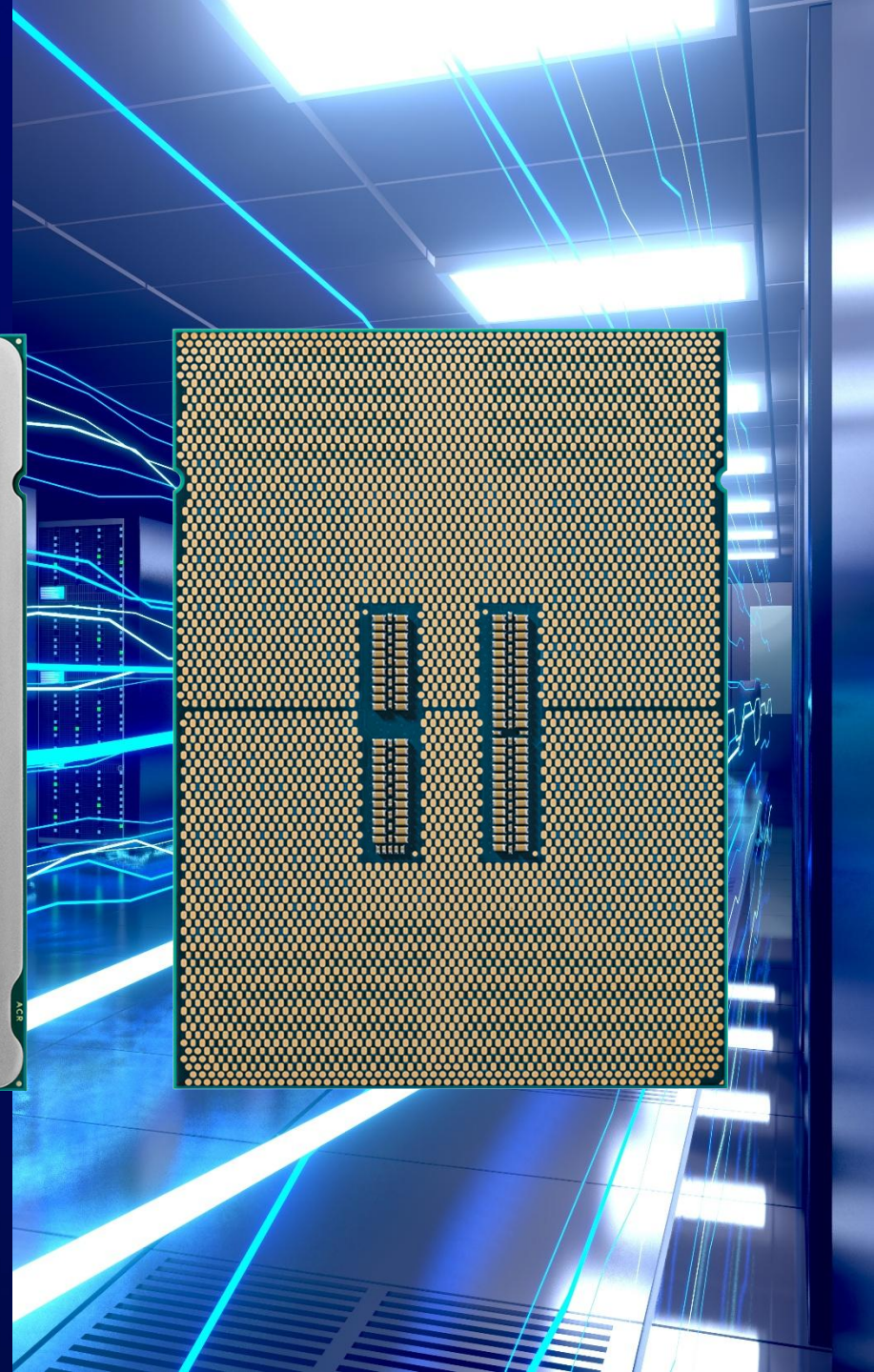
Intel® Xeon® 6 and 6+Processors

Speaker Name
Title Goes Here





intel

Data Center Requirements Are Evolving

Varying uses require unique optimization vectors

AI Everywhere

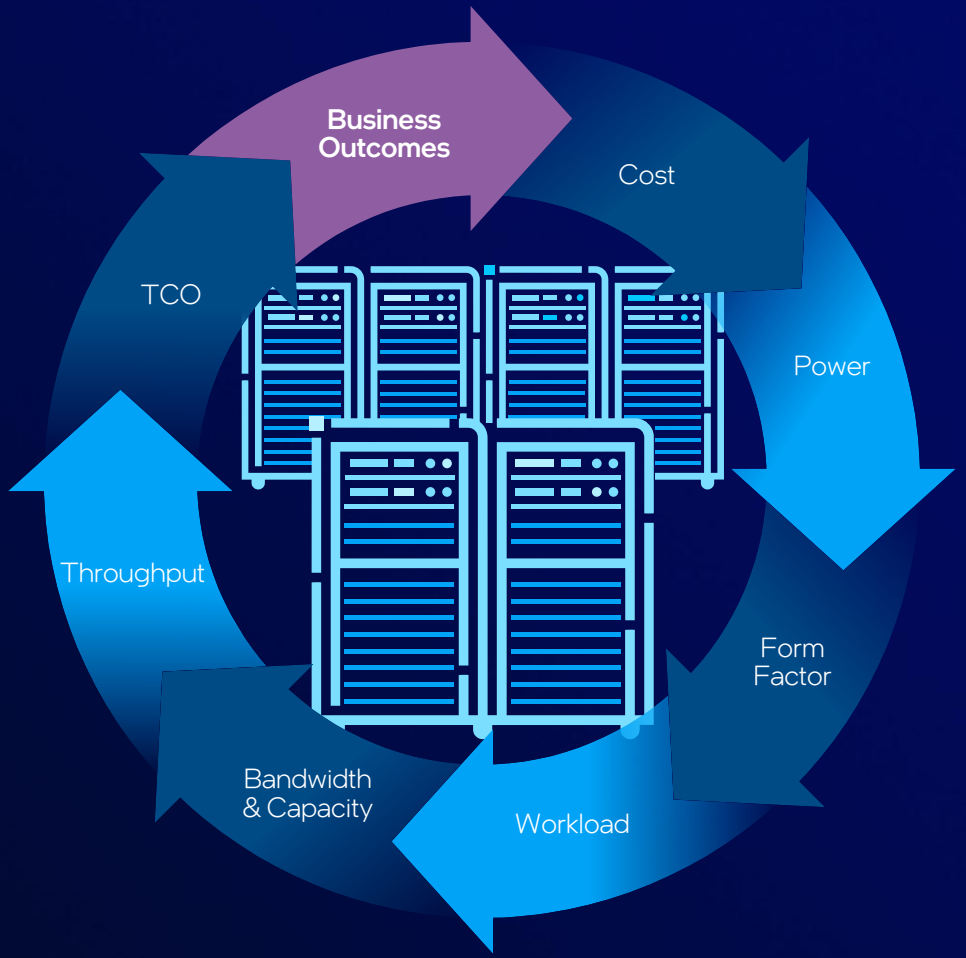
Enable performance at scale with accelerated hardware and open standards-based software

Throughput & Latency

Maximize system-level performance with best-in-class response time

Security, Quality & Reliability

Provide security, quality, and reliability for at-scale deployments



Efficiency & TCO

Increase rack density while meeting power efficiency requirements to improve TCO (total cost of ownership)

Sustainability

Minimizing carbon emissions through improved energy efficiency and circular product design

Software Compatibility

ISA consistency for software ecosystem compatibility

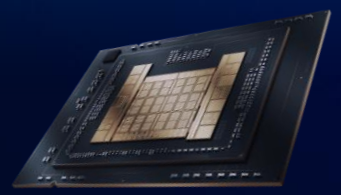
Addressing Tomorrow's Computing Needs

Across data center, network & edge

Intel® Xeon® 6 Processors

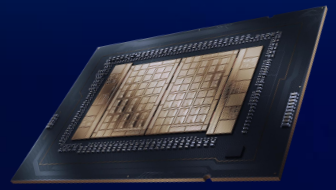
Maximum Efficiency with E-cores

Performance-per-watt for high-density compute and scale-out workloads



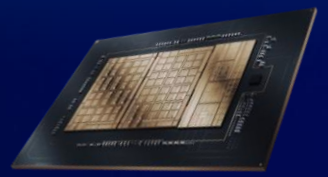
Peak Performance with P-cores

Per-core-performance for compute-intensive workloads



Built for Networking and Edge

More power-efficient, servers with Intel® vRAN Boost and media acceleration, with networking built in



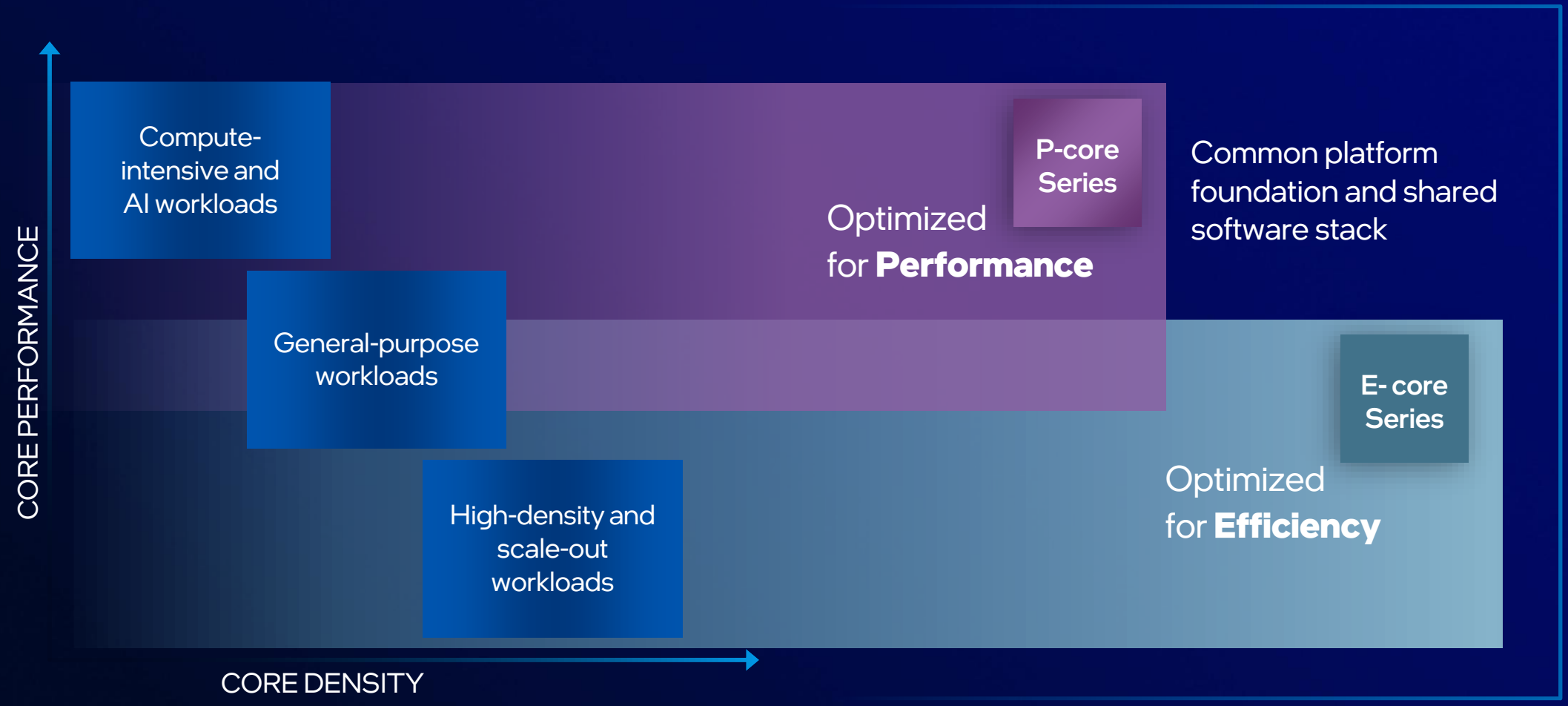
Performance Boost for Small Business

Affordable performance for business-critical services



Intel® Xeon® 6 Processors Designed to Address Market Needs

The best processors to meet diverse performance and efficiency requirements

















Intel® Xeon® 6 and 6+ Processors

Addressing the broadest set of enterprise workloads

Exceptional Performance
with more cores & higher memory bandwidth

Efficient Compute
improved perf/watt, built-in acceleration, & 1S-8S scalability

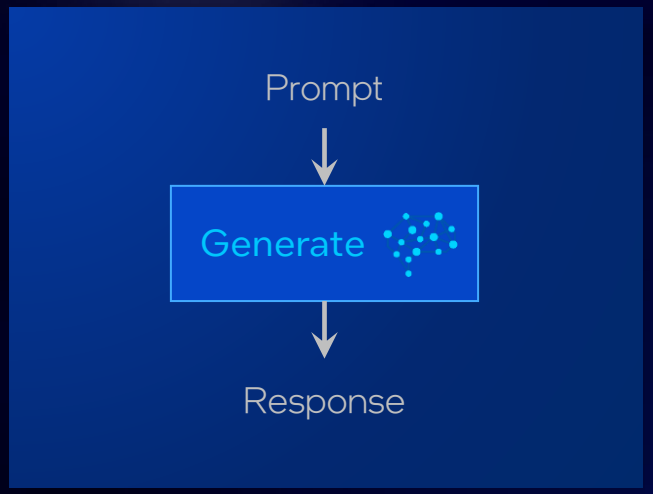
Trusted & Secure
most comprehensive confidential compute portfolio

Foundation for Agentic AI
best CPU for AI with Intel® AMX & best core per rack density at scale for sandboxing


Agentic AI with
Intel® Xeon® 6and
6+ Processors

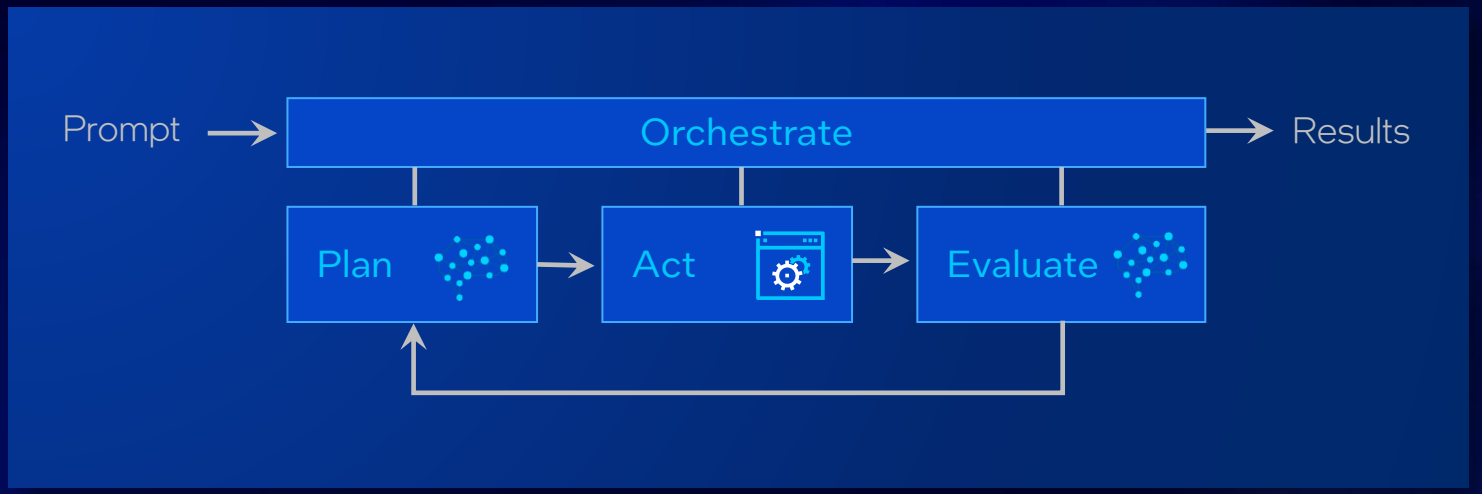
The Agentic AI shift is changing infrastructure needs

AI Inference



- Compute choice depends on AI model size, scale and target service levels

Agentic AI



- Managed by CPU – tool selection, routing, RAG, SW execution, governance
- Accelerated by GPU – workhorse for planning and reasoning tasks

Agentic AI turns a single-step prompt and response into a multi-step task loop

Choose the right hardware for the right Agentic AI task

Build on a trusted foundation for ease of deployment, management and governance

Common x86 Platform Foundation

(scale, security, manageability, telemetry, software compatibility and legacy support)

Host CPU
(for reasoning tasks)

- P-Cores with high single-threaded performance
- memory and I/O bandwidth
- Priority Core Turbo (PCT) for host-CPU mode

Orchestration and model co-serving

Built-in accelerators for tasks like:

- Data retrieval and augmentation
- Routing and tool selection
- Guardrail models and SLMs

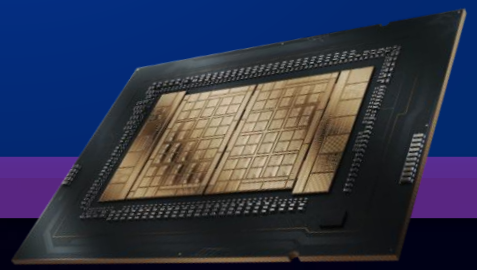
Sandboxed software tool execution

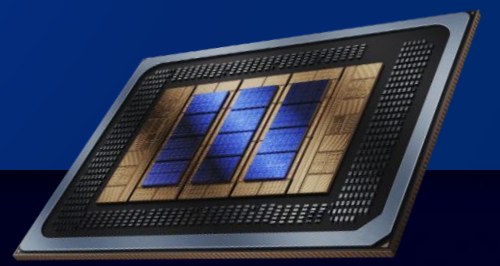
Performance cores

- AI and data accelerators
- Faster vector, floating-point
- Memory bandwidth & capacity
- Sandboxed tool execution with Intel® TDX

Efficient cores

- High agent density
- Sandboxed tool execution with Intel TDX





Intel® Xeon® 6

Intel Xeon 6+

Benefits of Intel Xeon for Agentic AI



- **Reduced Token Costs**
  CPUs with built-in AI can lower token costs on GPU systems by co-serving multi-agent AI models using existing resources
- **Workload Efficiency**
  Determine the right CPU:GPU ratios and utilize the flexibility of a CPU with AI acceleration to avoid the "GPU idle tax" and achieve maximum workload efficiency
- **Faster Data Access**
  More storage bandwidth and faster data indexing, backup and vector search with closer access to enterprise data
- **Infrastructure Consistency**
  A common foundation with all x86 CPUs, including host CPU and software stack with enterprise-grade manageability, telemetry and security protocols

Intel Xeon 6 and 6+ processors winning features

AI Agents that Scale, with Flexibility for Tomorrow's AI

The right hardware for the right Agentic task

Intel® Xeon® 6

Routing, co-serving and guardrails



Intel® Xeon® 6+

Sandboxed tool execution at scale



P-Cores

High per-core performance for the most compute intensive enterprise workloads

Intel® AMX

AI acceleration for agent routing, tool selection, SLM co-serving and guardrail models

E-Cores

Optimized for power and compute efficiency for high-density and scale-out workloads

Density

The best core per rack density at scale for sandbox tool execution with Intel® TDX

Trusted Confidential Compute

Intel® TDX, Intel® TDX Connect and Intel® SGX

intel

Your results may vary. Intel technologies may require enabled hardware, software or service activation.

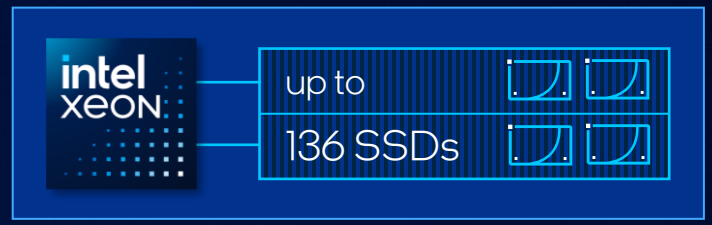
Agentic AI is Fueled by an Efficient Data Platform

Intel® Xeon® 6 performs best on mixed storage workloads required for Agentic AI

AI data platform workflow and performance metrics with Intel Xeon 6

+8 PCIe
lanes than AMD with Intel Xeon 6 resulting in 6% more I/O capacity[1]

Storage Server (1S)[1]



~32 GB/s
more storage bandwidth on Intel Xeon 6 platform with +4 E3.S SSDs[1]

Data Preparation
Ingestion, vectorization, tokenization and indexing

Data Storage
Database, compression, backup and extraction

Data Access
Search, retrieval and AI model data serving

30%
faster indexing of vector databases than AMD EPYC 9005 with Intel Xeon 6 using Intel AMX[1]

71%
faster database backup with Intel QAT vs. AMD with software only compression[1]

2.6x
faster vector search than AMD EPYC 9005 with Intel Xeon 6 using Intel SVS[1]



1 – See backup for details. Your results may vary. Intel technologies may require enabled hardware, software or service activation.
Intel® QuickAssist Technology (Intel® QAT), Intel® Scalable Vector Search (Intel SVS), Intel® Advanced Matrix Extensions (Intel® AMX)

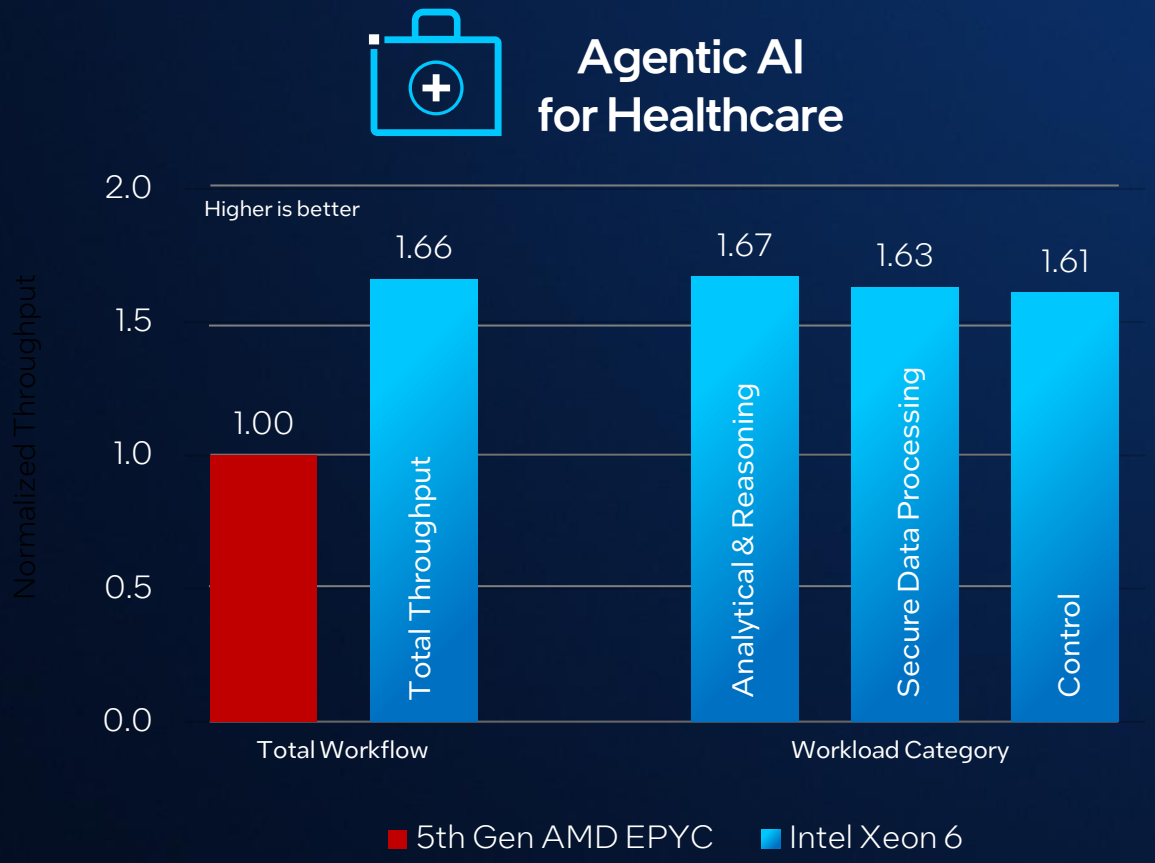
Boosting Agentic AI Throughput with Intel® Xeon®

Higher throughput across Healthcare agentic workflows, enabling organizations to process more agent-driven work

Up to

66%

higher agentic total throughput for Healthcare vs. AMD EPYC



Agentic workflow spanning clinical documentation, evidence retrieval, diagnostic analysis, fraud detection, risk assess, molecular research, genomic analysis, and laboratory diagnostics.
See 'Boosting Agentic AI Throughput with Intel® Xeon® CPUs' at Intel Newsroom for configuration and testing details. Results may vary

