04 with kernel: 4.20.0-042000rc6-generic, Benchmark: Virtual Converged Cable Access Platform (iMIX Gbps), Workload version: vcmts 18.10 , Compiler: gcc7.3.0, Other software: Kubernetes* 1.11, Docker* 18.06, DPDK 18.11, Results: 83.7

OVS DPDK: Tested by Intel on 1/21/2019 1-Node, 2x Intel® Xeon® Gold 6130 Processor on Neon City platform with 12x 16GB DDR4 2666MHz (384GB total memory), Storage: 1x Intel® 240GB SSD, Network: 4x Intel XXV710-DA2, Bios: PLYXCRB1.86B.0568.D10.1901032132, ucode: 0x200004d (HT= ON, Turbo= OFF), OS: Ubuntu* 18.04 with kernel: 4.15.0-42-generic, Benchmark: Open Virtual Switch (on 4C/4P/8T 64B Mpacket/s), Workload version: OVS 2.10.1, DPDK-17.11.4, Compiler: gcc7.3.0, Other software: QEMU-2.12.1, VPP v18.10, Results: 9.6. Tested by Intel on 1/18/2019 1-Node, 2x Intel® Xeon® Gold 6230N Processor on Neon City platform with 12x 16GB DDR4 2999MHz (384GB total memory), Storage: 1x Intel® 240GB SSD, Network: 6x Intel XXV710-DA2, Bios: PLYXCRB1.86B.0568.D10.1901032132, ucode: 0x4000019 (HT= ON, Turbo= OFF), OS: Ubuntu* 18.04 with kernel: 4.20.0-042000rc6-generic, Benchmark: Open Virtual Switch (on 6P/6C/12T 64B Mpacket/s), Workload version: OVS 2.10.1, DPDK-17.11.4, Compiler: gcc7.3.0, Other software: QEMU-2.12.1, VPP v18.10, Results: 15.2. Tested by Intel on 1/18/2019 1-Node, 2x Intel® Xeon® Gold 6230N Processor with SST-BF enabled on Neon City platform with 12x 16GB DDR4 2999MHz (384GB total memory), Storage: 1x Intel® 240GB SSD, Network: 6x Intel XXV710-DA2, Bios: PLYXCRB1.86B.0568.D10.1901032132, ucode: 0x4000019 (HT= ON, Turbo= ON (SST-BF)), OS: Ubuntu* 18.04 with kernel: 4.20.0-042000rc6-generic, Benchmark: Open Virtual Switch (on 6P/6C/12T 64B Mpacket/s), Workload version: OVS 2.10.1, DPDK-17.11.4, Compiler: gcc7.3.0, Other software: QEMU-2.12.1, VPP v18.10, Results: 16.9