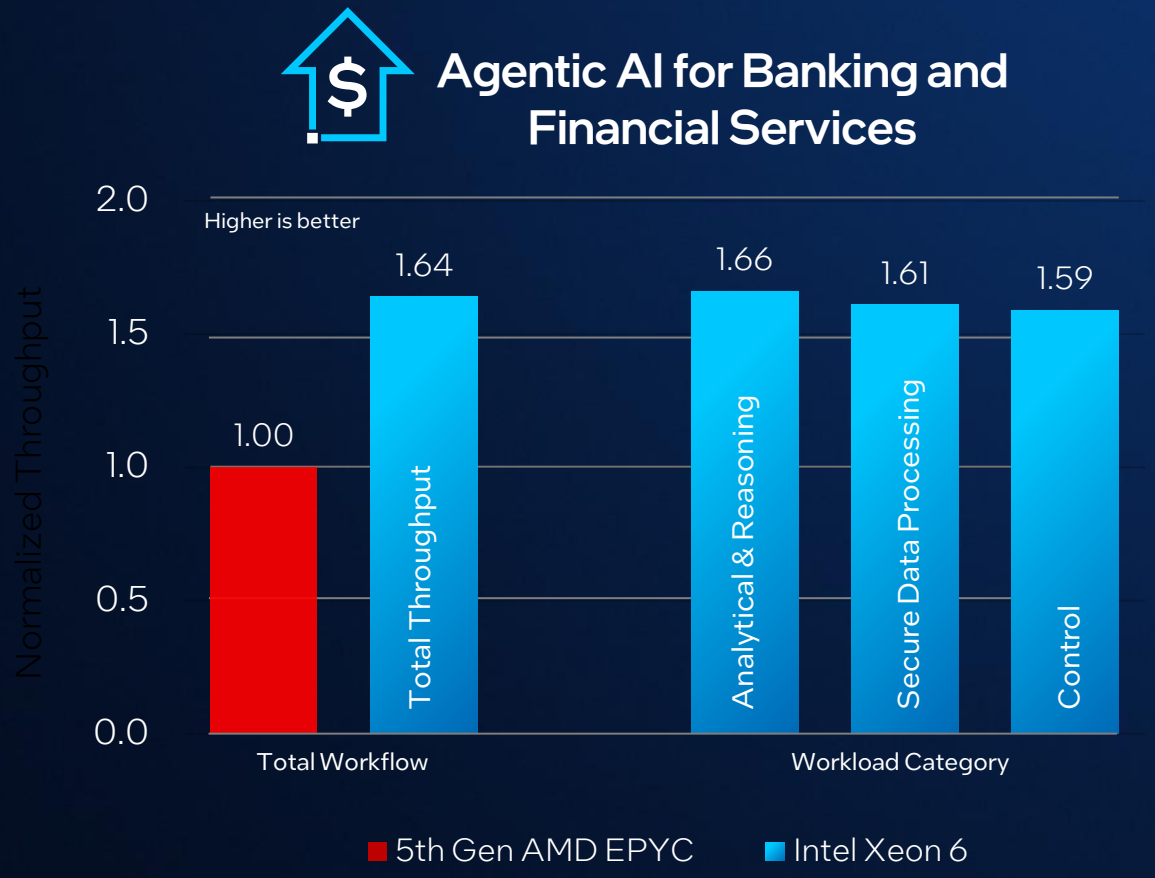
Boosting Agentic AI Throughput with Intel® Xeon®

Higher throughput across FSI agentic workflows, enabling organizations to process more agent-driven work

Up to

64%

higher agentic total throughput for Financial Services vs. AMD EPYC



Agentic workflow spanning lending, risk analysis, investment research, trading analytics, fraud detection, compliance, and regulatory reporting.
See 'Boosting Agentic AI Throughput with Intel® Xeon® CPUs' at Intel Newsroom for configuration and testing details. Results may vary

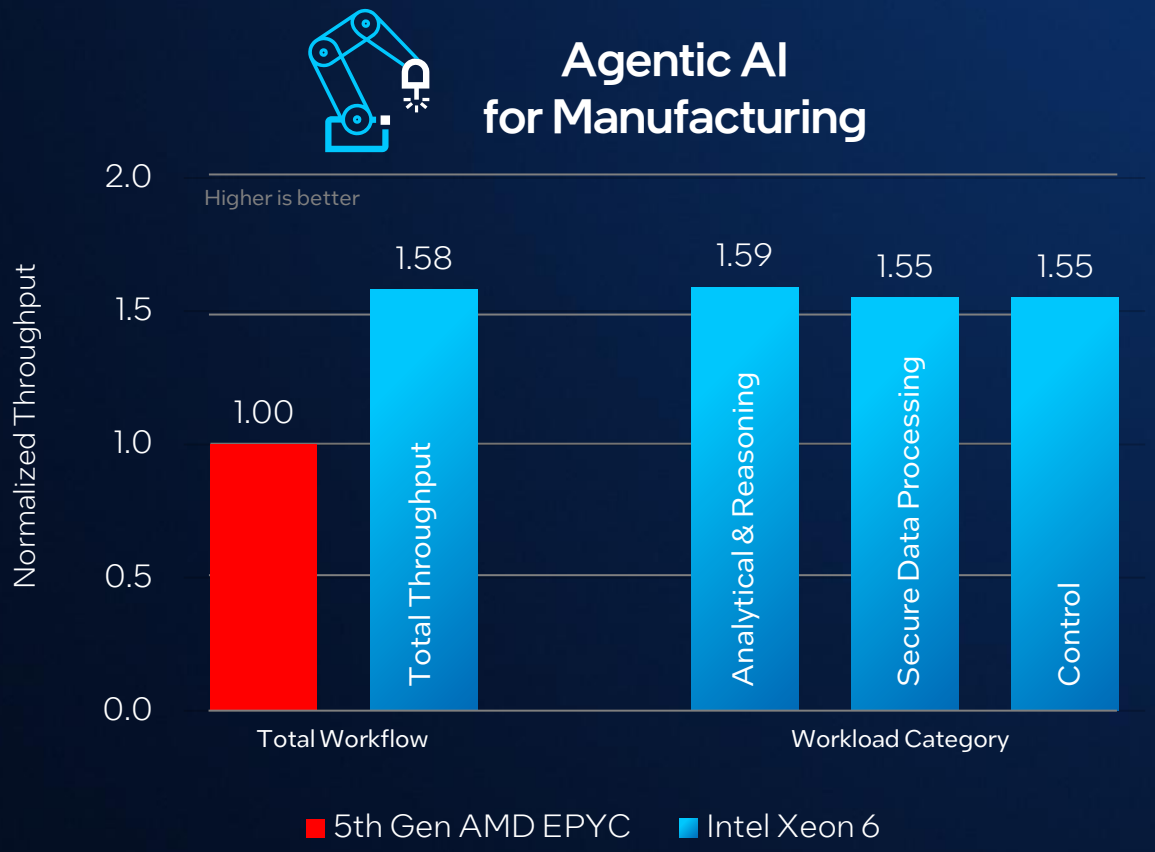
Boosting Agentic AI Throughput with Intel® Xeon®

Higher throughput across Manufacturing agentic workflows, enabling organizations to process more agent-driven work

Up to

58%

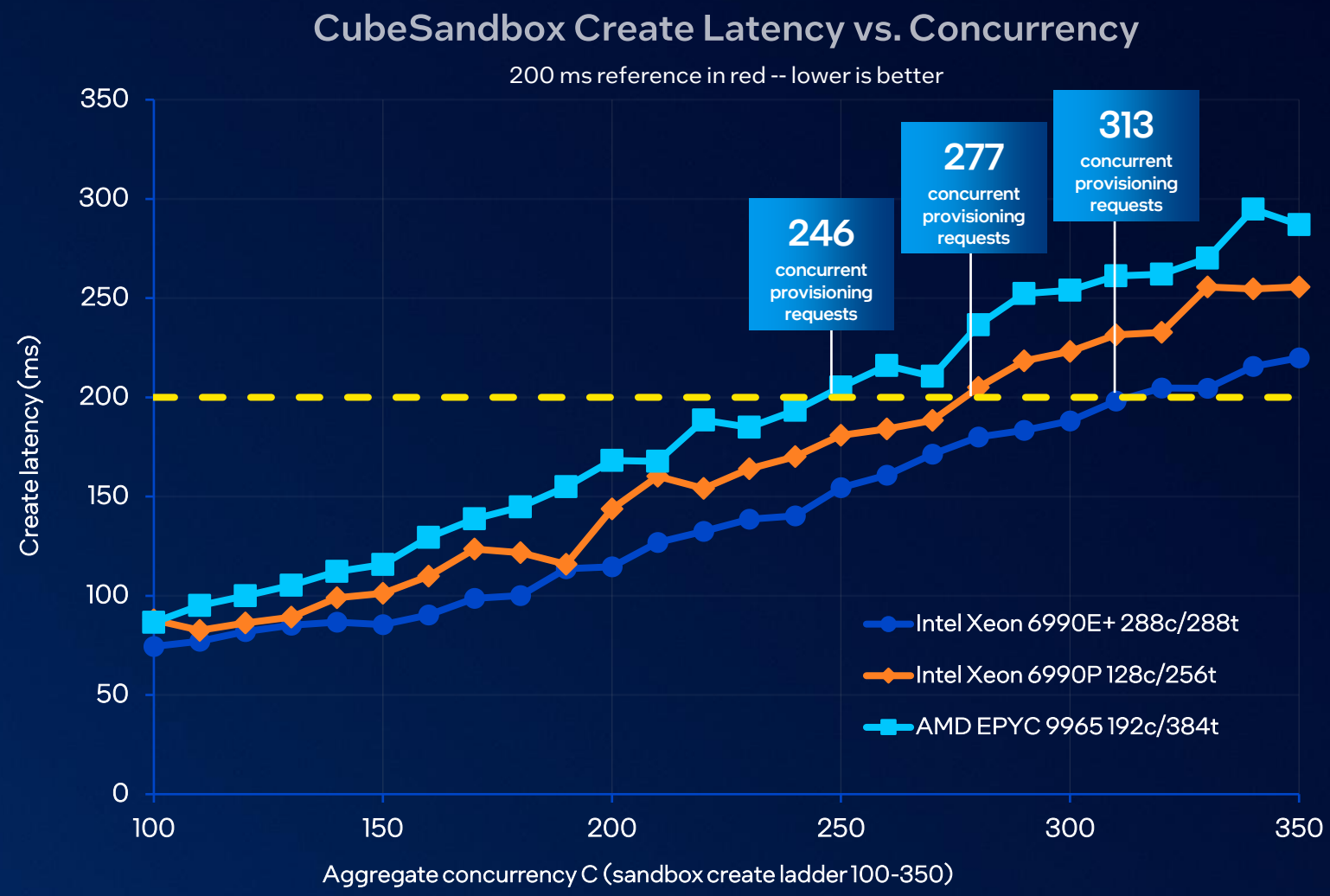
higher agentic total throughput for Manufacturing vs. AMD EPYC



Agentic workflow spanning predictive maintenance, quality inspection, supply chain optimization, production planning, factory operations, industrial security, and process optimization.
See 'Boosting Agentic AI Throughput with Intel® Xeon® CPUs' at Intel Newsroom for configuration and testing details. Results may vary

High Agentic Scalability with Intel® Xeon® 6 and 6+ CPUs

Confidently run more concurrent agents per socket, combining the scalability needed & responsiveness required



See 'Scaling Sandboxed Agentic AI on Xeon CPUs' at Intel Newsroom for configuration and testing details. Results may vary

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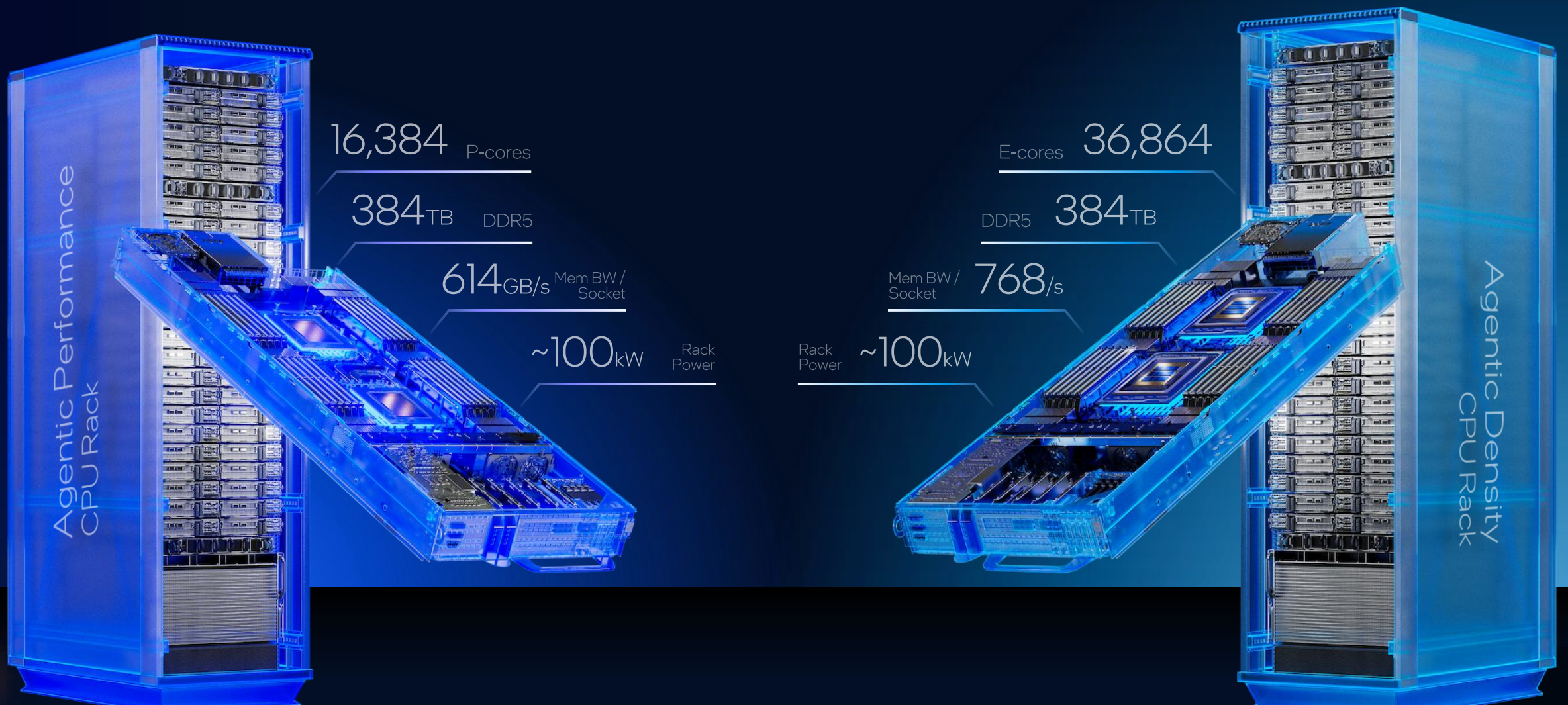
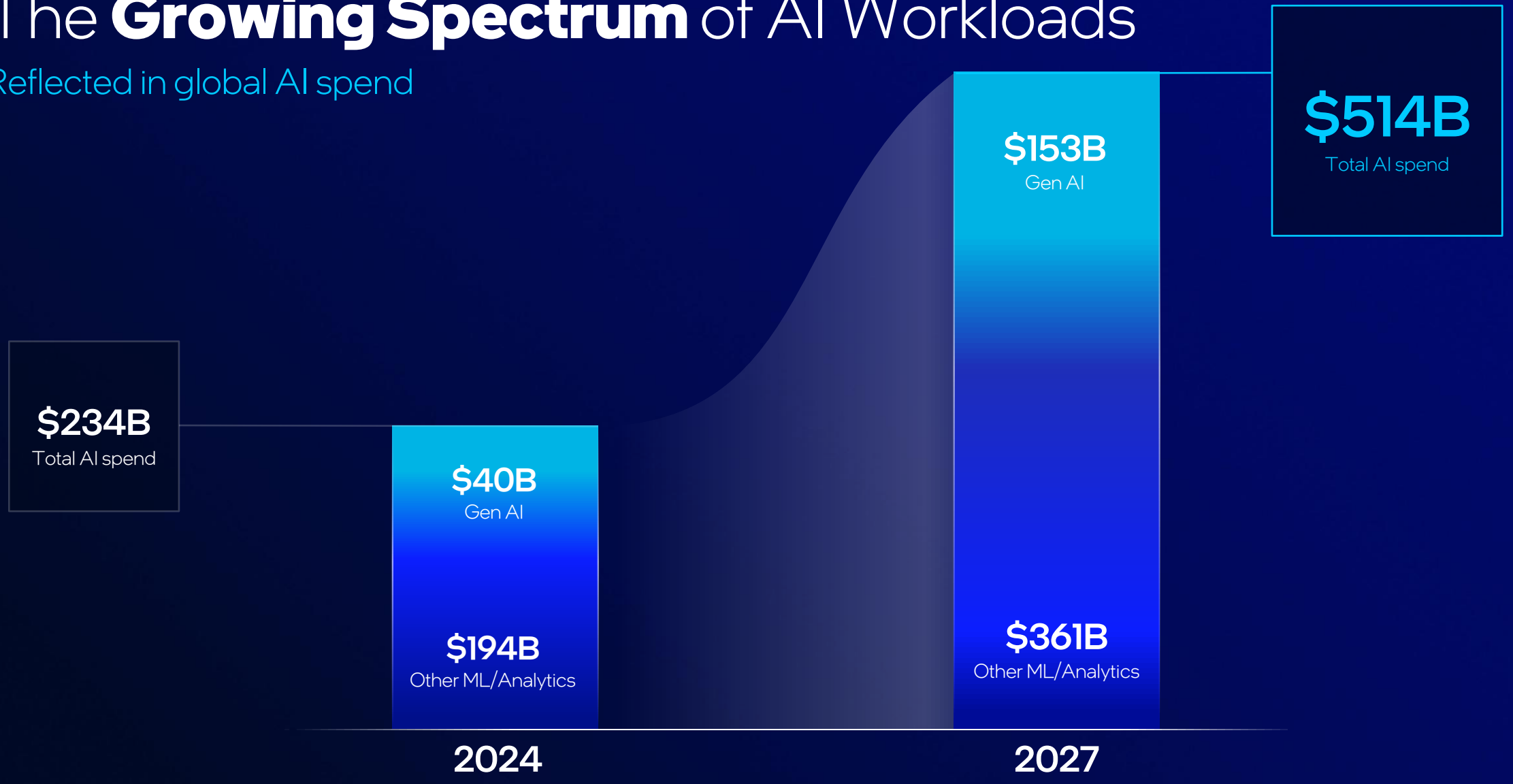
Built for Intelligence at Scale




AI with
Intel® Xeon® 6
Processors

The **Growing Spectrum** of AI Workloads

Reflected in global AI spend



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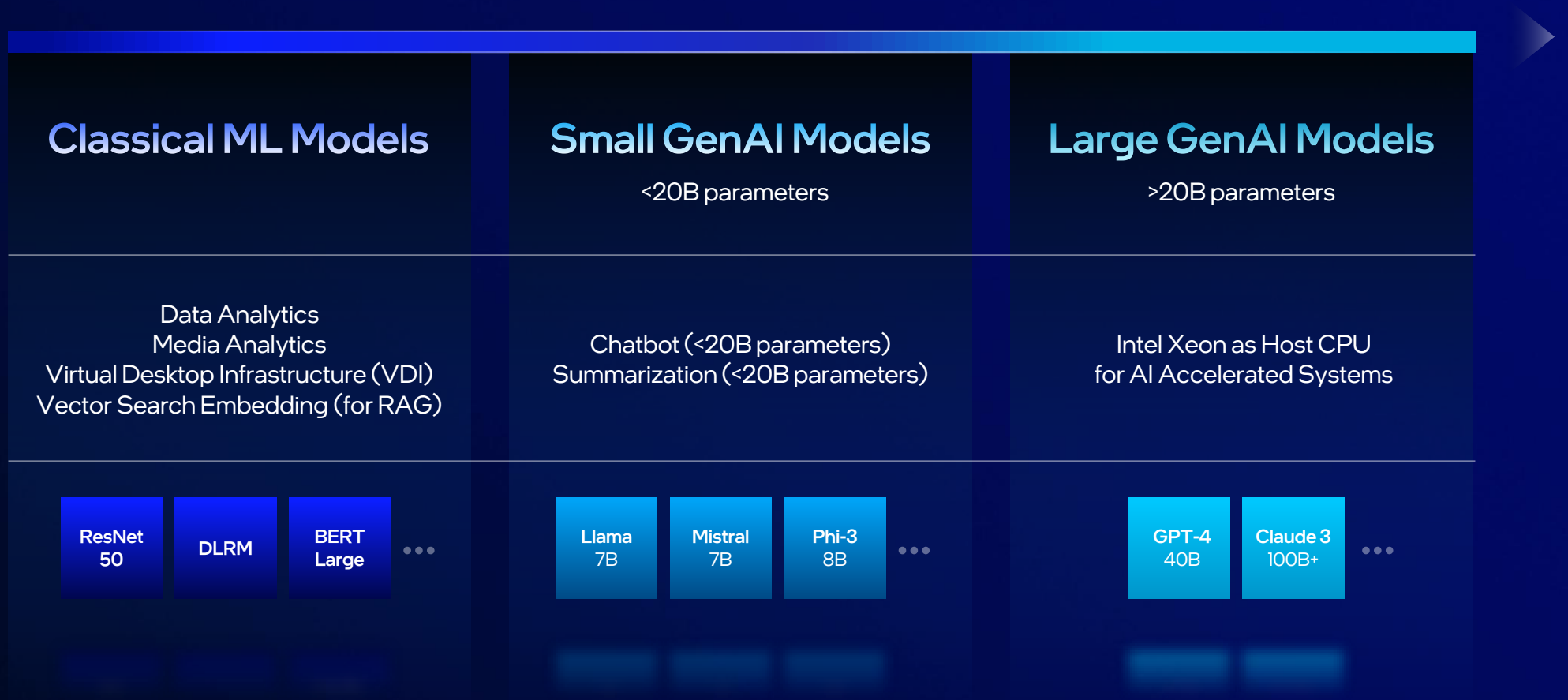
IDC's WW AI and Generative AI Spending Guide, V2 2024 (August)

Intel® Xeon® CPUs Along the AI Spectrum

Offering openness and flexibility to adapt to new trends



Intel® Xeon® 6 Processors for AI

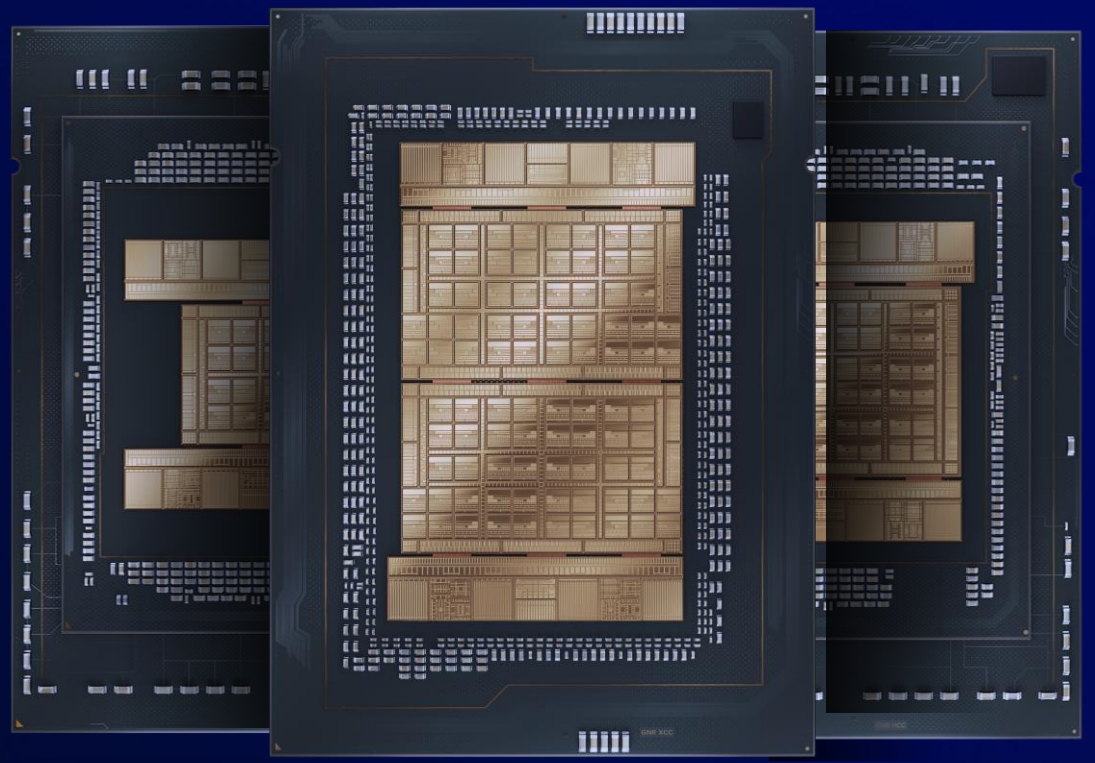
World's Best CPU for AI

Up to 128 P-cores
on 6900-series
up to 86 P-cores on 6500/6700-series

More bandwidth & cache
MRDIMM memory support
Up to **504MB** low latency LLC

AI accelerators built-in
Intel® AMX, Intel® AVX-512,
and Intel® AVX-2

Comprehensive SW suite
AI development across classical ML
and small GenAI models



The Most Deployed Host CPU

Superior I/O performance
up to **192** PCIe 5.0 lanes

High Single Threaded Performance
With Intel's latest generation P-core

Top Tier Memory Support
30% higher memory B/W with MRDIMMs
Expandability with CXL 2.0

Ready for Deployment
DC-MHS & NVIDIA MGX™
form factors supported

Best CPU: See ISC 2024 section of intel.com/performanceindex for workloads and configurations. Your results may vary. Intel technologies may require enabled hardware, software or service activation.
Most Deployed Source: IDC Server Tracker report, based on 1H'24 system volume.
*NVIDIA logo and MGX are trademarks of NVIDIA and/or its subsidiaries

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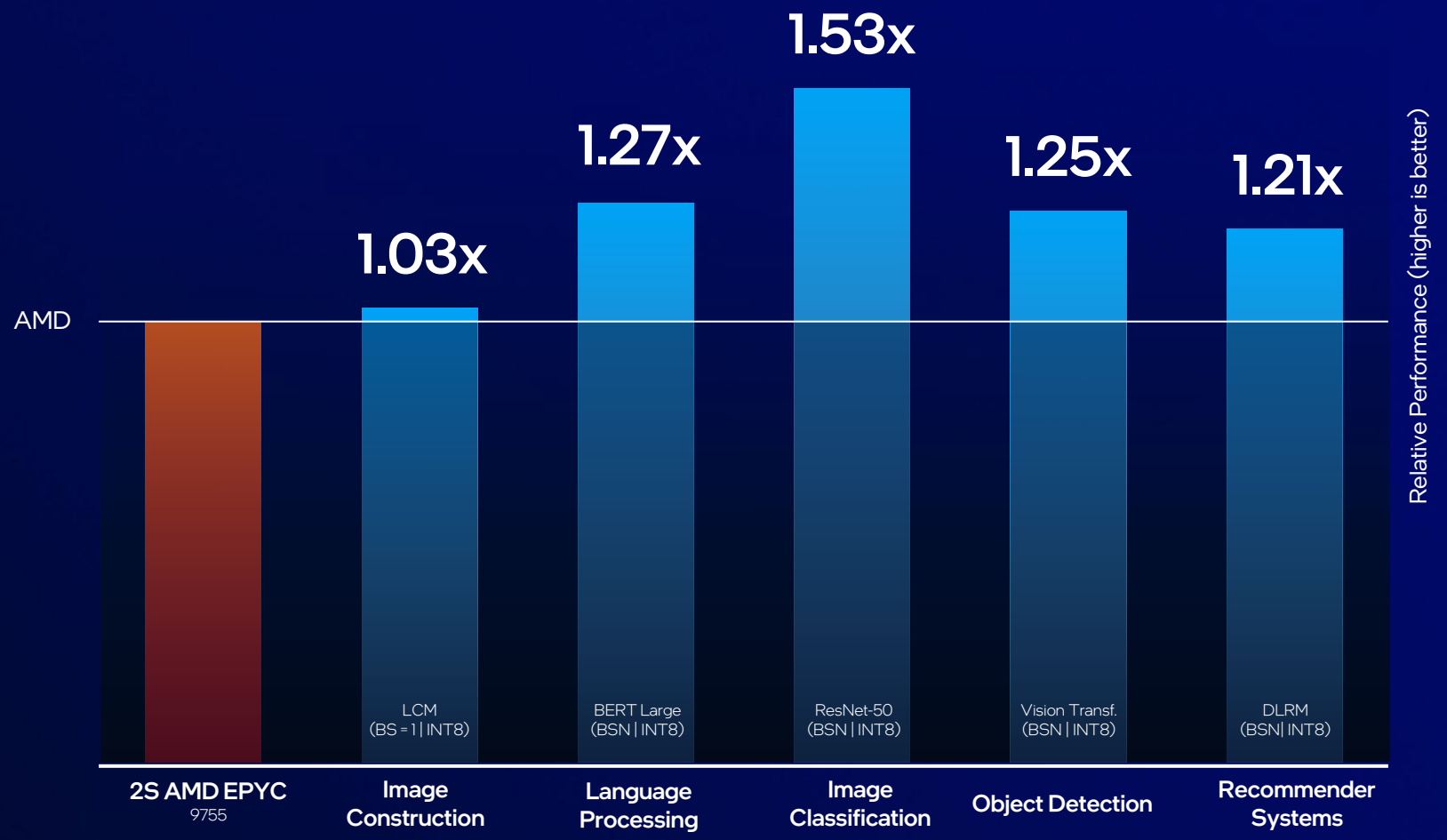
Delivering Amazing AI Performance

with Intel® AMX and with 33% less cores than competition



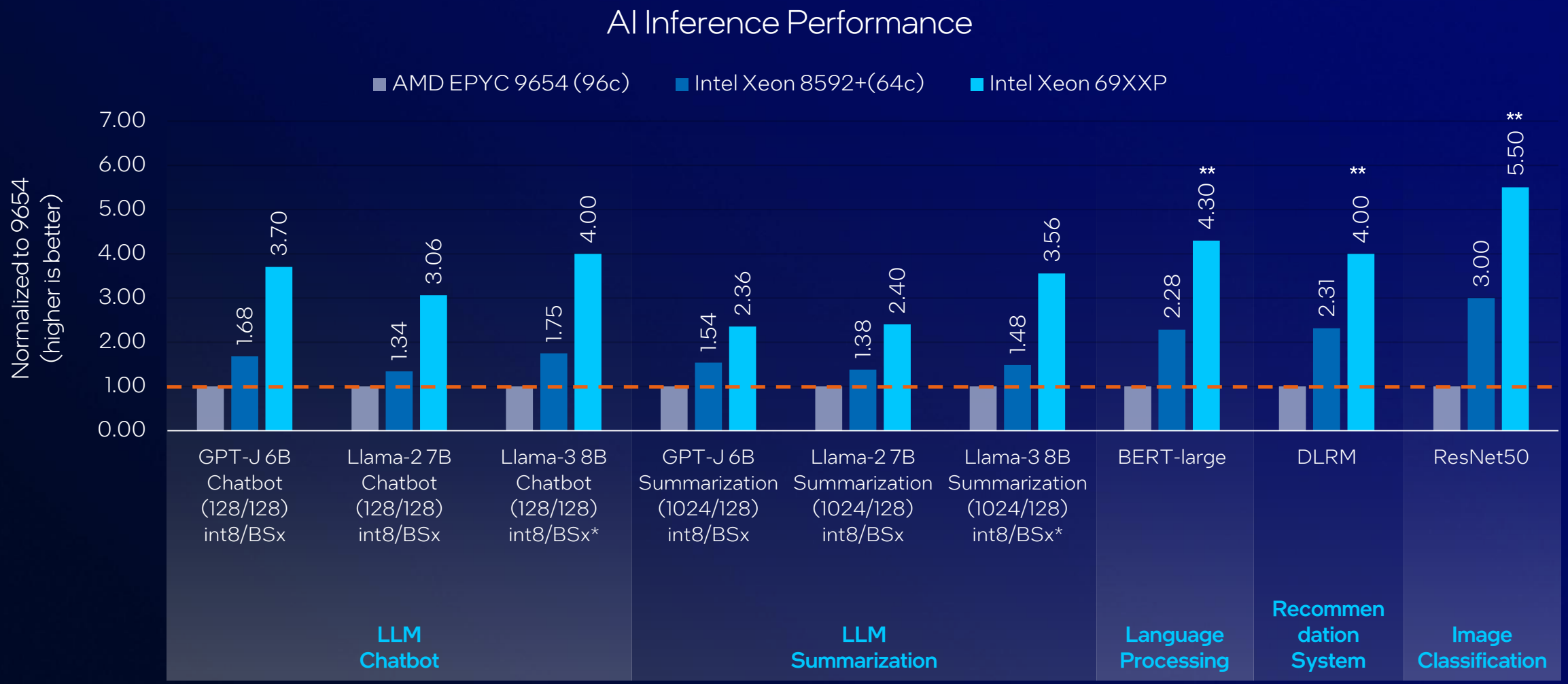
2S AMD EPYC 9755 (128 cores)

2S Intel Xeon 6787P (86 cores)

intel See [7A220 – 7A224] intel.com/processorclaims: Intel Xeon 6. Results may vary.

World's Best CPU for AI Inference

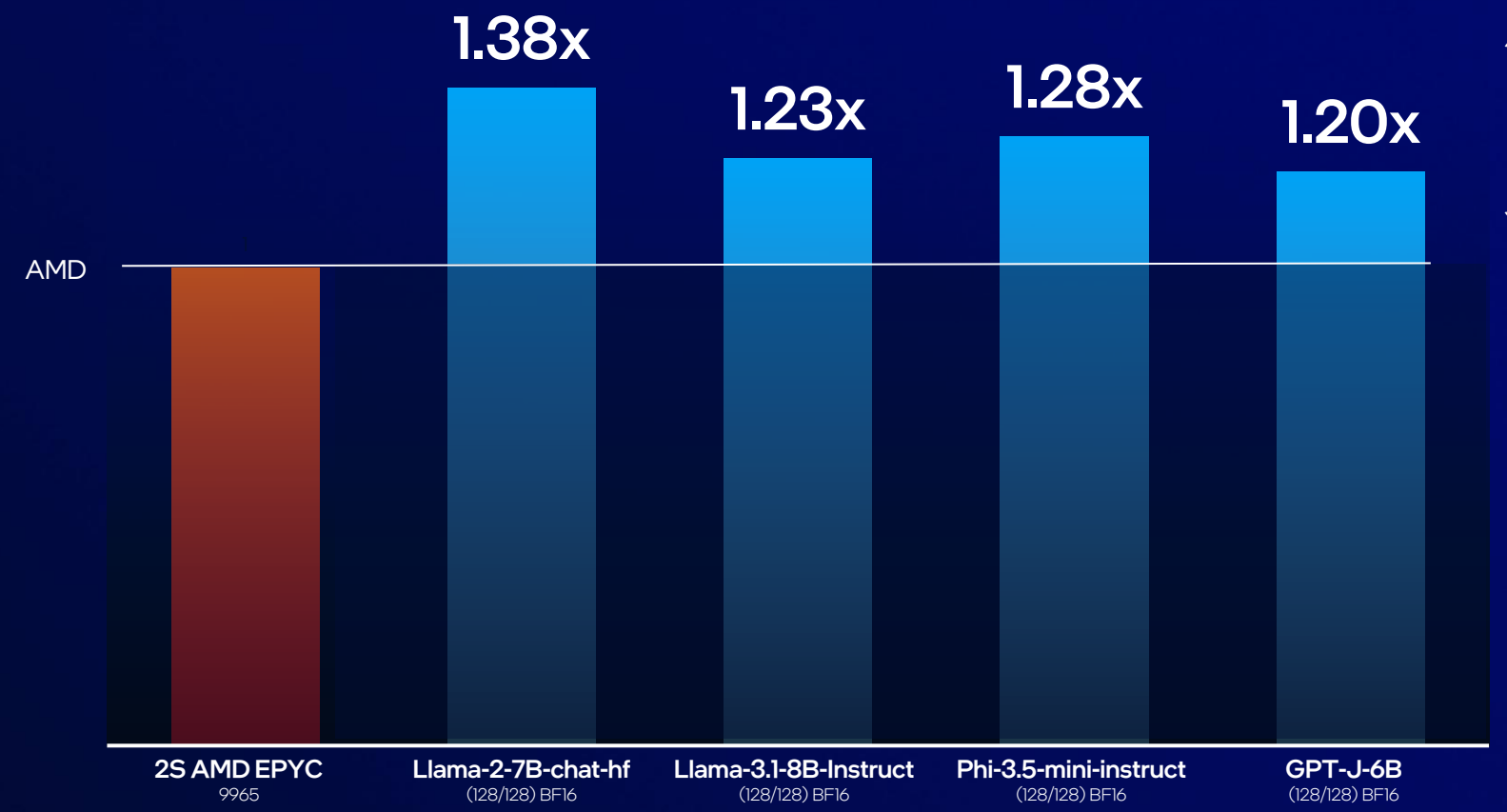
Continued leadership in AI with **5.5x** higher performance vs. competition



**Intel Xeon result based on 128C 6980P. All other 69XXP results on 96C 6972P.
See backup for workload and configurations. Results may vary.
* AMD EPYC 9654 with BF16 on Llama3 8B Chatbot; did not meet SLA on INT8

Leadership in Small Model Performance

Intel® Xeon® 6900P series processors with MRDIMM support outperform the best AMD EPYC 9005



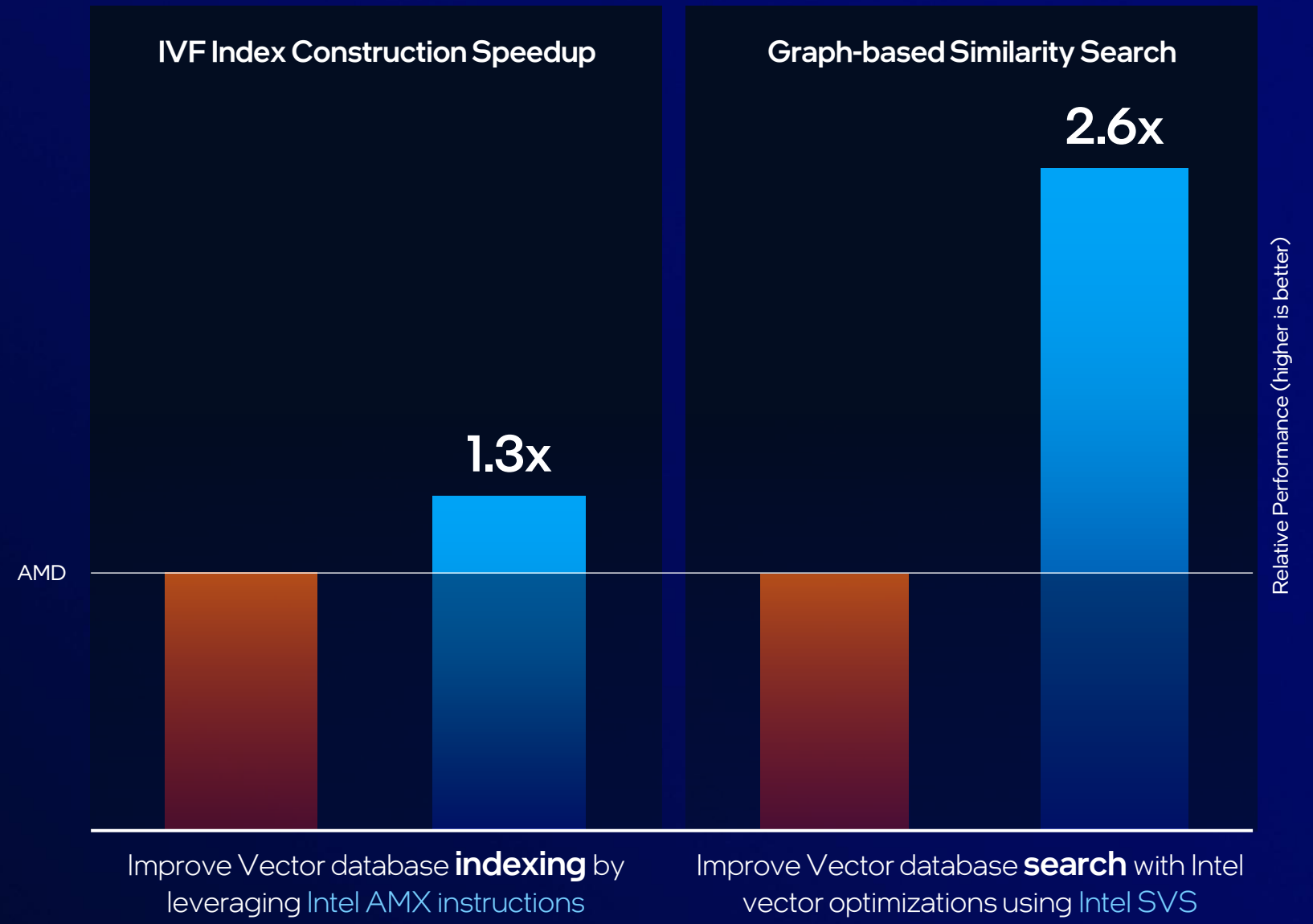
2S AMD EPYC 9965 (192 cores)

2S Intel Xeon 6980P (128 cores)

intel See [9A231] intel.com/processorclaims: Intel Xeon 6. Results may vary

Intel® SVS Vector Optimizations for Vector Databases

Intel® Xeon® processor (64c) vs. AMD EPYC (64c) on Wiki-45M (1S)



See [7D220] intel.com/processorclaims: Intel Xeon 6. Results may vary

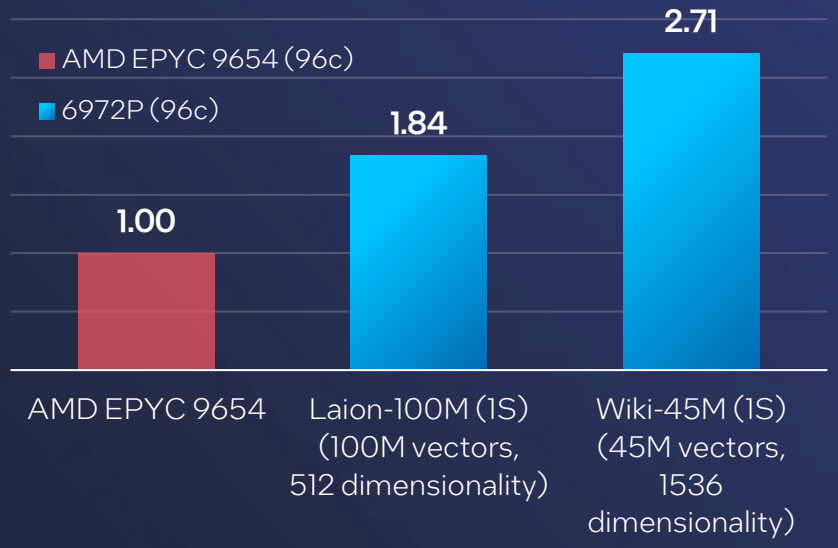
See [7D220] intel.com/processorclaims: Intel Xeon 6. Results may vary
Intel Scalable Vector Search (Intel SVS), Intel® Advanced Matrix Extensions (Intel® AMX)

Intel® SVS Vector Optimizations for Vector Databases

Intel® Scalable Vector Search (SVS)

Improve Vector database **indexing** by leveraging Intel AMX instructions

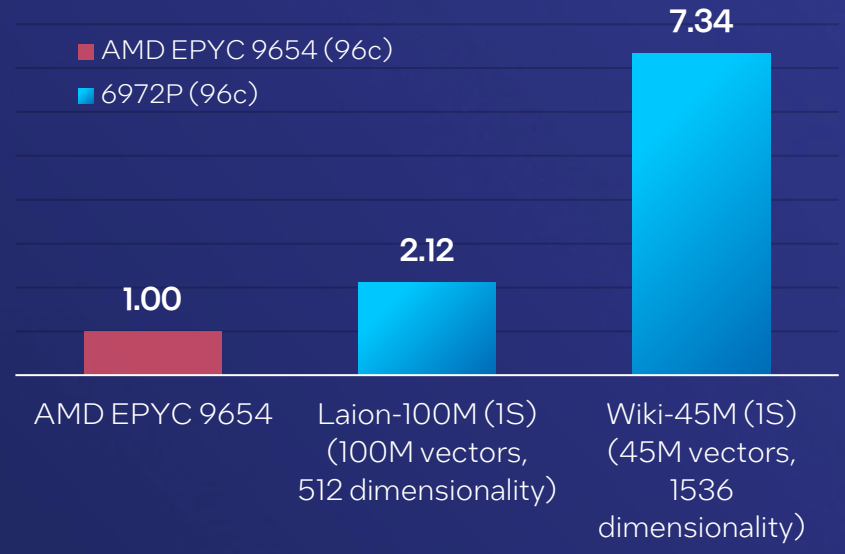
Intel SVS-Inverted File Index (IVF) Construction SpeedUp
Higher is better





Improve Vector database **search** with Intel vector optimizations using Intel SVS

Intel SVS- Graph based Similarity Search
Higher is better



intel See backup for workload and configurations. Results may vary.

Intel® Xeon® CPU Is the Most Deployed Host CPU[1] for AI Accelerated Systems

The role of a host CPU in maximizing the performance of an AI accelerated system:

- Data preprocessing to prepare data for training models
- Data transmission to GPU for parallel processing
- Manages check-pointing to system memory
- Inherent flexibility to process mixed workloads running on same infrastructure

Host CPU Technical Requirements	Intel Xeon 6 Winning Features
Superior I/O performance	20% more lanes with up to 192 PCIe 5.0 lanes resulting in higher I/O bandwidth[2]
High single threaded performance	High per core performance and max turbo frequency
High memory bandwidth and capacity	30% higher bandwidth w/ MRDIMMs[3] Mem capacity expansion with CXL
RAS for large scale systems	Advanced RAS support (ex: PCIe enhanced Downstream Port Containment - eDPC)
Flexible form factor support	Both DC-MHS and NVIDIA® MGX™ supported*

1. Source: IDC Server Tracker report, based on Q1'24 system volume
2. 2S system as compared to 5th Gen Intel Xeon processor
3. Compared to DDR5 6400 RDIMM

* NVIDIA logo, MGX and HGX are trademarks of NVIDIA and/or its subsidiaries

Recommended Intel® Xeon® 6 Processors as Host CPUs

Jointly identified by Intel and NVIDIA for AI use cases in the data center



Intel Xeon 6 SKUs Qualified for NVIDIA® MGX™ and NVIDIA HGX™ Systems

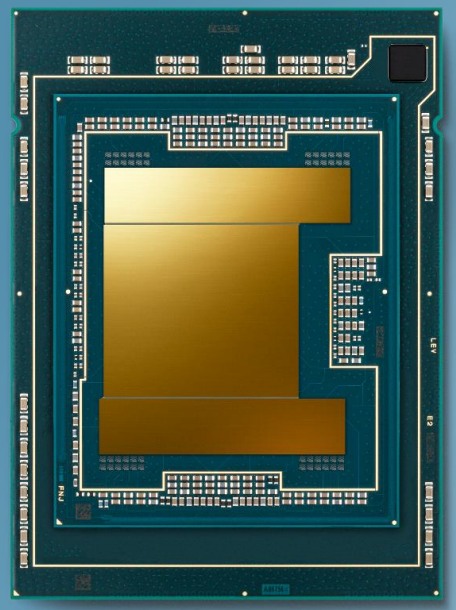
Systems (per system config)	**Intel Xeon 6** Processors
MGX (1 CPU, 4 GPUs, 3 NICs)	Intel Xeon 6761P[1] (64C)
MGX (2 CPUs, 4 GPUs, 3 NICs)	Intel Xeon 6737P (32C) Intel Xeon 6960P[2] (48C)
MGX (2 CPUs, 8 GPUs, 5 NICs)	Intel Xeon 6767P (64C) Intel Xeon 6960P[2] (72C)
MGX (2 CPUs, 16 GPUs, 1 NIC)	Intel Xeon 6767P (64C) Intel Xeon 6960P[2] (72C)
HGX[3] (2 CPUs, 8 GPUs, x NICs)	Intel Xeon 6767P (64C) Intel Xeon 6960P[2] (72C)

Other Intel Xeon 6 SKUs can be used in AI Accelerated systems including Intel Xeon 6 with E-cores for high-density infrastructure requirements.