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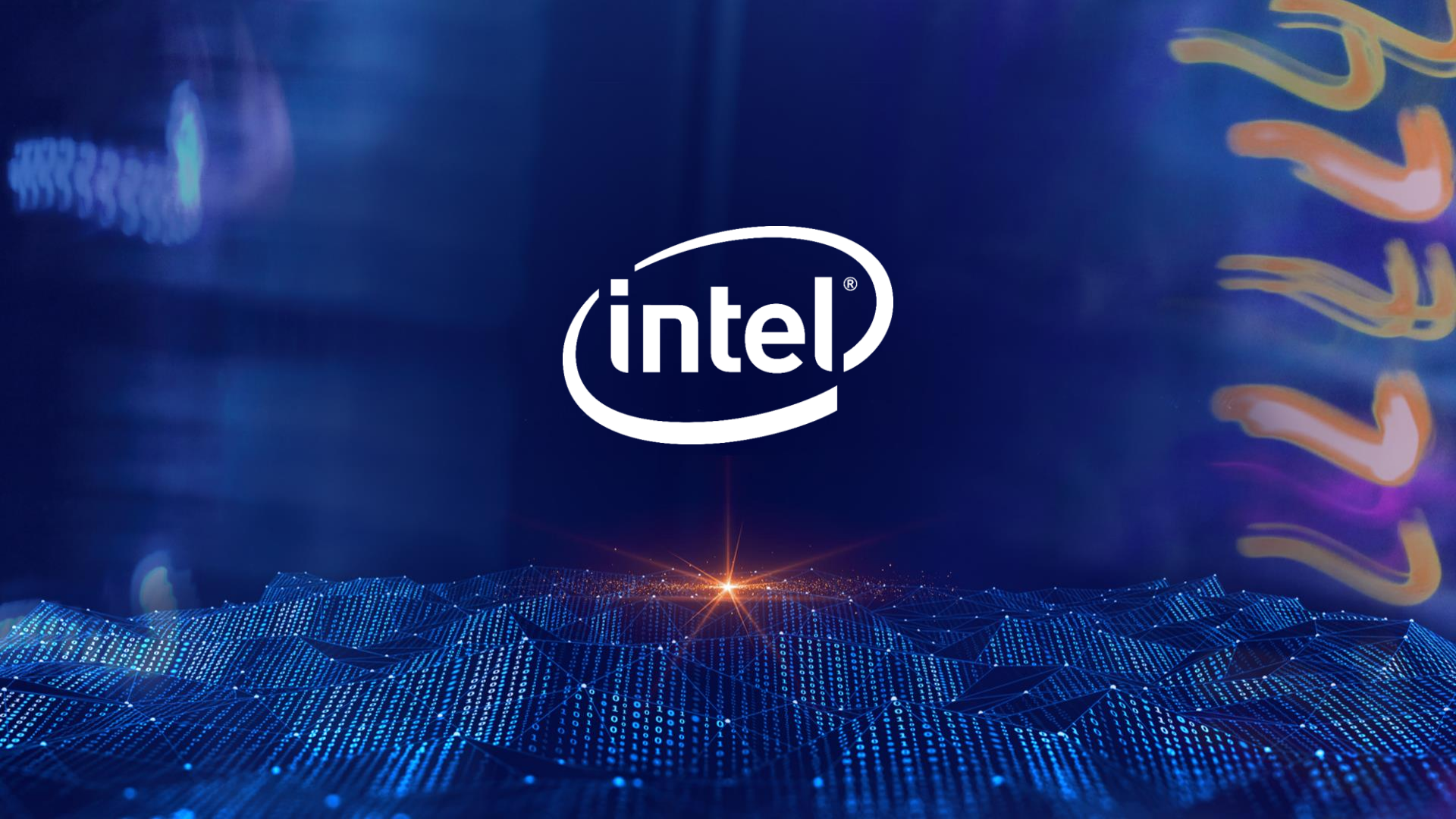
11
> 45% latency reduction with Open Source Redis using 2nd gen Intel® Xeon® Scalable Processors and Intel® Ethernet 800 Series with ADQ.
Calculation: (new - old) / old x 100%
Rtt Average Latency across all run for baseline vs ADQ
(382-1249)/1249 * 100% = -69% Reduction in Rtt Average Latency

12
> 30% throughput improvement with Open Source Redis using 2nd gen Intel® Xeon® Scalable Processors and Intel® Ethernet 800 Series with ADQ.
Calculation: (new - old) / old x 100%
Transaction Request Rate across all run for baseline vs ADQ
(79601-44345)/44345 * 100% = 80% Throughput Improvement

Source: Intel internal testing as of February 2019
Configuration details provided in the following tables:

	SUT	Client
Test by	Intel	Intel
Test date	2/11/2019	2/11/2019
Platform	Intel® Server Board S2600WFTF	Dell* PowerEdge* R720
# Nodes	1	11
# Sockets	2	2
CPU	2nd Generation Intel® Xeon® Scalable processor 8268 @ 2.8GHz	Intel® Xeon® processor E5-2697 v2
Cores/socket, Threads/socket	24/48	12 / 24
ucode	0x3000009	0x428
HT	On	On
Turbo	On	On
BIOS version	SE5C620.86B.01.00.0833.051120182255	2.5.4
System DDR Mem Config: slots / cap / run-speed	8 slots / 128GB / 2400MT/s	16 slots / 128GB / 1600MT/s
System DCPMM Config: slots / cap / run-speed	2 slots / 1024GB	-
Total Memory/Node (DDR+DCPMM)	1024GB	128GB
Storage - boot	1x Intel SSD (OS Drive 64GB)	1x Dell (OS Drive 512GB)
Storage - application drives	-	-
NIC	1x Intel® Ethernet Network Adapter E810-CQDA2	1x Intel® Ethernet X520-DA2
PCH	Intel® C620 Series Chipset	Intel® C600 Series Chipset
Other HW (Accelerator)		
OS	CentOS 7.6	CentOS 7.4
Kernel	4.19.18 (Linux.org Stable)	3.10.0-693.21.1.el7
IBRS (0=disable, 1=enable)	1	0
eIBRS (0=disable, 1=enable)	0	0
Retpoline (0=disable, 1=enable)	1	0
IBPB (0=disable, 1=enable)	1	0
PTI (0=disable, 1=enable)	1	1
Mitigation variants (1,2,3,3a,4, L1TF)	1,2,3,L1TF	1,2,3,L1TF
Workload & version	Redis 4.0.10	redis-benchmark 4.0.10
Compiler	gcc (GCC) 4.8.5 20150623	-
NIC Driver	ice 08.15	ixgbe 4.4.0-k-rh7.4


intel