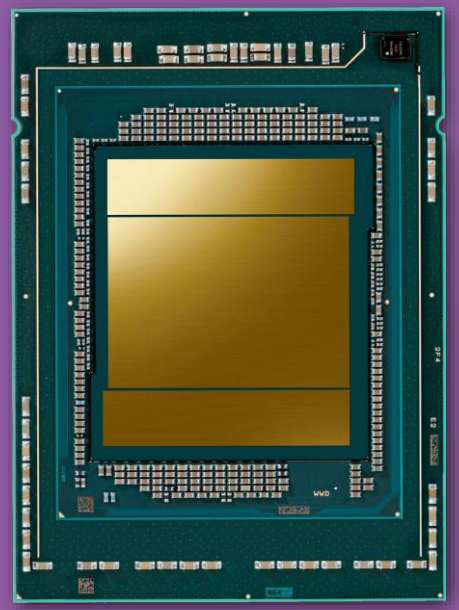
1. Intel Xeon 6761P SKU is only for single socket systems
2. Intel Xeon 6960P SKU can be configured 72C□48C for higher frequencies
3. Three different topologies supported; for additional topologies and configuration details, please contact your Intel representative

* NVIDIA logo, MGX and HGX are trademarks of NVIDIA and/or its subsidiaries

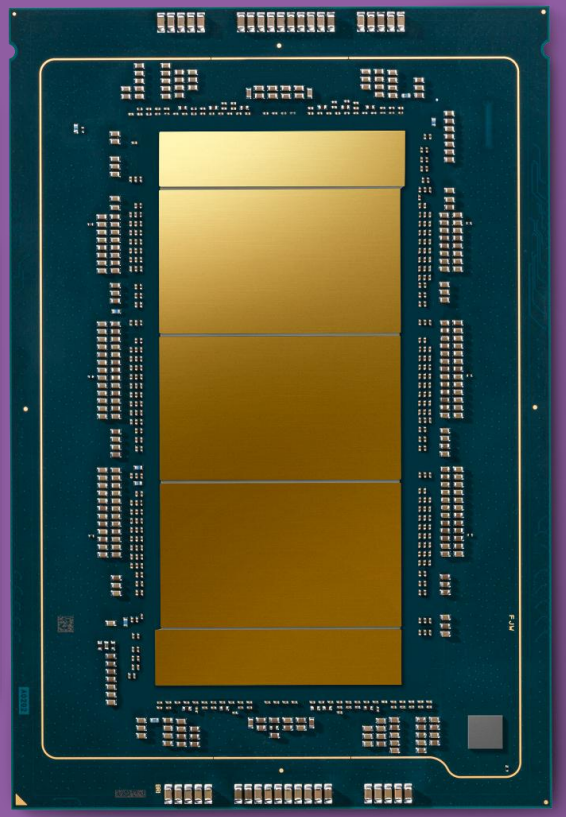
Intel® Xeon® 6 Processor Microarchitectures



Intel® Xeon® 6700 with Efficient-Cores (E-Cores)



Intel® Xeon® 6700 With Performance-Cores (P-cores)



Intel® Xeon® 6900 with Performance- Cores (P-Cores)

Scalability and Flexibility with Modular SoC Architecture

Intel® Xeon® 6 processor architecture



Module-die Fabric

Enables **flexible** construction offering customers a breadth of compute **choices**

Multi-die Architecture

I/O die with UPI, PCIe, CXL and Intel® Accelerator Engines

Compute die with cores, cache, and memory controllers

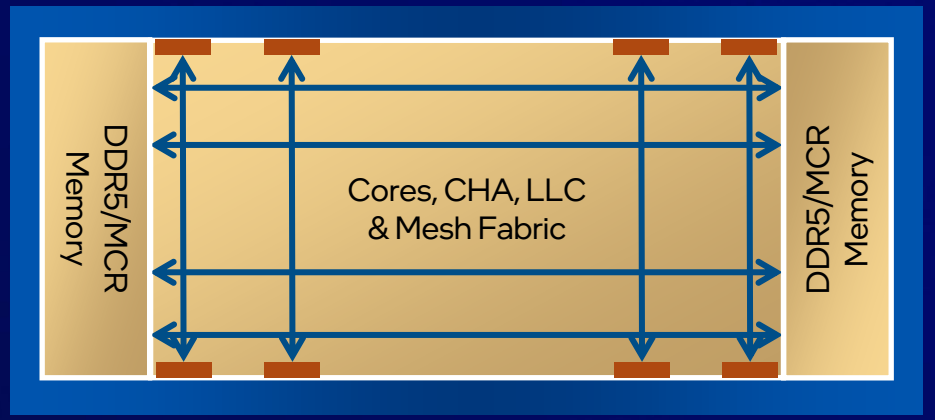
Embedded Multi-die Interconnect Bridge

In-package high-density interconnect enabling **high bandwidth**, **low power,** and **low latency**

Modular Compute Die Architecture

Higher performance and efficiency on Intel 3 process

- **Monolithic Mesh** enables direct access between agents within the socket
- **Modularity** and **flexible routing** allows per-die definition of rows and columns
- **Last level cache** shared with all cores, can be partitioned into per-die sub-numa clusters
- **Fabric distributes** IO traffic across multiple columns to ease congestion
- **Global infrastructure** is modular and hierarchical
- **EmiB technology** extends the high-speed fabric across all die in the package



Modular I/O Die Architecture

Universal and common I/O stacks across Intel® Xeon® 6 processors on Intel 7 process

Universal I/O Stacks

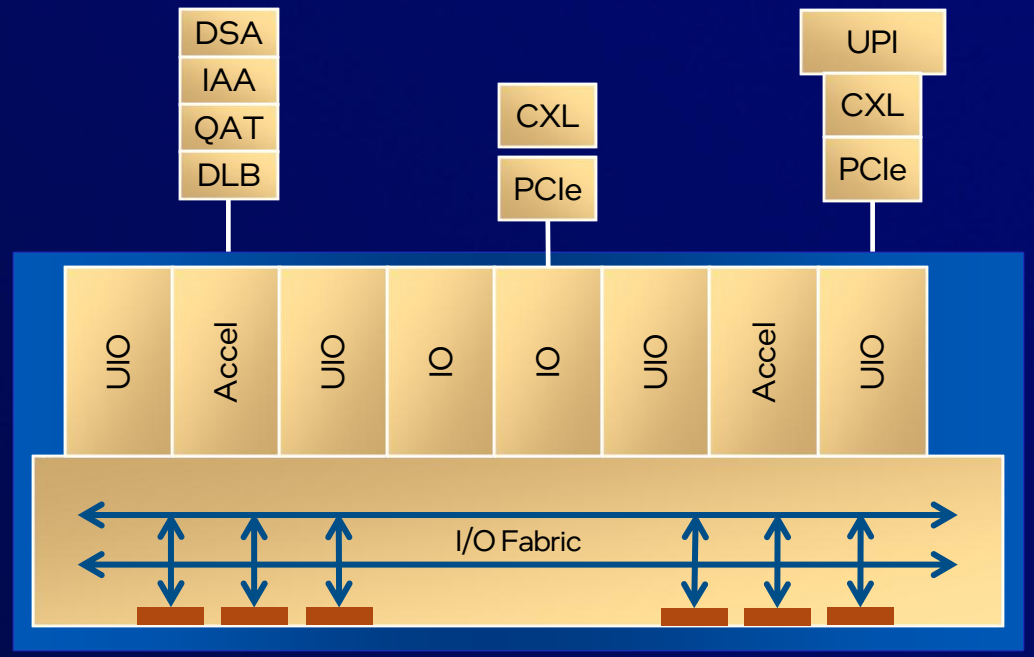
UPI, PCIe, CXL and Intel® Accelerator Engines

New Capabilities

Full CXL support, extends Intel® Resource Director Technology (RDT), secure interconnect

Enhanced I/O Performance

UPI @ 24GT/s w/6-links, UPI affinity, distributes traffic across all mesh columns



Intel® Data Streaming Accelerator (Intel® DSA)
Intel® In-Memory Analytics Accelerator (Intel® IAA)
Intel® QuickAssist Technology (Intel® QAT)
Intel® Dynamic Load Balancer (Intel® DLB)

Intel® Xeon® 6 Processors

P-Core & E-Core SKUs
Up to **288 cores**
per processor

Increased Memory Bandwidth
Up to **1.7x (DDR5)**
vs. 5th Gen Intel® Xeon® CPU

Up to **2.3x (MRDIMM)****
vs. 5th Gen Intel Xeon CPU

Increased I/O Bandwidth
1.2x (PCIe 5)
vs. 5th Gen Intel Xeon CPU

Increased Inter-Socket Bandwidth
Up to **1.8x (UPI 2.0)**
vs. 5th Gen Intel Xeon CPU

Compute Express Link (CXL) 2.0
Type 1, Type 2, & Type 3



Socket Scalability
1 to 8S

Increased Last Level Cache
Up to 504MB total

Integrated IP Accelerators
Intel® QuickAssist Technology (Intel® QAT)
Intel® In-Memory Analytics Accelerator (Intel® IAA)
Intel® Data Streaming Accelerator (Intel® DSA)
Intel® Dynamic Load Balancer (Intel® DLB)

AI Accelerator Built In
Intel® Advanced Matrix Extensions (Intel® AMX)**

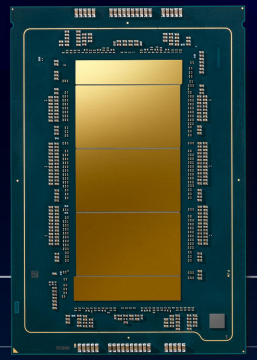
Hardware Enhanced Security
Intel® Trust Domain Extensions (Intel® TDX)
Intel® Software Guard Extensions (Intel® SGX)

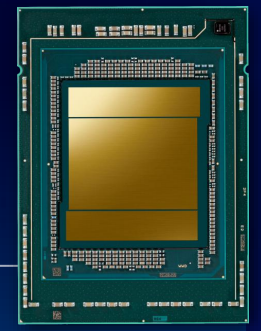
Common OS and Firmware
Simplify development and deployment

intel

**P-core only

Addressing Tomorrow's Data Center Needs



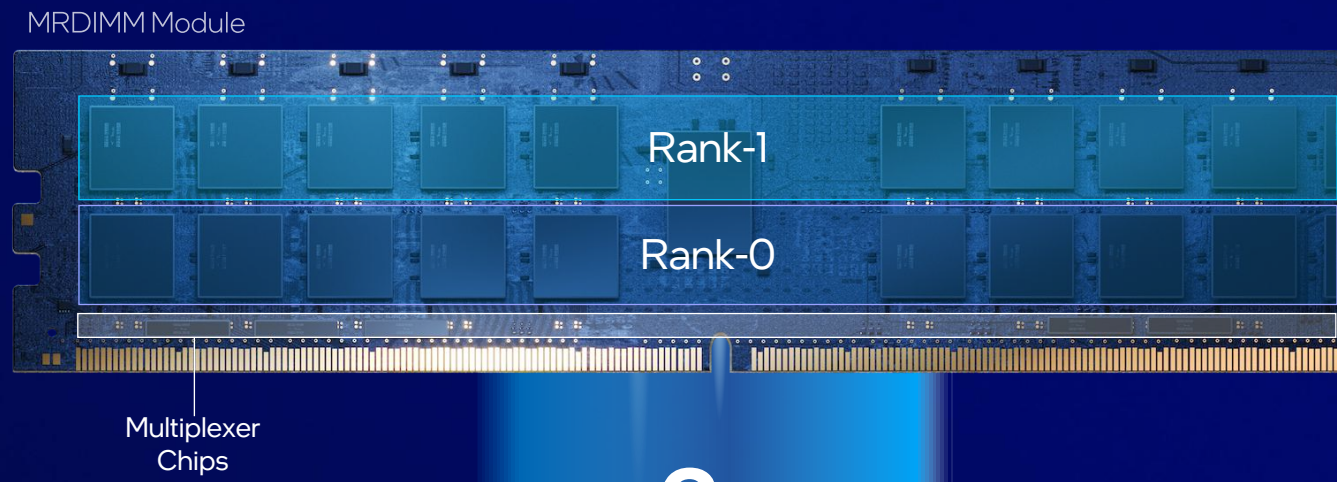


Intel® Xeon® 6900P CPU		Intel® Xeon® 6700/6500P CPU
128 Performance cores	CPU	86 Performance cores
1S, 2S	Socket Support	1S, 2S, 4S, 8S
400 to 500W	Max TDP per CPU	150 to 350W
12ch	Memory Channels	8ch
6400 (1 DPC) DDR5 | 8800 MRDIMM (1 DPC)	Memory Support	8000 (1 DPC) DDR5 | 6000 (2 DPC) DDR5 | 8000 MRDIMM (1 DPC)
96 lanes PCIe | 64 lanes CXL	PCIe G5 | CXL 2.0	88 lanes PCIe | up to 136 lanes for single socket designs| 64 lanes CXL
6 links – 24GT/s	UPI 2.0 Links	4 links – 24GT/s
up to 504MB	Last Level Cache	up to 336MB
Vector AES, SHA2-256 extensions, VPMADD52	Crypto	Vector AES, SHA2-256 extensions, VPMADD52
Intel® Software guard extensions - Intel® Trust domain extensions	Security	Intel® Software guard extensions, Intel® Trust domain extensions
Intel® QAT, Intel® DLB, Intel® DSA, Intel® IAA	Accelerators	Intel® QAT, Intel® DLB, Intel® DSA, Intel® IAA

intel

Significant Bandwidth Advantage with Multiplexed Rank DIMM (MRDIMM)

and Intel® Xeon® 6 CPUs with P-cores



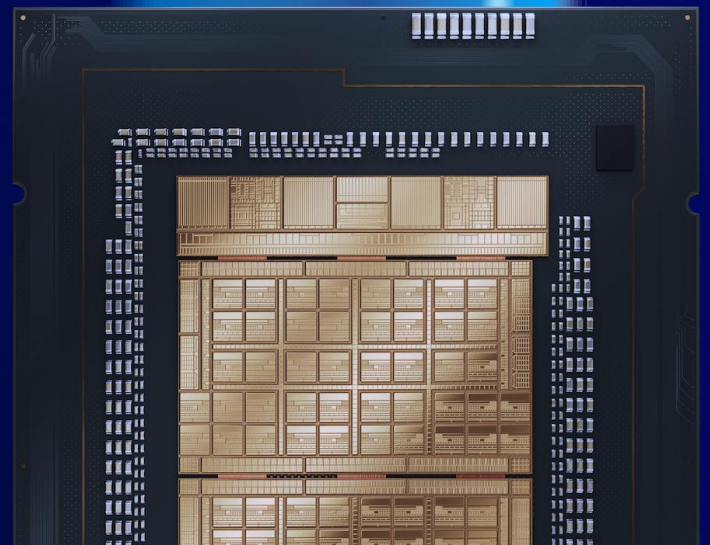
2x

DDR5 Transfers

Up to 8800 MT/s data rate

Improving memory B/W scaling

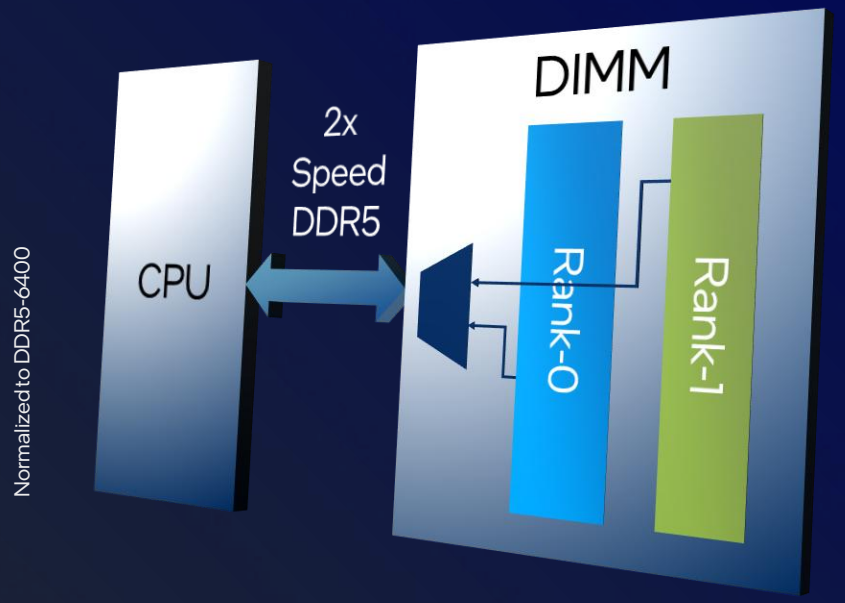
Great for memory bound workloads



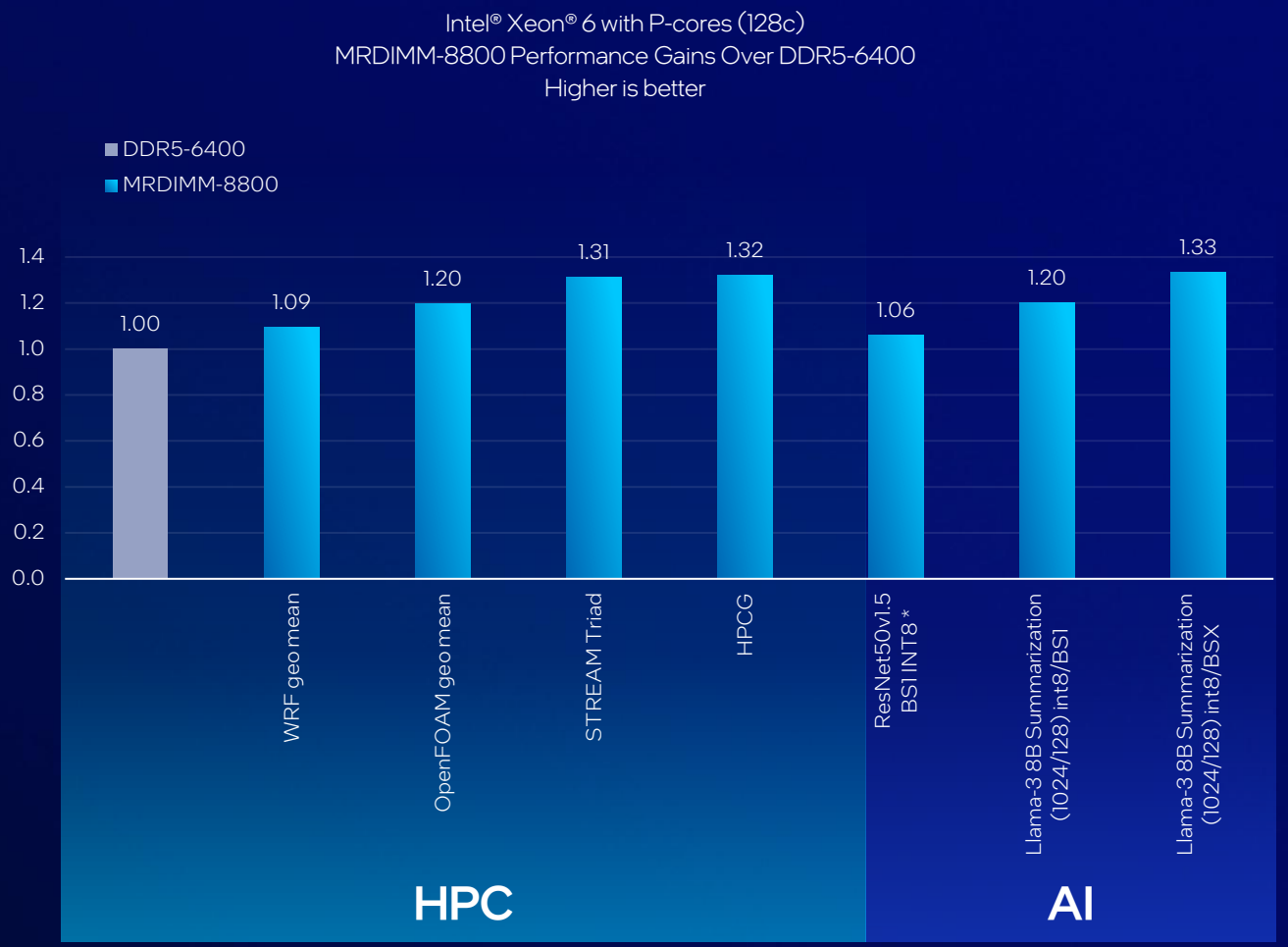
intel

Multiplexed Rank DIMMs

First to market on Intel® Xeon® 6 processors with P-core



MRDIMMs deliver up to **8800 MT/s** data rate on Intel Xeon 6 with P-cores



See backup for workload and configurations. Results may vary. * 6972P (96c) used.
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Compute Express Link 2.0 (CXL 2.0)

CXL Memory is a cost efficient, flexible, first-class solution

CXL Compute Express Link®

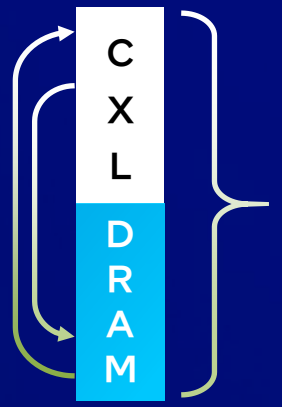
Benefits:

- CXL 2.0 support for all (Type 1, Type 2 and Type 3) devices and backward compatible with CXL 1.1
- Link bifurcation for multiple devices per host port
- Enhanced CXL memory (Type 3) tiering support for capacity and bandwidth expansion
- Managed hot plug support for device addition/removal

intel XEON

Enhanced Support
for CXL memory Type 3 devices, including Flat Memory Mode only available on Intel® Xeon® 6 CPUs

Flat Memory Mode
H/W-controlled tiering mode that is completely independent of O/S version and data-tiering capabilities

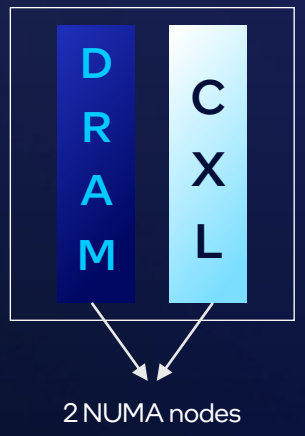


Single tier: OS visible memory

Intel® Xeon® 6 Processors with CXL® Attached Memory

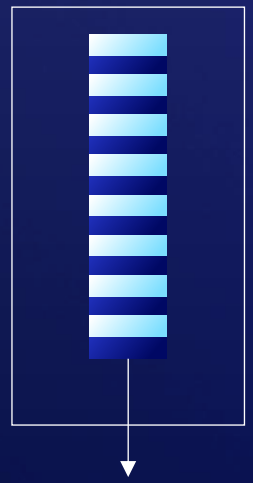
CXL Memory is a cost efficient, flexible, first-class solution

CXL Numa Node



- SW (Hypervisor/OS/App)-assisted tiering
- 4KB page transfer, with movement overheads

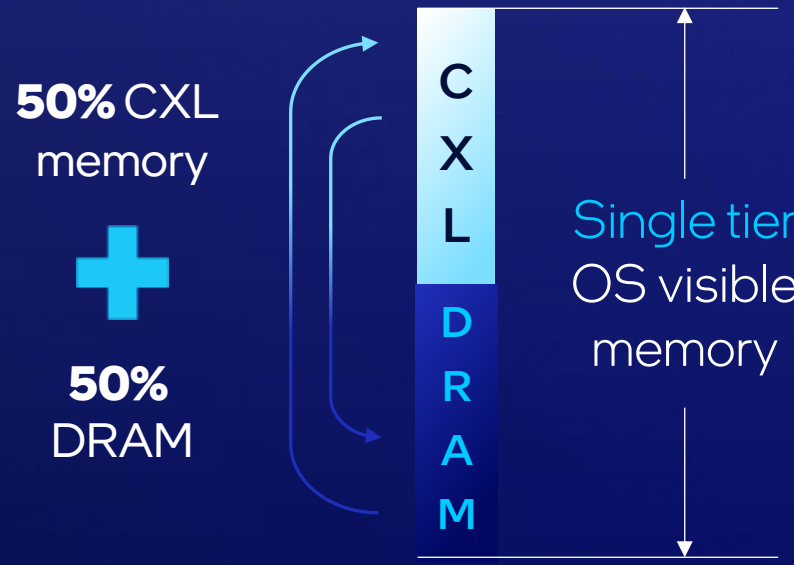
CXL Hetero Interleaved



- HW-based memory interleaving
- Interleaving DRAM and CXL memory address space
- Only on Intel® Xeon® 6900/6700 series processors with P-cores, not on Xeon 6900/6700 series processors with E-cores

Flat Memory Mode

Only available on Intel Xeon 6 CPUs

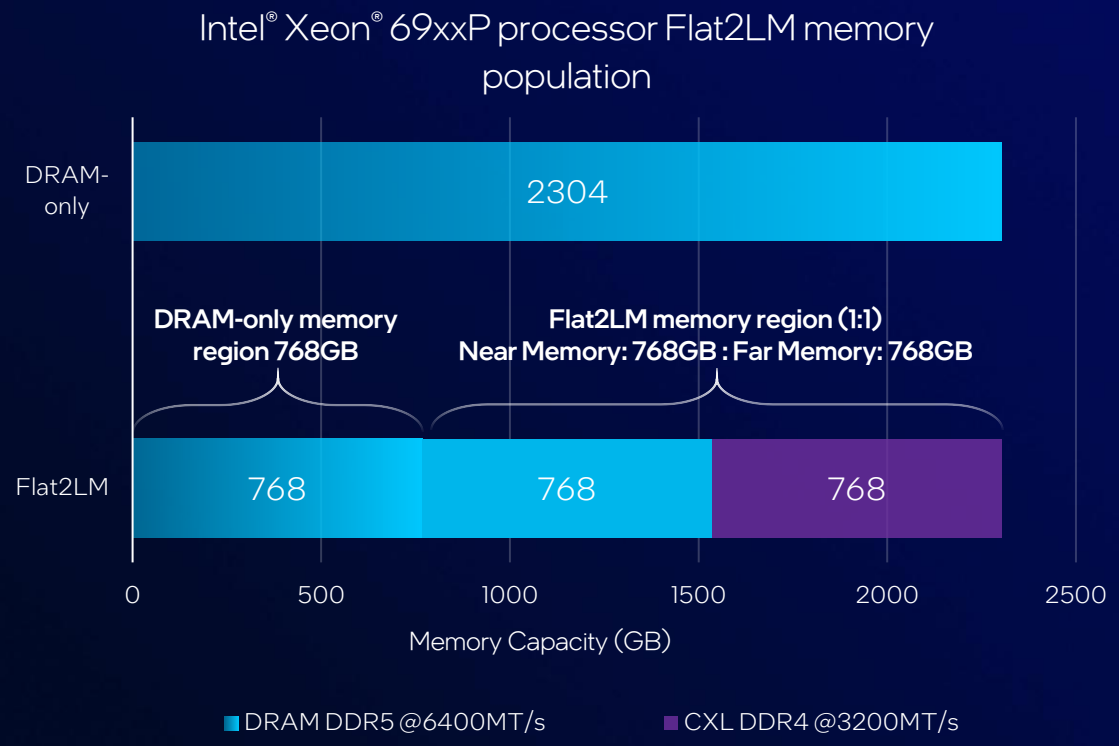


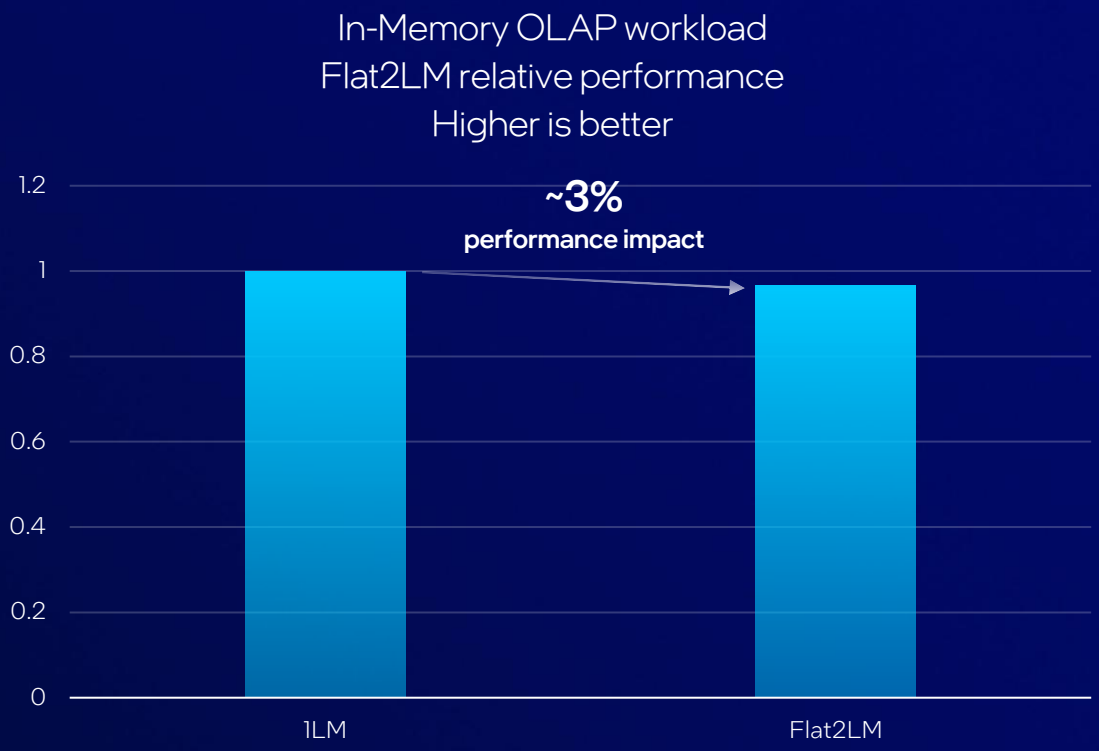
- HW-assisted tiering, fully SW transparent
- Single native DDR + CXL memory region
- 1:1 Near/Far memory ratio

intel

CXL Performance Running Flat Memory Mode

Improved TCO with minimal impact to performance





Flat2LM = Intel® Flat Memory Mode
See [9D52] at intel.com/processorclaims: Intel Xeon 6. Results may vary

Intel® Accelerator Engines | Intel® Xeon® Processor with P-core

Most built-in accelerators of any CPU on the market, providing customers with increased performance, cost savings, and sustainability advantages for the biggest and fastest-growing workloads

Intel® AI Engines

- Intel® Advanced Matrix Extensions (Intel® AMX)
- Intel® Advanced Vector Extensions 512 (Intel® AVX-512)

Intel® Security Engines

- Intel® Software Guard Extensions (Intel® SGX)
- Intel® Trust Domain Extensions (Intel® TDX)
- Intel® QuickAssist Technology (Intel® QAT)

Intel® HPC Engines

- Intel® Advanced Vector Extensions 512 (Intel® AVX-512)
- Intel® Advanced Matrix Extensions (Intel® AMX)

Intel® Network Engines

- Intel® QuickAssist Technology (Intel® QAT)
- Intel® Dynamic Load Balancer (Intel® DLB)
- Intel® Data Streaming Accelerator (Intel® DSA)

Intel® Analytics Engines

- Intel® In-memory Analytics Accelerator (Intel® IAA)
- Intel® Data Streaming Accelerator (Intel® DSA)
- Intel® QuickAssist Technology (Intel® QAT)

Intel® Storage Engines

- Intel® Data Streaming Accelerator (Intel® DSA)
- Intel® QuickAssist Technology (Intel® QAT)
- Intel® Volume Management Device (Intel® VMD)*

intel

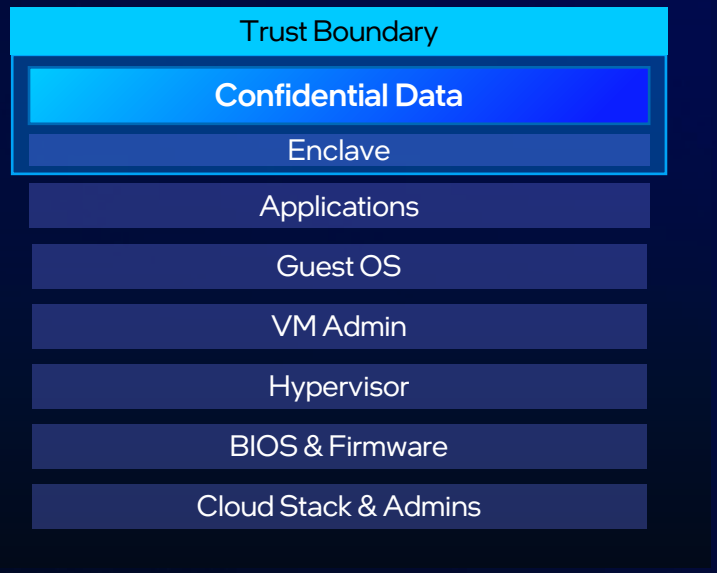
*enables Intel® Virtual RAID (VROC)

The Most Comprehensive Portfolio

for confidential computing

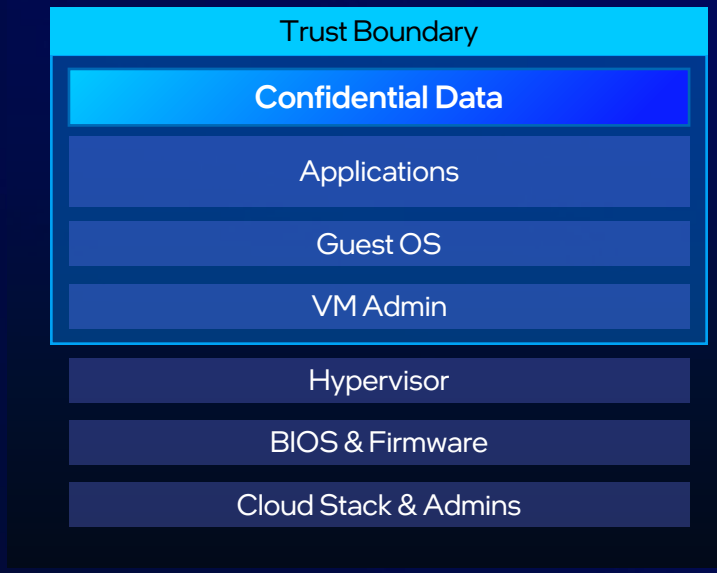
App Isolation
Intel® SGX

Smallest trust boundary for greatest data protection & code integrity



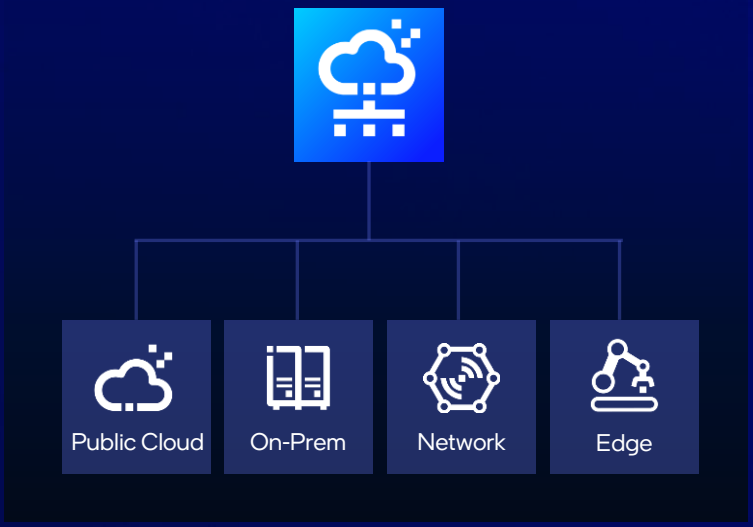
VM Isolation
Intel® TDX

Most straightforward path to greater security, compliance & control for legacy apps



Trust Services
Intel® Tiber™ Trust Authority

Uniform, independent attestation of trustworthy environments



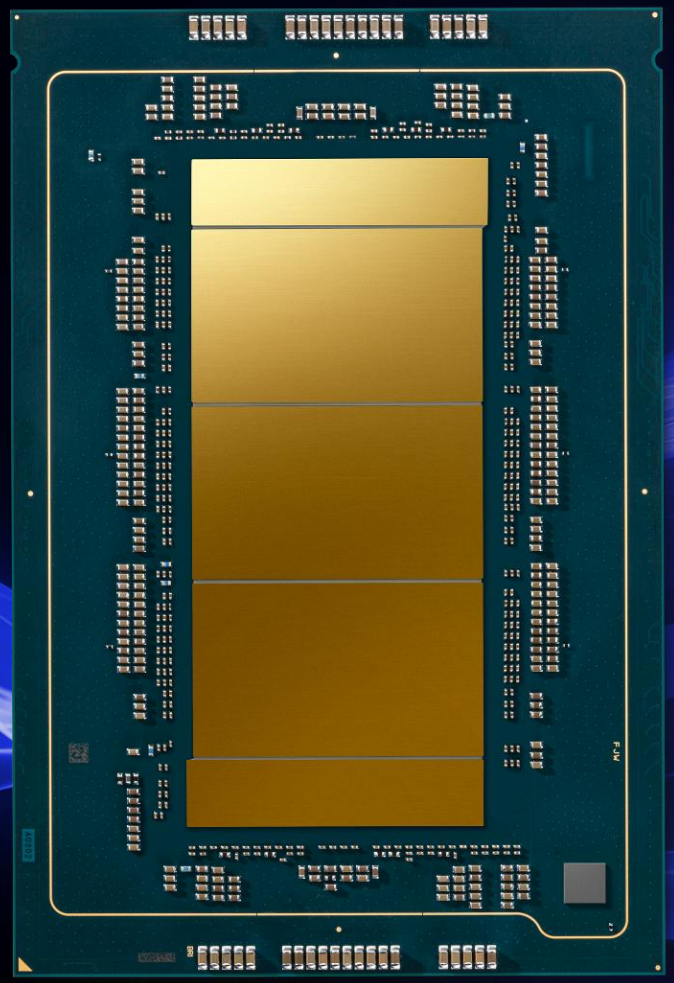
The Next Milestone in Confidential AI with **Intel® TDX Connect**

Provides a high-performance encrypted connection between the CPU and PCIe devices with direct memory access and lower overhead



*Activating TDX Connect will require Intel Xeon 6 with P-cores, TDX Module updates, an enabled OS, and an enabled device

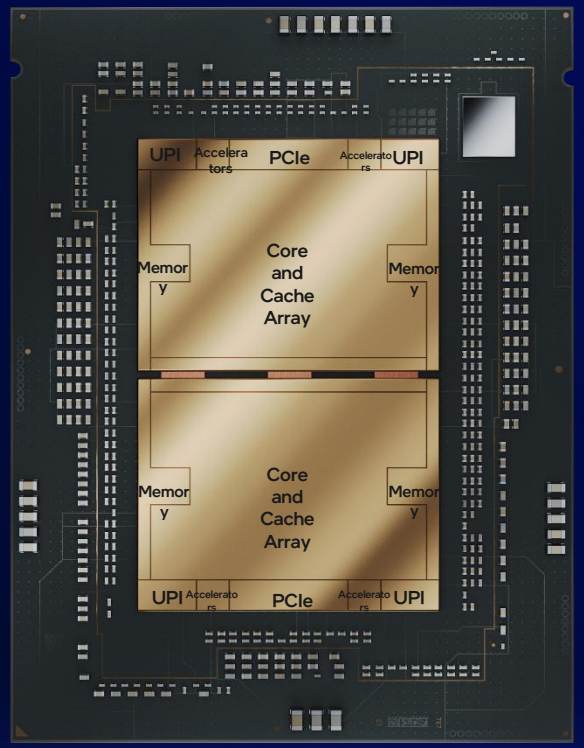
Intel® Xeon® 6900 Processors with Performance-Cores (P-cores)

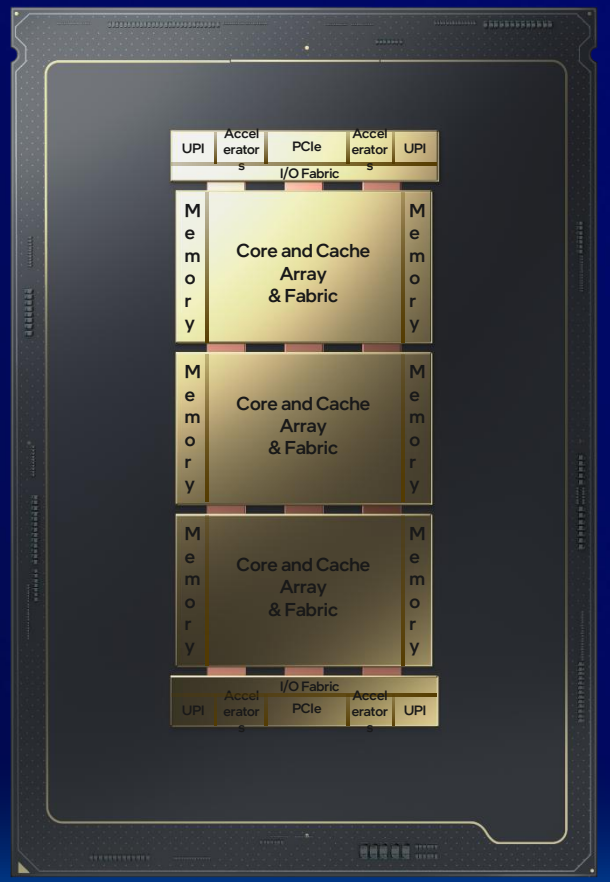


intel

Scalability and Flexibility

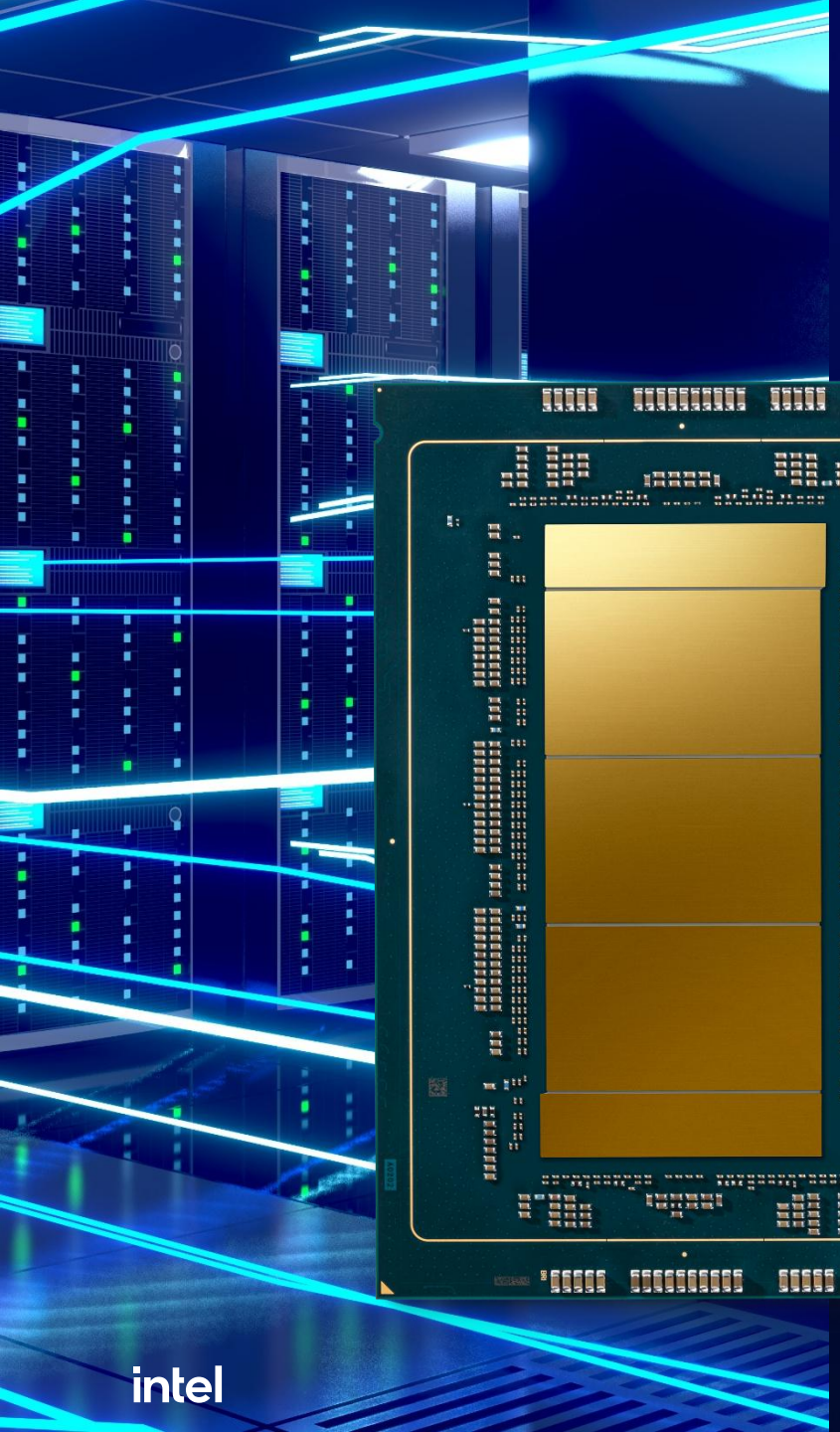
Intel® Xeon® 6 processor die package advancements





5th Gen Intel Xeon

Intel Xeon 6900 series with
Performance-core



Intel® Xeon® 6900 Processor

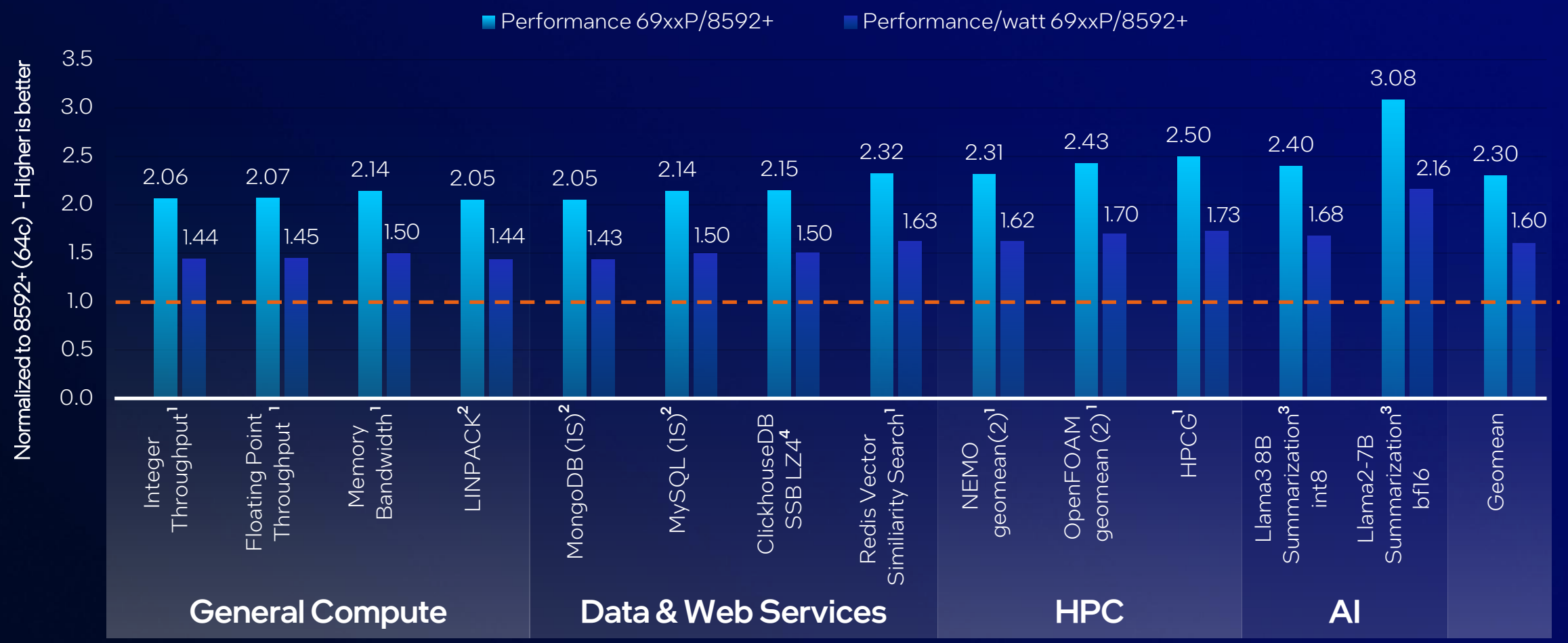
with Performance-cores (P-cores)

- Up to **6400 MT/s** DDR5
- **8800 MT/s** MRDIMM memory
- Up to **128** performance cores
- **6 UPI 2.0** links, up to **24 GT/s**
- Up to **96 lanes** PCIe 5.0/CXL® 2.0
- L3 cache as large as **504 MB**
- Intel Advanced Matrix Extensions (Intel AMX) with **FP16 support**

intel

Significant Gains Across Broad Workloads

Intel® Xeon® 6900 processor with P-cores vs. 5th Gen Intel® Xeon® processors



[1]128c, MRDIMM [2]128c, DDR5 [3]96c MRDIMM [4]96c, DDR5

intel

See [9G1, 9D2, 9W4, 9D3, 9H2, 9H11, 9H9, 9A2] at intel.com/processorclaims: Intel Xeon 6. Results may vary. Performance/Watt based on CPU TDP.
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Performance Leadership

Intel® Xeon® 6900P processors

Up to **5.5x** higher AI Inferencing performance vs. AMD EPYC

Up to **2.1x** higher HPC performance vs. AMD EPYC

See [9A3, 9H11] at intel.com/processorclaims: Intel Xeon 6. Results may vary.

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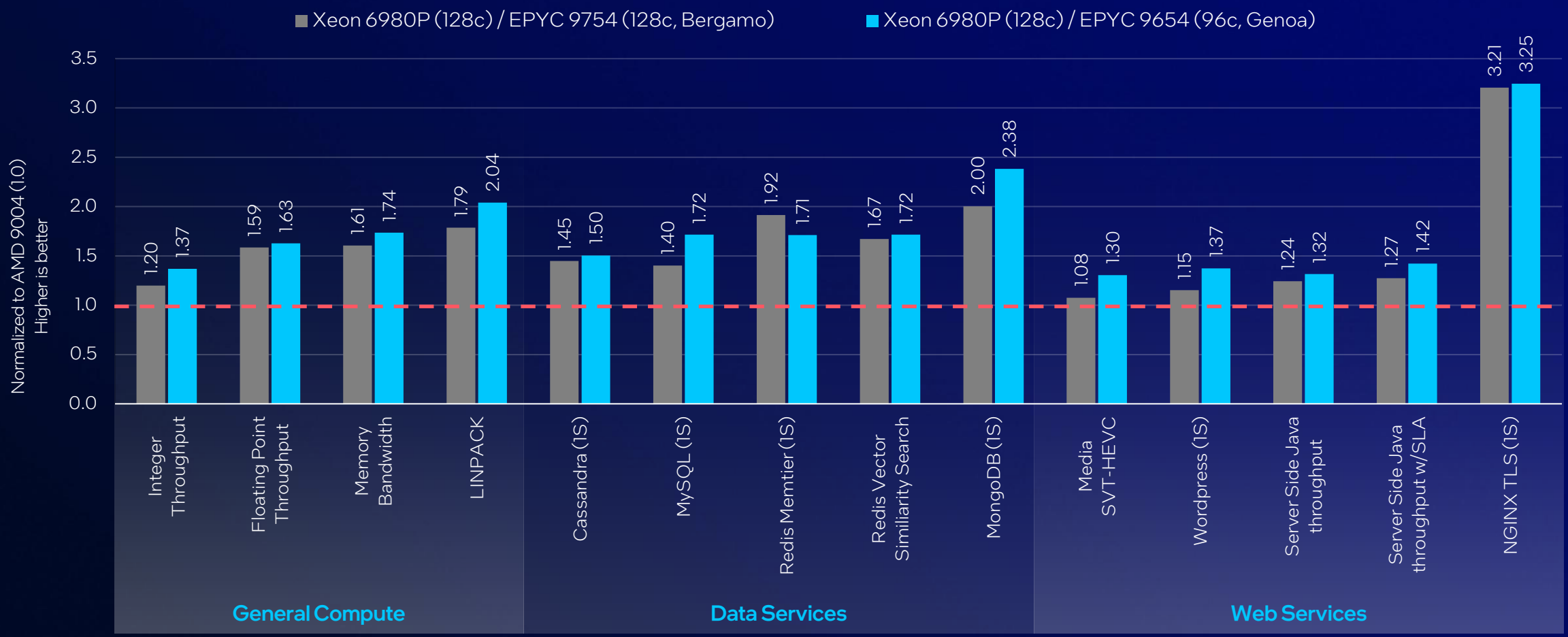
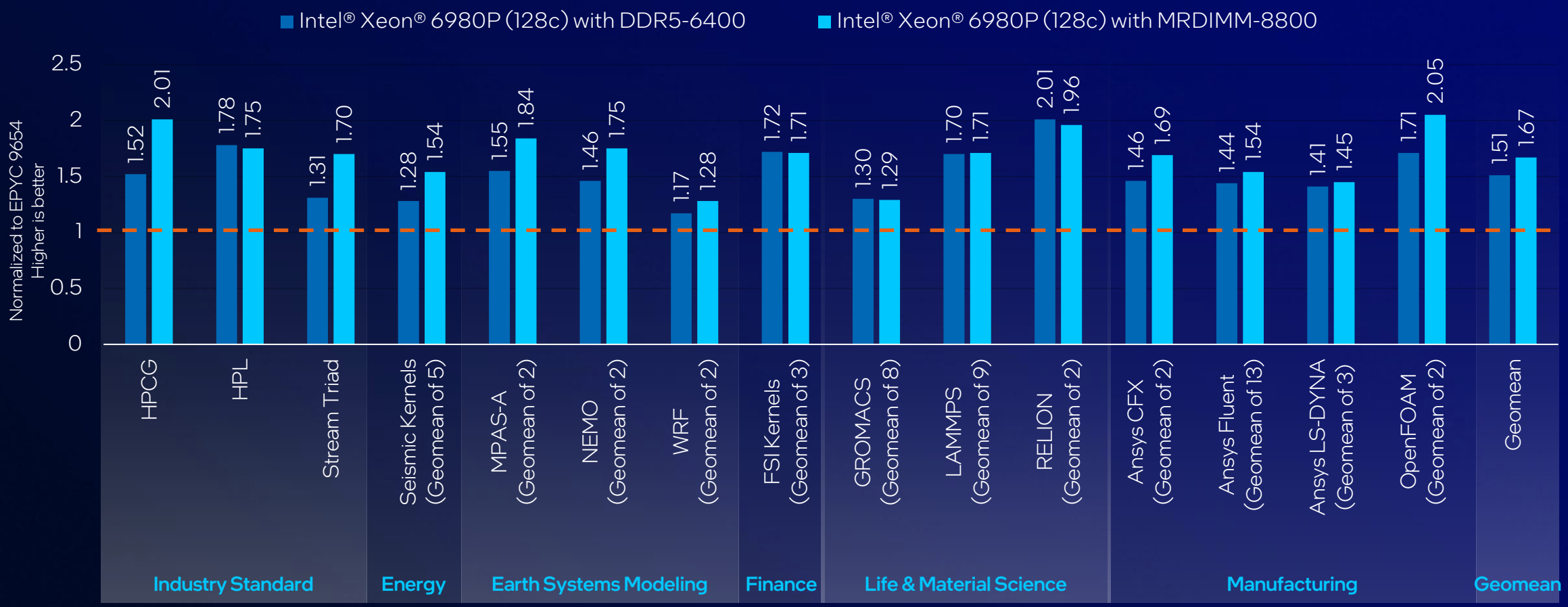
Performance Leadership Across Broad Workloads

Intel® Xeon® 6 processor with P-cores



Performance Leadership on HPC Workloads

Higher core counts, higher bandwidth memory



See [9H5, 9H6] at intel.com/processorclaims: Intel® Xeon® 6. Results may vary.

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Advantages of Intel® Xeon® 6 Processor in the Cloud

Reducing the cost of cloud computing



2x

cores per socket

vs. 5th Gen Intel Xeon CPUs

1.2x

higher average performance per core

vs. 5th Gen Intel Xeon CPUs

1.6x

higher average performance per watt

vs. 5th Gen Intel Xeon CPUs

30%

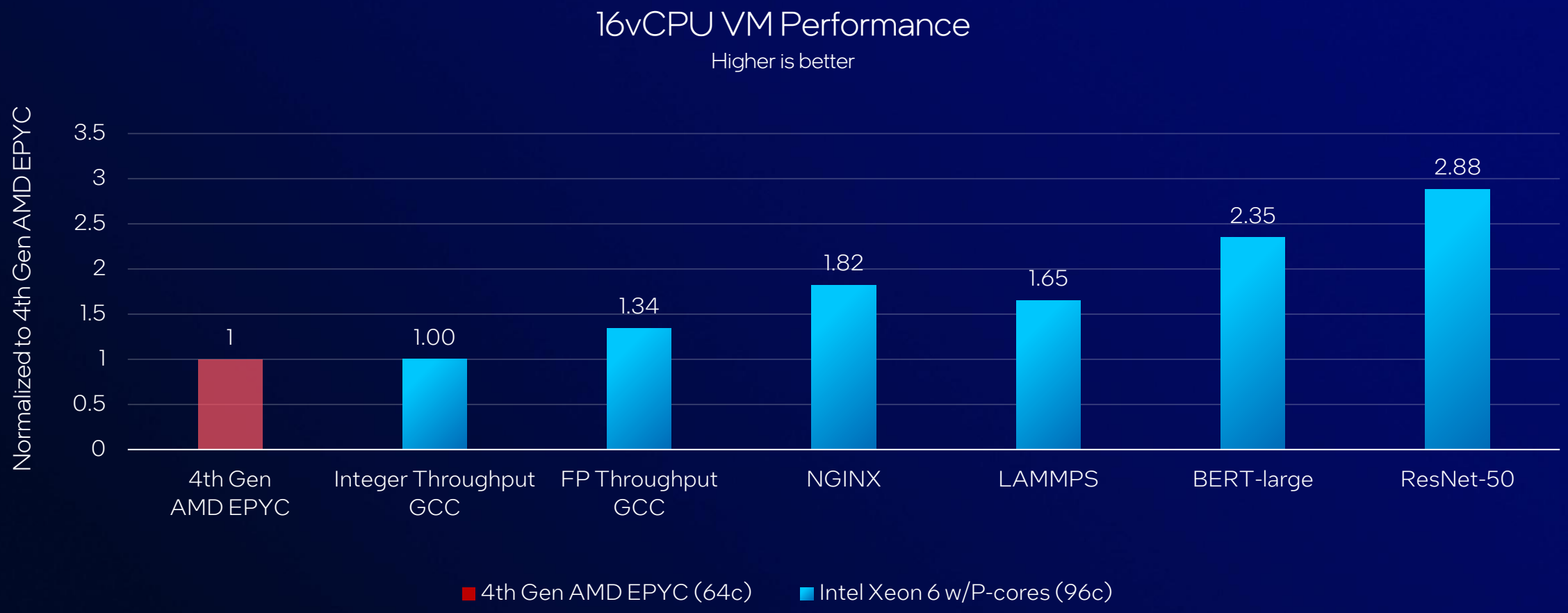
lower average TCO for similar perf-levels

vs. 5th Gen Intel Xeon CPUs

intel See backup for workload and configurations. Results may vary.

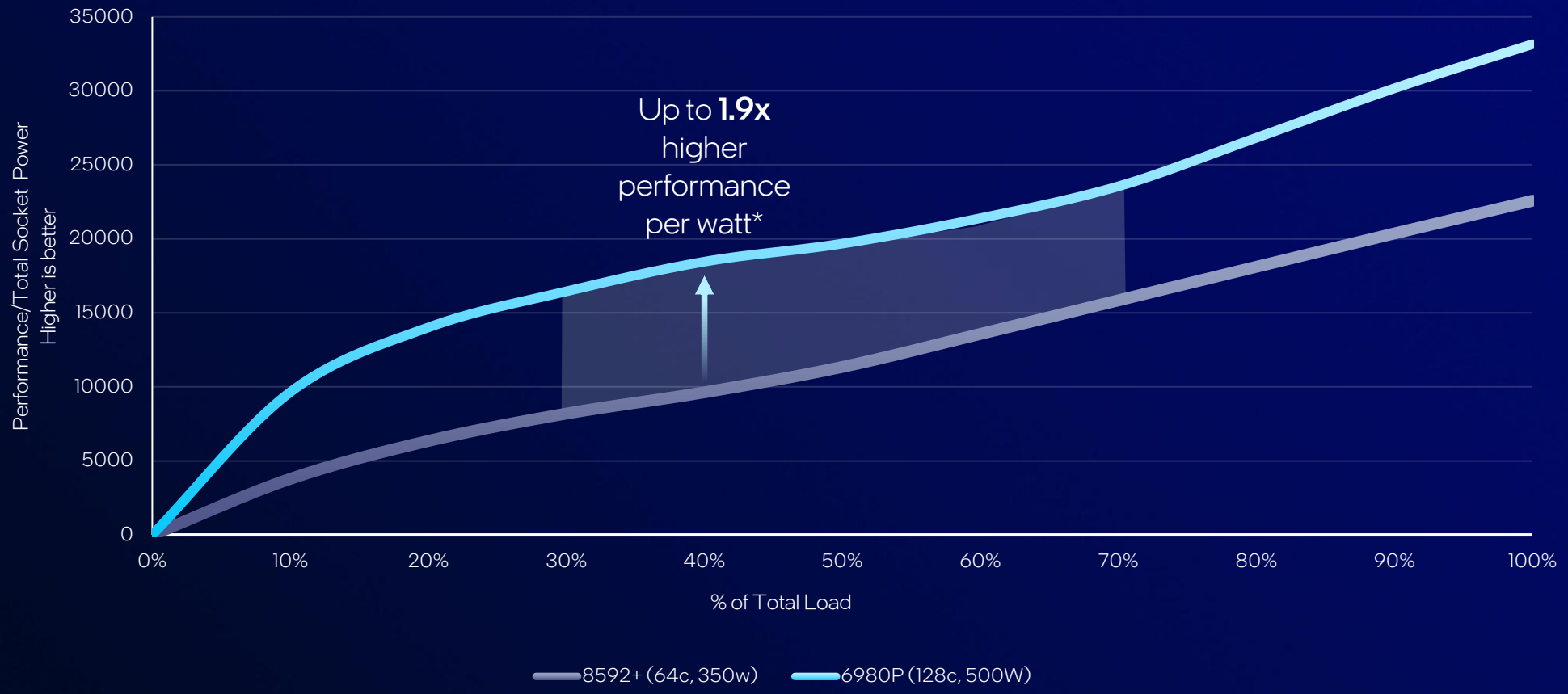
Leadership vCPU Performance

Intel® Xeon® 6 processor with P-cores vs AMD EPYC



Higher Performance Efficiency Across Server Utilization

Intel® Xeon® 6900P processors deliver significant advantages in performance per watt at typical 40% server utilization



*CPU socket power used

See [9G2] at intel.com/processorclaims: Intel Xeon 6. Results may vary.

Achieve Better TCO Without Compromising on Performance

Intel® Xeon® 6 processor with Performance-cores

Comparisons to deploying Intel Xeon 6972P processor-based servers vs. AMD EPYC 9654 servers	HPC (OpenFOAM)	Data Services (MongoDB)	Web (NGINX TLS – 1S)
Performance advantage (per server)	1.8x	2x	3x
Server consolidation	154 to 80 servers	228 to 110 servers	420 to 140 servers
Rack consolidation	11 to 10 racks	12 to 10 racks	21 to 10 racks
Lower fleet power (megawatt)	992MWh	1897MWh	8130MWh
Reduced CO2 emissions (metric tons)	421 metric tons	804 metric tons	3447 metric tons
TCO savings ($)	$2.3M	$4.2M	$11.8M
	29% Lower TCO	**38% Lower TCO**	**58% Lower TCO**

intel

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See [9T9, 9T8, 9T7] at intel.com/processorclaims: Intel Xeon 6. Results may vary.

Achieve Better TCO Without Compromising on Performance

Intel® Xeon® 6 processor with Performance-cores

Comparisons to deploying Intel Xeon 6972P processor-based servers vs. AMD EPYC 9654 servers	AI – Image Classification (ResNet50)	Gen AI (Llama2 7B Chatbot)
Performance advantage (per server)	4.9x	3.1x
Server consolidation	496 to 100 servers	252 to 80 servers
Rack consolidation	31 to 10 racks	18 to 10 racks
Lower fleet power (megawatt)	16717MWh	6997MWh
Reduced CO2 emissions (metric tons)	7087 metric tons	2967 metric tons
TCO savings ($)	$18.8M **74% Lower TCO**	$7.2M **57% Lower TCO**

intel See [9T10., 9T11] at intel.com/processorclaims: Intel Xeon 6. Results may vary.



Intel® Xeon® 6 Processor

1.9x

higher performance per watt at a typical 40% server utilization vs. prior generation

Designed for Efficiency

2.5x

higher HPC performance vs. prior generation

Significant Performance Leaps

5.5x

higher AI Inferencing performance vs. AMD EPYC

Unmatched Performance

See [9G2, 9H9, 9A3] at intel.com/processorclaims: Intel Xeon 6. Results may vary

Delivering Unmatched Performance

Introducing
Intel® Xeon® 6700/6500
Processors with
Performance-Cores (P-cores)



intel

Intel® Xeon® 6 Processors with P-cores

Unmatched Performance

Up to

50%

higher AI performance with 1/3 less cores

vs. AMD EPYC 9005

Broadest Range of Workloads

Up to

40%

average higher performance

vs 5th Gen Intel® Xeon® processors

Optimizing Data Centers

Up to

50%

lower TCO and better performance

vs. AMD EPYC 9005

See [7A220 (ResNet50), 7G20, 7T221 (Vision Transformer)] intel.com/processorclaims: Intel Xeon 6. Results may vary

INTRODUCING

Intel® Xeon® 6700P & 6500P Processors

The perfect balance of power, performance, & efficiency

Run the broadest range of enterprise workloads

meeting the compute and virtualization demands in today's challenging data centers

Optimize your data center

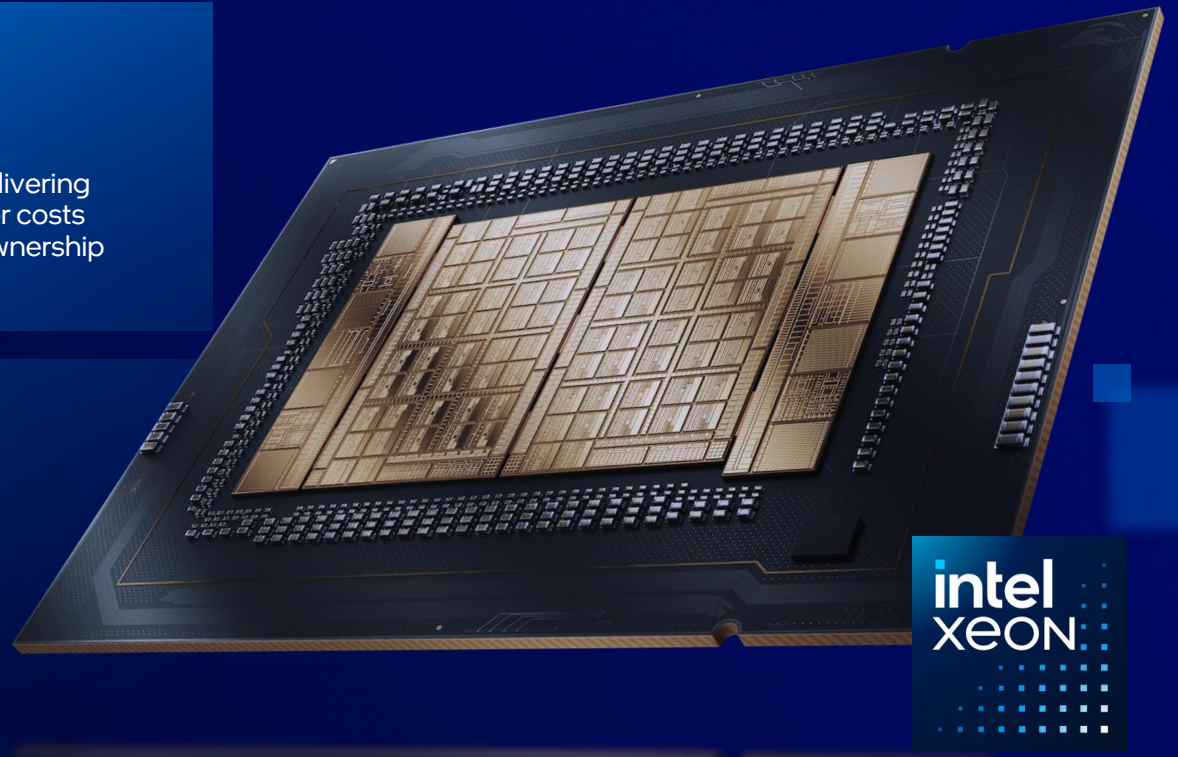
with server consolidation, delivering better efficiency, lower power costs and improved total cost of ownership

Scale AI everywhere

with the best CPU for AI inferencing and the most deployed host CPU for accelerated AI systems

Protect your data

hardware- based security, confidential computing, and trust services



intel

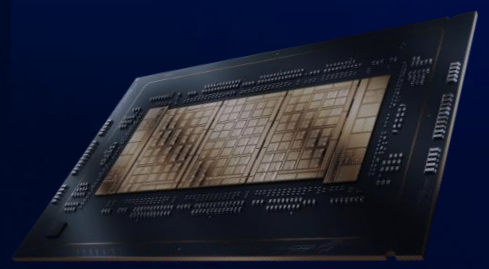
Intel® Xeon® 6 Processor Die Packages

UCC

Up to **128 P-cores**

Triple Compute Tile, Intel 3
Dual I/O Tile, Intel 7

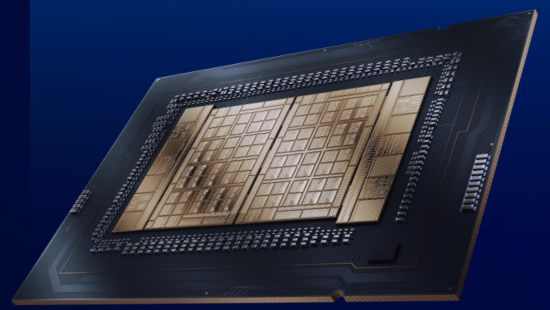
Launched Q4 '24



XCC

Up to **86 P-cores**

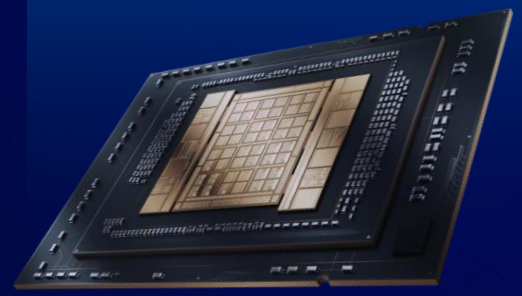
Dual Compute Tile
Dual I/O Tile



HCC

Up to **48 P-cores**

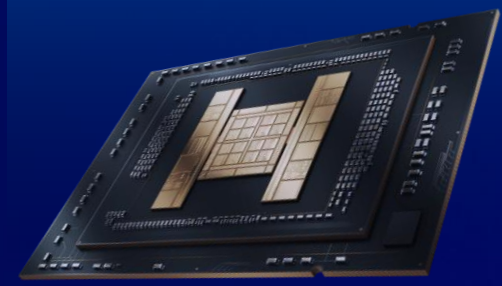
Single Compute Tile
Dual I/O Tile



LCC

Up to **16 P-cores**

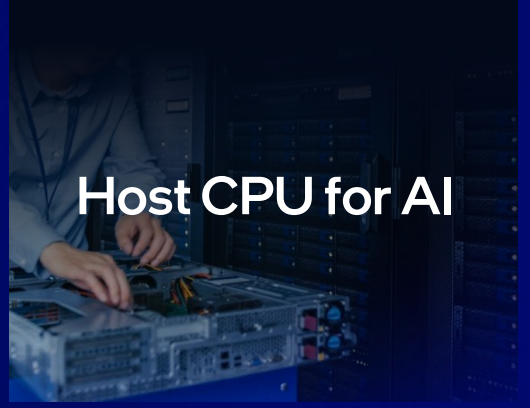
Single Compute Tile
Dual I/O Tile











Intel® Xeon® 6 | **1-socket platform with 136 PCIe lanes**

Delivers enhanced performance and lower TCO for today and tomorrow's data center demands

Increased PCIe lanes

Up to 136 lanes for greater lane volume for peripherals & devices

Improved I/O performance

Removal of power and latency penalties in a single socket



Enhanced performance and power efficiency

Greater core density, MRDIMMs and Intel® Accelerators

Cost optimization

Opportunity for server consolidation for improved total cost of ownership

Only x86 Solution Meeting the Market's Need for Scalability

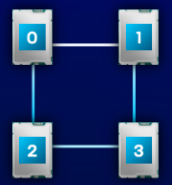
Intel® Xeon® 6 processor 4S/8S configurations provide more processing power, I/O bandwidth, and memory capacity

Generational Specs

	2nd Gen Intel Xeon	4th Gen Intel Xeon	Intel Xeon 6700 with P-cores
Max Cores / socket	28 cores	60 cores	86 cores
DDR Mem capacity / socket	Up to 3TB	Up to 4TB	Up to 4TB
Memory speed	Up to 2933 MT/s (DDR4)	Up to 4800 MT/s (DDR5)	Up to 8000 MT/s (DDR5)

Topology Support

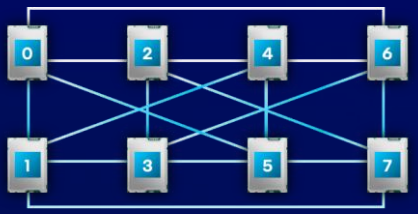
4 socket
Ring (2 UPI)



4 socket
Fully connected (3 UPI)

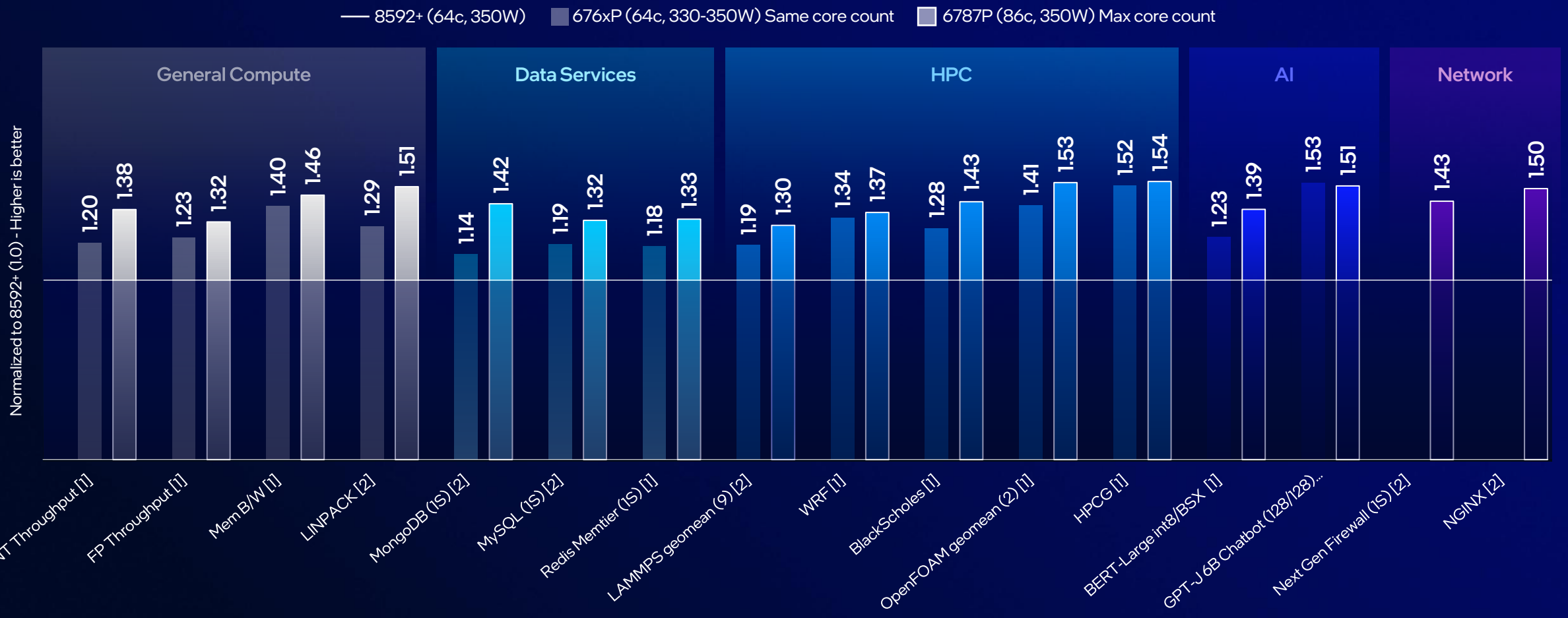


8 socket
Optimized (4 UPI)



Delivering Significant Gains Across Broad Workloads

All within similar or lower power envelope



[1] MRDIMM [2] DDR. See [7G20, 7D21-7D23, 7H21-7H25, 7A21, 7A28, 7N20, 7N25] intel.com/processorclaims: Intel Xeon 6. Results may vary.
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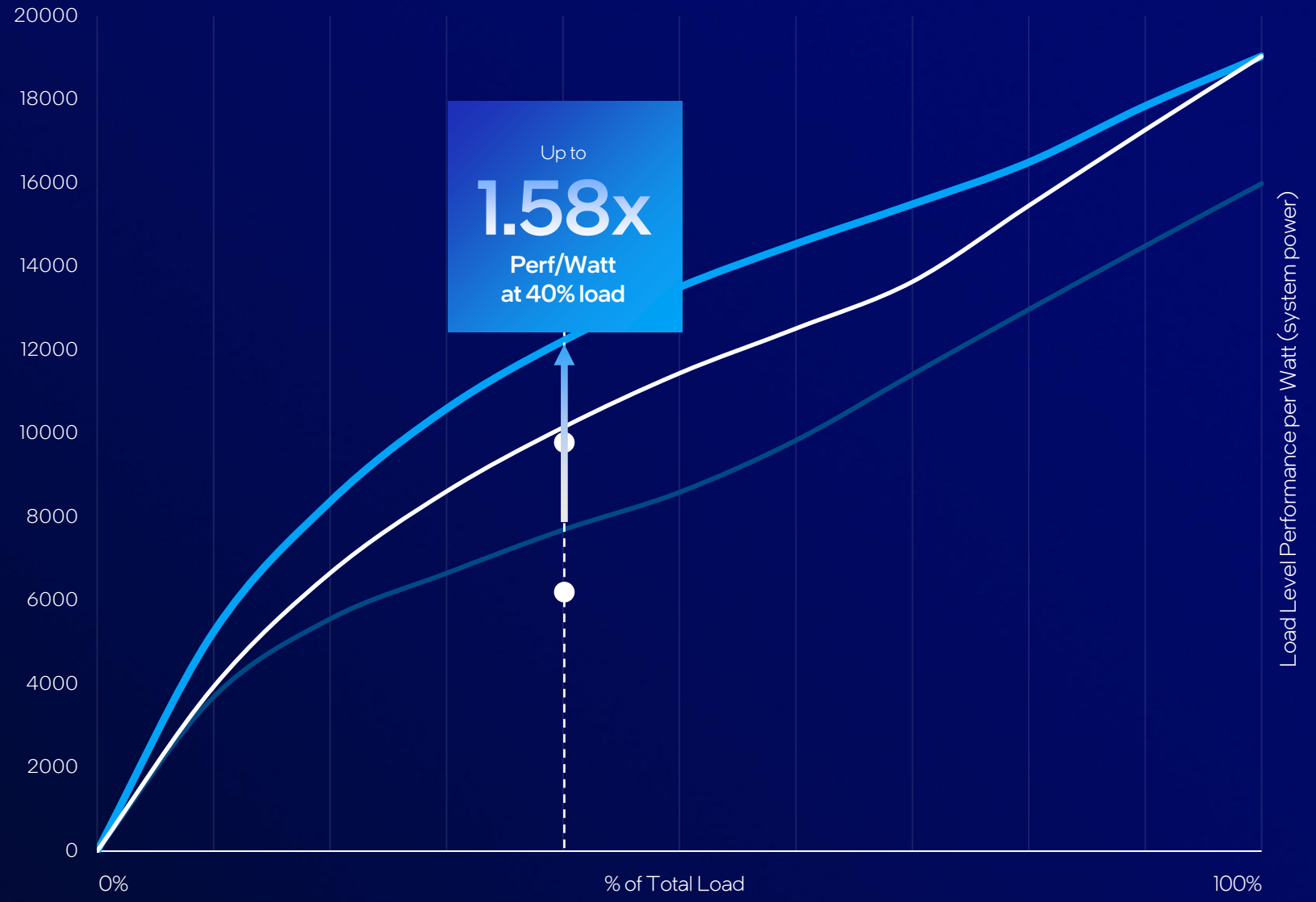
Higher Performance Efficiency Across Server Utilization

Intel® Xeon® 6 processor with P-cores delivers significant advantages in performance per watt at typical 40% server utilization



- Intel Xeon 8592+
- Intel Xeon 6760P Latency Optimized Mode
- Intel Xeon 6760P Out Of Box (OPM)

intel

See [7T20] intel.com/processorclaims: Intel Xeon 6. Results may vary

Optimizing Today's Data Centers

Broad benefits for modernizing infrastructure

Improved Performance

Energy Efficiency

Modern Workloads

Sustainability Goals



Increased Reliability and Uptime

Cost Savings

Breadth of Compute Choice

Enhanced Security

intel

Refresh Aging Infrastructure to Save Space and Cost

Replace 2nd Gen Intel® Xeon® processor-based servers with Intel Xeon 6 processor-based servers

HPC
HPCG

4:1 Consolidation



75% fewer servers
54% less power

Data Services
MongoDB (1S)

5:1 Consolidation



81% fewer servers
73% less power

Image Classification
ResNet 50

10:1 Consolidation



90% fewer servers
80% less power

Web Services
NGINX TLS (1S)

10:1 Consolidation



90% fewer servers
83% less power

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*Estimated over 4 years. See [7T21, 7T22 , 7T25 ,7T26] intel.com/processorclaims: Intel Xeon 6. Results may vary.

Refresh Aging Infrastructure to Save Space and Cost

Refresh and consolidate 2nd Gen Intel Xeon servers with Intel Xeon 6700P servers

Data Services MySQL (1S)	**Data Services** MongoDB (1S)	**HPC** HPCG[1]	**Web Services** Server Side Java	**Web Services** NGINX TLS (1S)	**AI – Image Classification** ResNet 50	
4.29x	**5.42x**	**3.95x**	**4.09x**	**9.7x**	**9.9x**	Performance Advantage per server
780 to 180 servers	**1080 to 200** servers	**480 to 120** servers	**420 to 100** servers	**1940 to 200** servers	**1000 to 100** servers	Less servers
14735 MWh	**23036** MWh	**9889** MWh	**7551** MWh	**35107** MWh	**30044** MWh	Fleet Energy Saved*
6247 metric tons	**9766** metric tons	**4193** metric tons	**3202** metric tons	**14883** metric tons	**12737** metric tons	Reduced CO2 Emissions*
$3.3M	**$6.7M**	**$1.6M**	**$1.6M**	**$17.2M**	**$10.4M**	TCO Savings*
29% savings	**44%** savings	**22%** savings	**26%** savings	**67%** savings	**68%** savings	TCO % Savings*

5:1 average server consolidation and a nearly 40% average TCO savings

1- MRDIMM. Others DDR.
*Estimated over 4 years. See [7T21- 7T26] intel.com/processorclaims: Intel Xeon 6. Results may vary

Intel® Xeon® 6 Processor Delivers Performance Advantage

Across diverse data center workloads

Intel Xeon 6900P vs AMD EPYC 9005



Performance comparison at ~similar core counts.
See [9D220 - 9D222, 9W220, 9H221 - 9H224, 9A221 - 9A224] intel.com/processorclaims: Intel Xeon 6. Results may vary

Save Power and Money on New Server Purchases

Performance advantage and TCO savings vs AMD EPYC 9005 servers

Intel Xeon 6900P Processor-based Servers

Recommendation System
DLRM

1.87x Perf / Server



Computational Fluid Dynamics
OpenFOAM

1.43x Perf / Server



Intel Xeon 6700P Processor-based Servers

Web Services
NGINX TLS (1S) on 6760P

1.55x Perf / Server



Image Construction
Vision Transformer on 6760P

2.09x Perf / Server



*Estimated over 4 years. See [9T223, 9T222, 7T223, 7T221] intel.com/processorclaims: Intel Xeon 6. Results may vary.
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Save Power and Money on New Server Purchases

Performance advantage and TCO savings vs AMD EPYC 9005 servers

AI Recommendation System DLRM[1]	HPC CFD OpenFOAM[1]		AI Vision Transformer[1]	Web Services NGINX TLS (1S)
1.87x	**1.43x**	**Performance Advantage** per server	**2.09x**	**1.55x**
170 to 90 servers	**126 to 90** servers	Less servers	**289 to 140** servers	**320 to 200** servers
5497 MWh	**2623** MWh	Fleet Energy Saved*	**5788** MWh	**5258** MWh
2330 metric tons	**1112** metric tons	Reduced CO2 Emissions*	**2454** metric tons	**2229** metric tons
$4.0M	**$1.9M**	TCO Savings*	**$6.3M**	**$5.4M**
46% savings	**28%** savings	**TCO % Savings***	**52%** savings	**41%** savings

1- MRDIMM, Others DDR. *Estimated over 4 years. See [9T223, 9T222, 7T223, 7T221] intel.com/processorclaims: Intel Xeon 6. Results may vary.
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The processor designed for cloud-scale efficiency

Intel® Xeon® 6700 Processors with Efficient-Cores

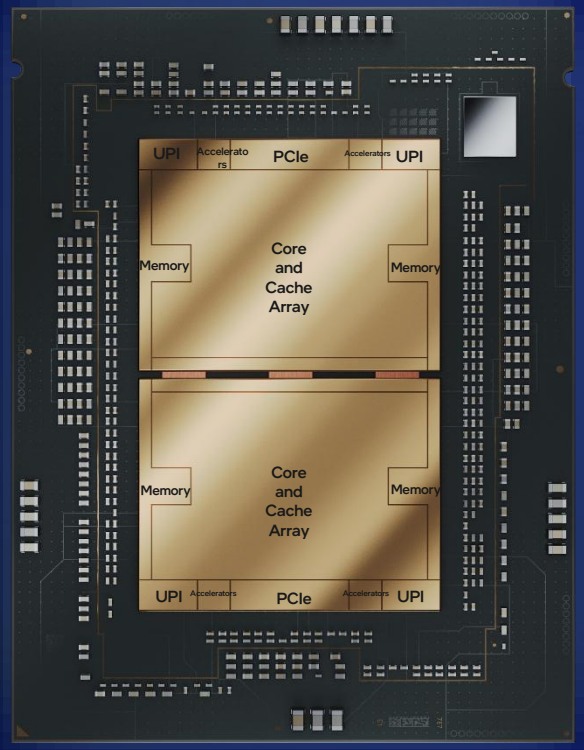
(E-cores)



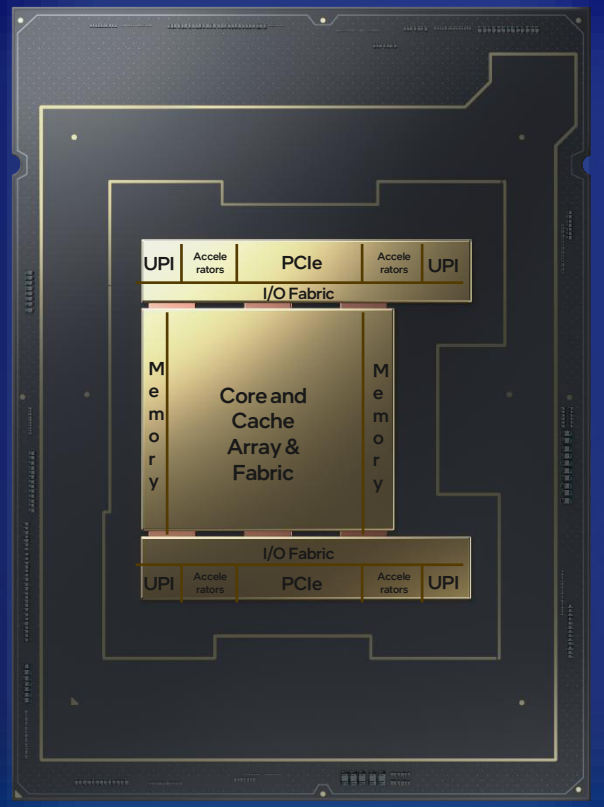
intel

The Architectural Evolution

Intel® Xeon® 6 processor die package advancements



5th Gen Intel Xeon
(Two-Tile Architecture)



Intel Xeon 6700 series with E-cores

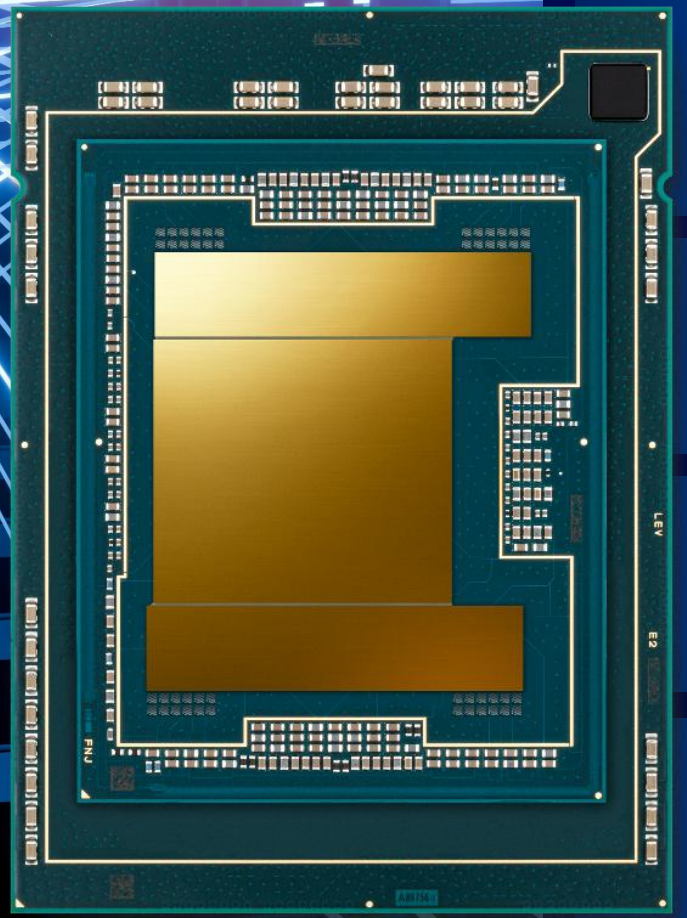
Intel® Xeon® 6 Processors

	Intel Xeon 6700 /6500 Series Processors with P- cores		Intel Xeon 6900 Series Processors with P- cores		Intel Xeon 6 Processors with E-cores
Cores	up to **86 cores**		up to **128 cores**		up to **144 cores** (6700E series) | **288 cores** (6900E series)
Sockets	1S, 2S, **4S, 8S**		1S, 2S		1S, 2S
Max TDP	150 to 350W		400 to 500W		205 to 500W
Memory	up to **8 channels** DDR5 | MRDIMM		up to **12 channels** DDR5 | MRDIMM		up to **12 channels** DDR5
Max Memory Speed	8000 (1 DPC) DDR5 | 6000 (2 DPC) DDR5 | 8000 MRDIMM (1 DPC)		6400 (1 DPC) DDR5 | 8800 MRDIMM (1 DPC)		6400 (1 DPC) DDR5 | 5200 (2 DPC) DDR5 (6700E) 6400 (1DPC) DDR5 (6900E)
Intel® UPI	up to **4 UPI 2.0** at up to 24 GT/s per lane		up to **6 UPI 2.0** at up to 24 GT/s per lane		up to **6 UPI 2.0** at up to 24 GT/s per lane
PCI Express 5.0	up to **88 lanes** up to **136 lanes** for single socket designs		up to **96 lanes**		up to **96 lanes**
Compute Express Link	up to **64 lanes CXL 2.0**		up to **64 lanes CXL 2.0**		up to **64 lanes CXL 2.0**
AI Acceleration Intel® Deep Learning Boost	**Intel AMX** (INT8, BF16, FP16)	**Intel AVX 512** (VNNI/INT8)	**Intel AMX** (INT8, BF16, FP16)	**Intel AVX 512** (VNNI/INT8)	**Intel AVX 2** (VNNI/INT8)
Security	Intel Software Guard Extensions, Intel Trust Domain Extensions				
Crypto	Vector AES, SHA2-256 extensions, VPMADD52				
Integrated Accelerators	Intel QuickAssist Technology, Intel Dynamic Load Balancer, Intel Data Streaming Accelerator, Intel In-memory Analytics Accelerator				

Optimize and Scale

Your Infrastructure with Cloud-Native Agility

Intel® Xeon® 6 processors with Efficient-cores (E-cores)



Delivers distinct advantages for cloud-scale workloads

Data services, networking, media, and microservices

Unmatched core density for scale-out capacity

Up to **144** Cores per socket

Highest task parallel performance per watt

Up to **3x** Higher performance per watt as compared to 2nd Gen Intel® Xeon® processor[1]

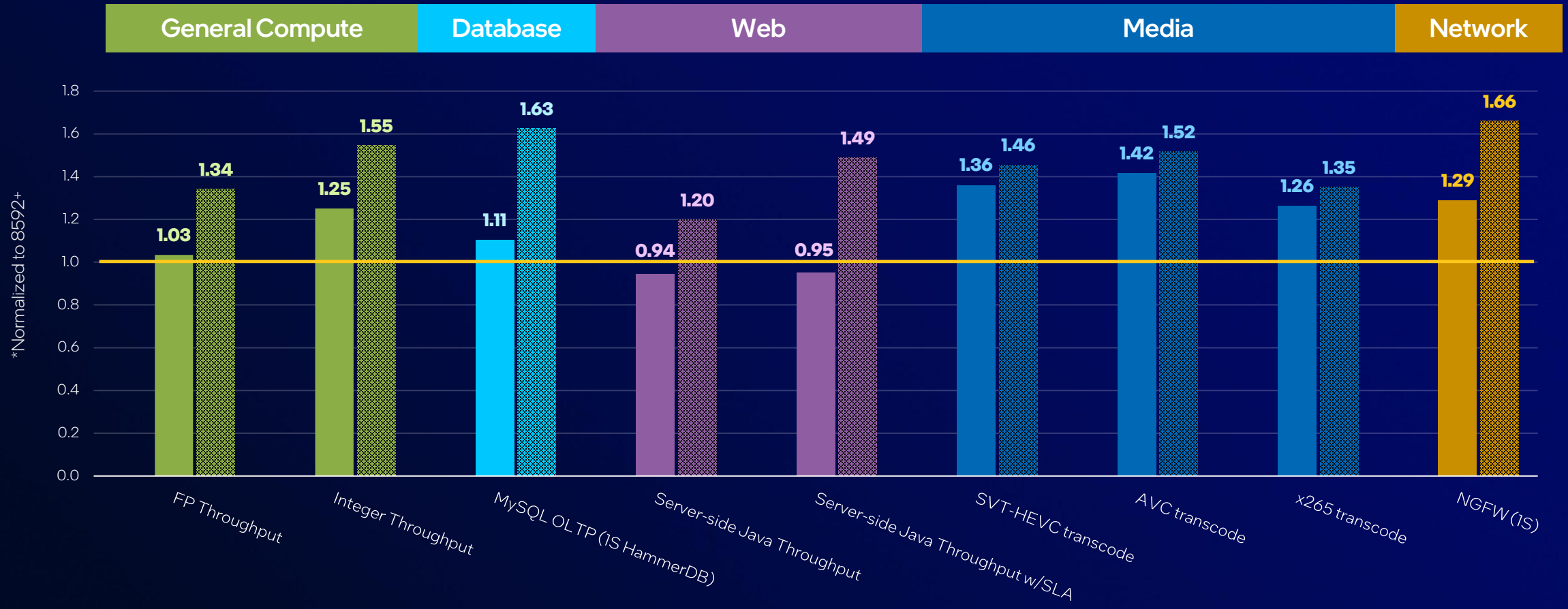
Increase rack utilization for better efficiency and total cost of ownership

3:1 Consolidate servers using 2nd Gen Intel Xeon processors to Intel Xeon 6 with E-cores[1]

1. See [7N5, 7T1] at intel.com/processorclaims: Intel® Xeon® 6. Results may vary.

Gen-over-Gen Gains Across Broad Workloads

Intel® Xeon® 6700 Series processors with E-cores vs. 5th Gen Intel® Xeon® processors



Performance

Performance/Watt

2S Intel® Xeon® 6780E with E-cores (144 cores) vs. 2S 5th Gen Intel® Xeon® Platinum 8592+ (64 cores)

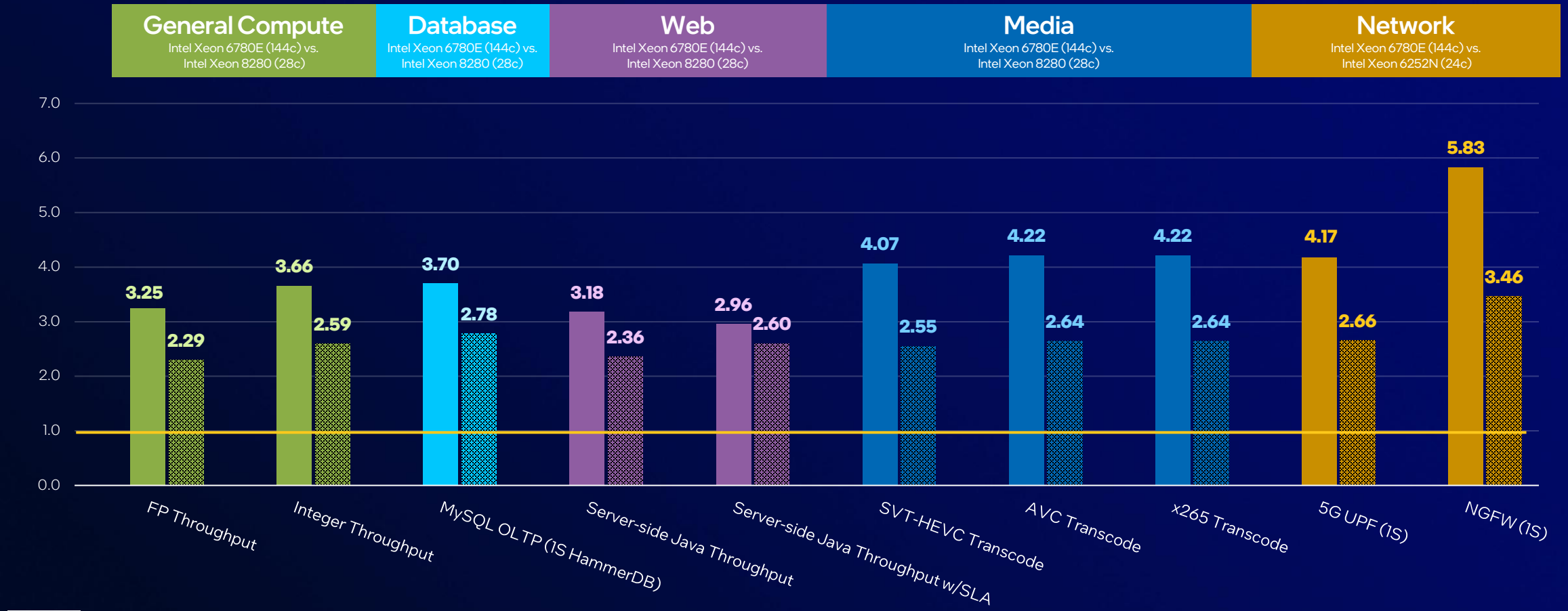
*Normalized to 5th Gen Intel Xeon-SP (Higher is better)

Socket power is power consumed by CPUs

See [7G2, 7D2, 7W5, 7W2 and backup] at intel.com/processorclaims : Intel® Xeon® 6. Results may vary.

Broad Workload Performance and Performance/Watt Gains

Intel® Xeon® 6700 Series processors with E-cores vs. 2nd Gen Intel® Xeon® processors



Intel® Xeon® 6 with E-core performance & efficiency vs. 2nd Gen Intel® Xeon® processors

Normalized to 2nd Gen Intel Xeon Scalable Processor (Higher is better)

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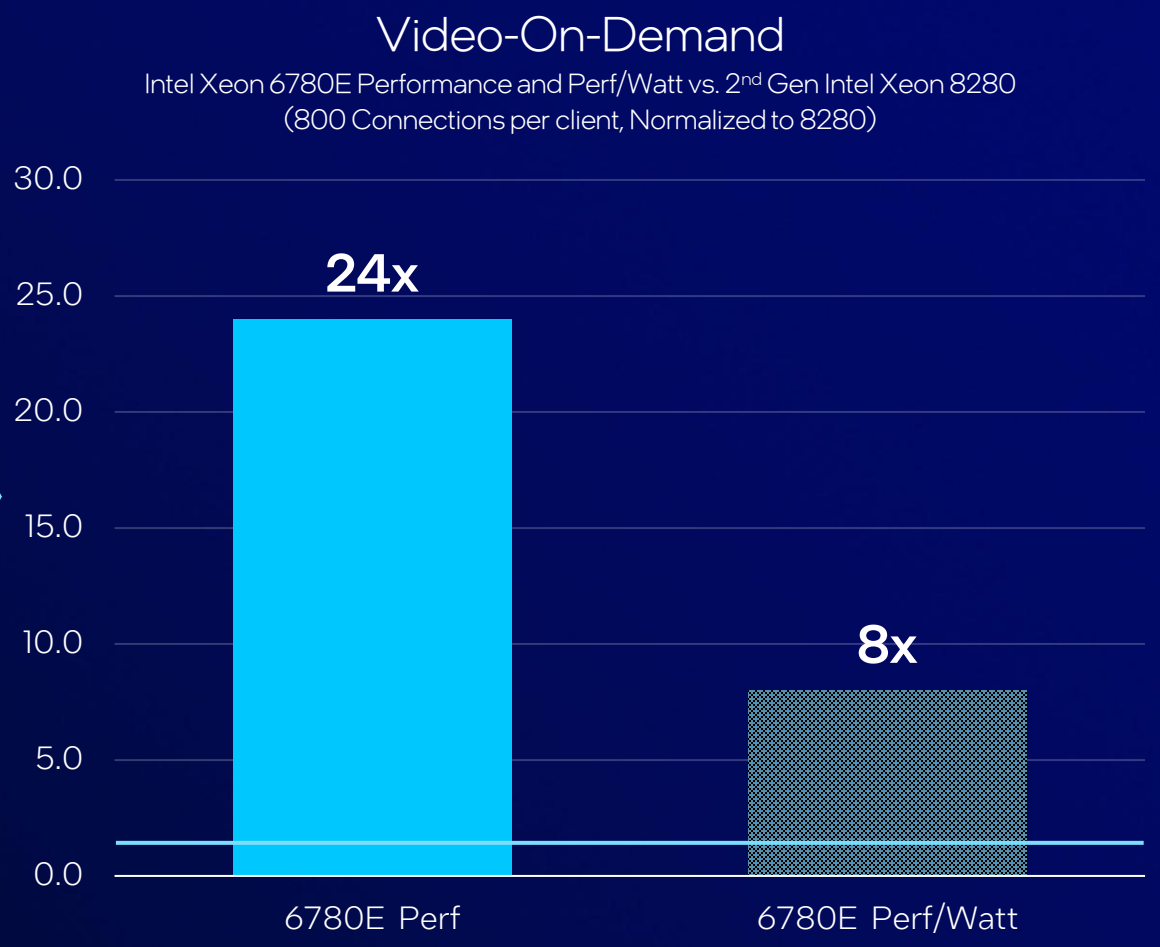
See [7G1, 7D1, 7W4, 7N1, 7N2] at intel.com/processorclaims: Intel® Xeon® 6. Results may vary

Intel® Xeon® 6 Platform Enhancements

Driving top performance and perf/watt gains for CDN Video-on-Demand

	Intel® Xeon® 6780E vs. 2nd Gen Intel® Xeon® 8280
CPU	2.5x more threads Less power per thread
Memory	1.3x more mem channels 2.2x increase in DRAM speed Up to 2x Mem bandwidth*
PCIe	4x PCIe Lanes 4x PCIe transfer rate per lane Lower PCIe controller latency
Network/ Storage	4x NVMe drives 4x Ethernet connection speeds



*STREAM Triad workload
See [7N5] at intel.com/processorclaims: Intel® Xeon® 6. Results may vary.

Intel® Xeon® 6 Platform Enhancements

Driving top performance and perf/watt gains for CDN Video-on-Demand

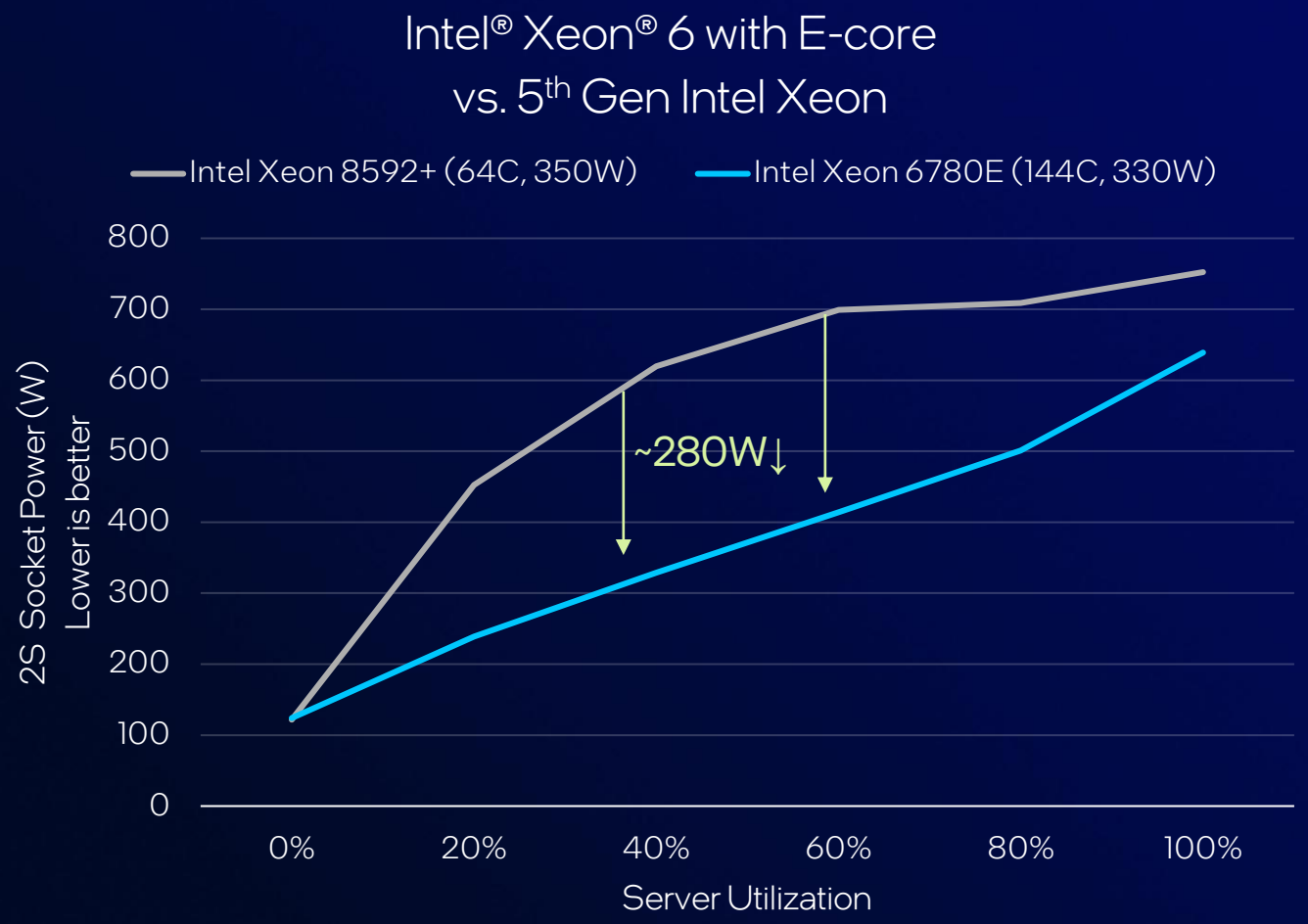
Technology	2nd Gen Intel® Xeon® 8280	Intel® Xeon® 6780E	Refresh
Processor cores (threads)	28 cores (56 threads)	144 cores (144 threads)	2.5x more threads
Processor TDP (W/thread)	205W (3.66W/thread)	330W (2.29W/thread)	Less power per thread
Memory channels per socket	6 channels	8 channels	1.3x more
DRAM technology	DDR4 @ 2933 MT/s	DDR5 @ 6400 MT/s	2.2x increase
Memory bandwidth*	217GB/s	460GB/s	Up to 2x the memory bandwidth
PCIe lanes (NVMe drives)	8 (PCIe Gen3)	32 (PCIe Gen5)	4x increase
PCIe transfer rate per lane	Gen3 = 8GT/s	Gen5 = 32GT/s	4x increase
PCIe controller (NVMe drives)	PCIe switch	Direct attach (or integrated I/O die)	Lower latency
NVMe drives	2 drives	8 drives	4x more
Ethernet connection speeds	2x 100GbE	4x 200GbE	4x increase

intel

*STREAM Triad workload

Lower Power Across Server Utilization

Intel® Xeon® 6 processor with E-cores delivers improved energy efficiency across the load line

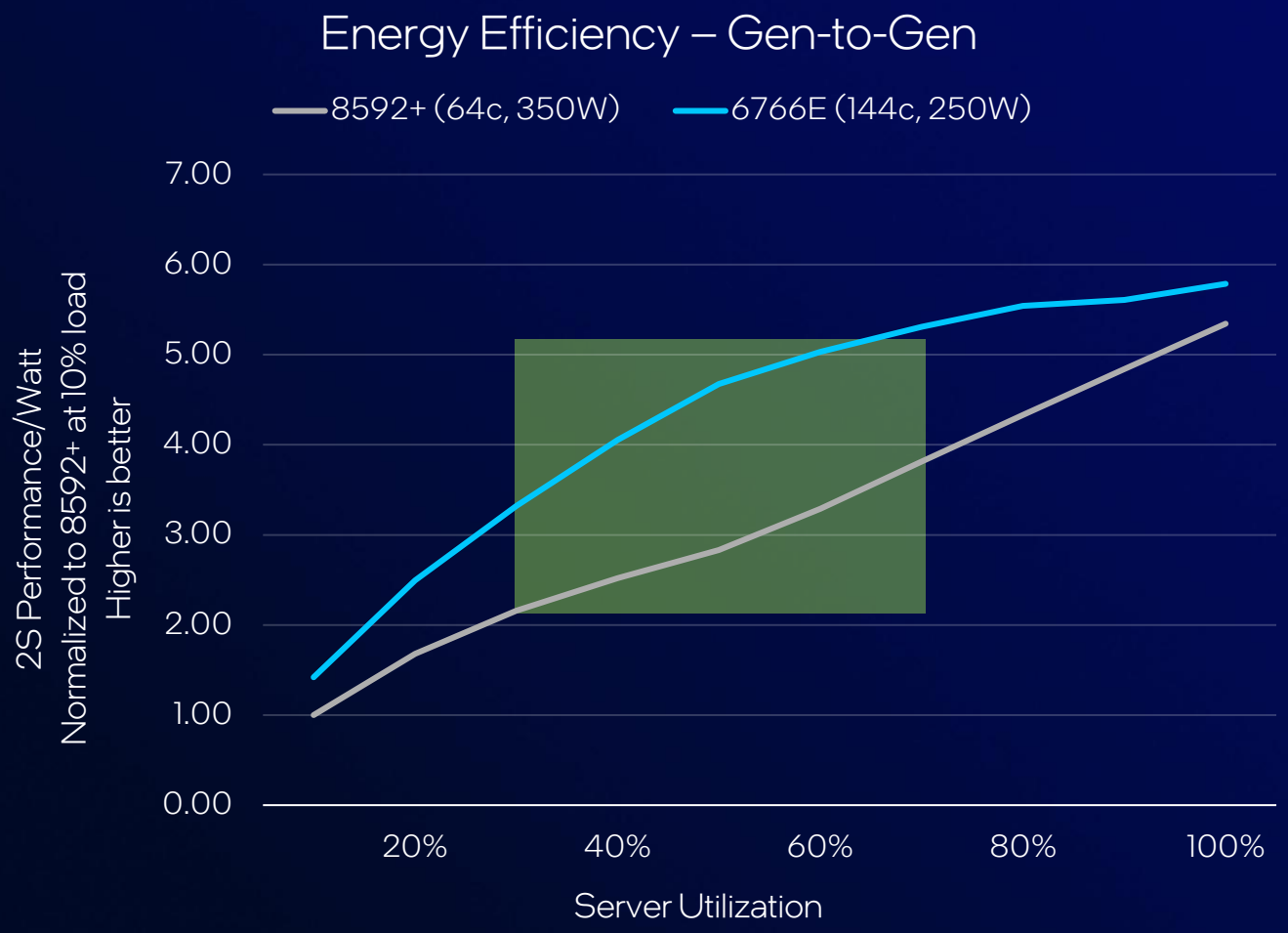


- Power increases linearly with load on Intel Xeon 6 with E-cores
- Save up to 280W power when operating at sweet spot 40-60% server utilization
- 18% improved performance on Intel Xeon 6780E vs. Intel Xeon Platinum 8592+
- Lower power and cooling costs in your datacenter with default out-of-box settings

*Out-of-Box mode: Assumes default energy-efficient BIOS and OS settings.
Socket power is power consumed by CPUs
See [7T3] at intel.com/processorclaims: Intel® Xeon® 6. Results may vary

Higher Performance Efficiency Across Different Loads

Intel® Xeon® 6 processor with Efficient-cores lowers customer power and cooling costs



Intel Xeon 6 with Efficient-cores delivers improved energy efficiency out of the box* when compared to Intel Xeon 8592+ across different loads

~60 percent average performance/watt gain between **40-60 percent load** comparing Intel Xeon 6766E vs. Intel Xeon 8592+

*Out-of-Box mode: Assumes default energy-efficient BIOS and OS settings.
Socket power is power consumed by CPUs.
See [7T4] at intel.com/processorclaims: Intel® Xeon® 6. Results may vary.

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Refresh Aging Servers for Significant Rack Level Benefits

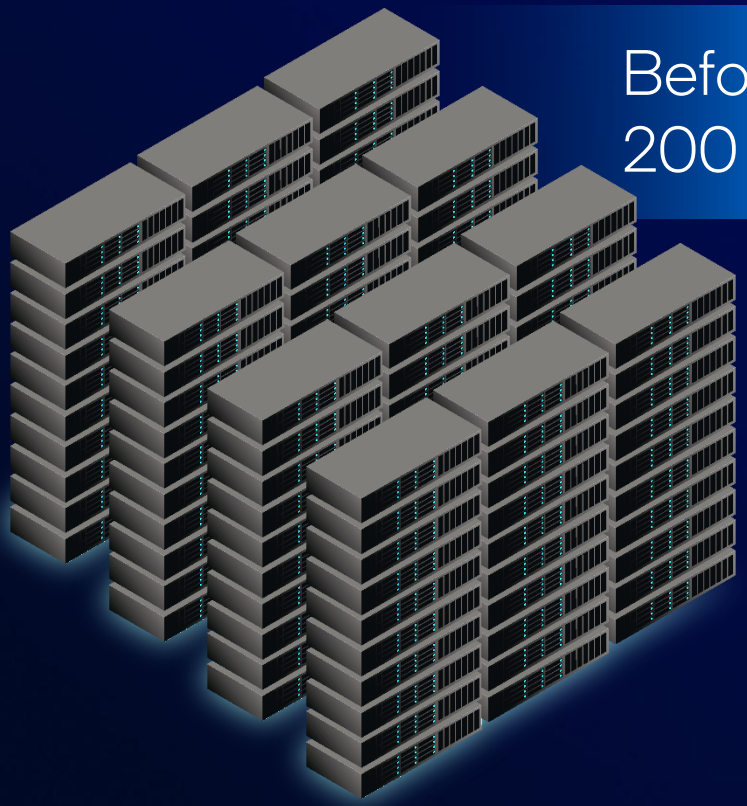
Intel® Xeon® 6 processor significantly reduces data center infrastructure space, power, and costs

Comparison of 1 - 15KW rack with Equivalent Performance on Intel® Xeon® 6700E series vs. 3 racks of 2nd Gen Intel® Xeon®-based servers	**Integer Throughput** Intel Xeon 8280 vs. Intel Xeon 6780E	**Media Transcode (AVC)** Intel Xeon 8280 vs. Intel Xeon 6780E
Intel Xeon 6 performance gain per server	**3.6x**	**4.2x**
Intel Xeon 6 performance/watt gain per server	**2.7x**	**2.6x**
Rack consolidation	3:1	3:1
4-year fleet energy saved per consolidated rack	1,540 MWh	1,195 MWh
4-year CO2 emissions reduced per consolidated rack	650 tons	500 tons

See [7T1,7T2] at intel.com/processorclaims: Intel® Xeon® 6. Results may vary

Today's AI Data Center

Process the same media streams/second in less space and at lower power to enable new AI projects



Before
200 Racks

2nd Gen
Intel® Xeon® Processor

3:1

Rack Consolidation[1]

Over 4 years

80k MWh[1]

Fleet energy saved

34k mt[1]

Reduced CO2 emissions



Now
66 Racks

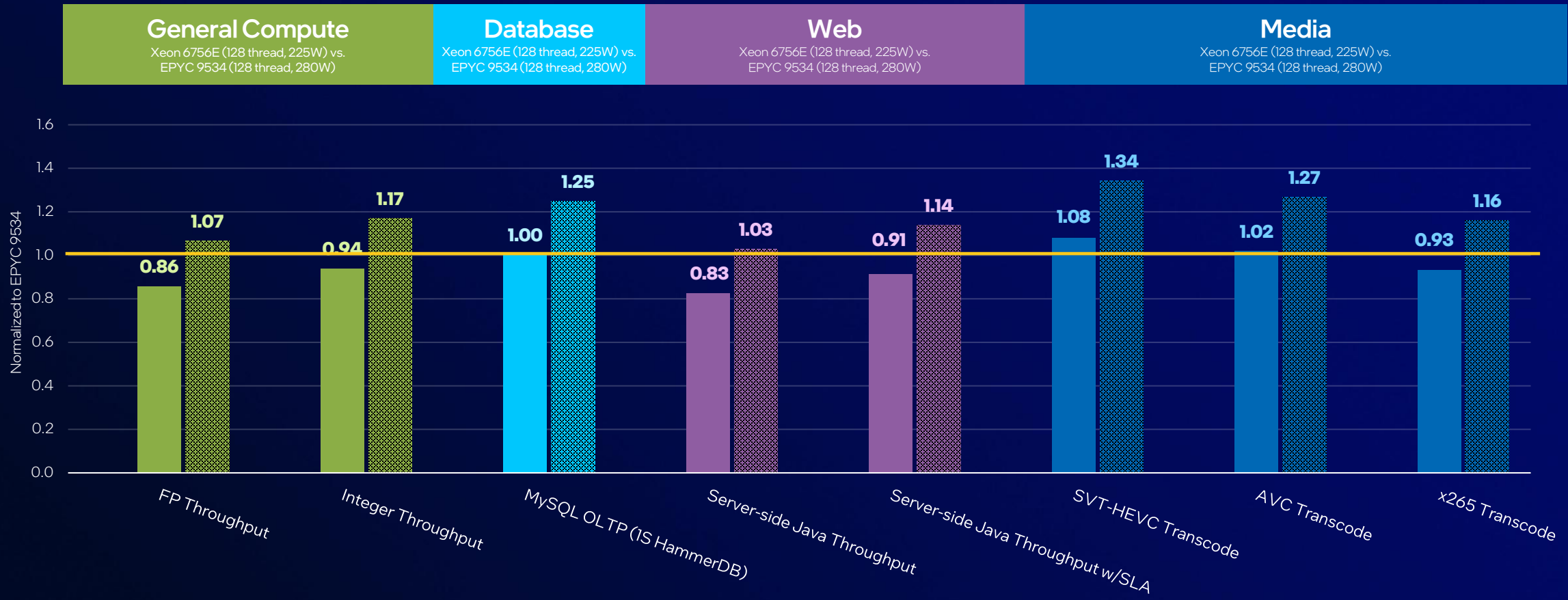
Intel® Xeon® 6700E
processor

intel

1. See [7T2] at intel.com/processorclaims: Intel® Xeon® 6. Results may vary.

Leading Efficiency At Similar Thread Performance vs Competition

Intel® Xeon® 6 processor with E-cores vs. 4th Gen AMD EPYC at 128 threads



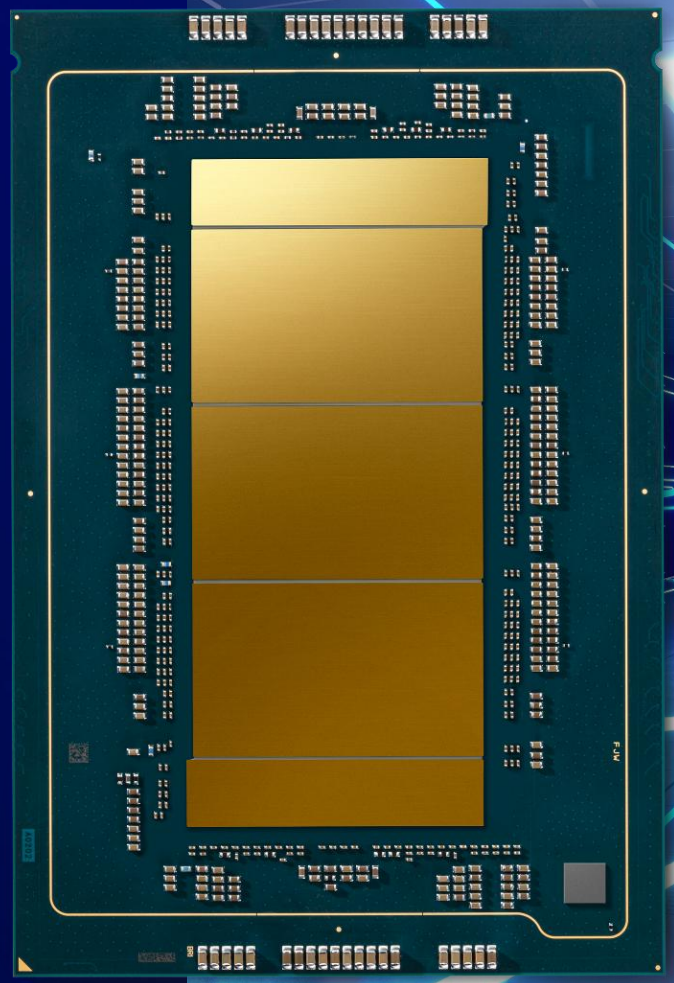
Intel Xeon 6756E vs. 4th Gen AMD EPYC 9534

Normalized to 4th Gen AMD EPYC 9534 (Higher is better)

Power = cpu TDP.

1. See [7T2] at intel.com/processorclaims: Intel® Xeon® 6. Results may vary.

Intel® Xeon® 6300 for Entry Server Series Processors



intel

Introducing Intel® Xeon® 6300 for Entry Server Series Processors

8 new processors for single-socket servers featuring 8, 6 or 4 CPU cores



1.57x average performance gain with Xeon 6369P over Xeon E-2388[1]

Enhanced Performance

- Up to a 1.3x performance improvement over the prior generation[1]
- Frequencies up to 5.7GHz with Intel® Turbo Boost Max Technology 3.0
- Up to 128GB DDR5 memory with speeds up to 4800 MT/s and ECC support

Greater Expandability

- Up to 16 lanes of PCIe 5.0 from CPU
- Up to 24 lanes of PCIe 4.0 from CPU and PCH
- Up to 15 total USB 3.2 ports

Modern Manageability and Security

- Intel® Server Platform Services (Intel® SPS) 6 firmware with Intel® Node Manager support

Essential performance, expandability, and reliability for entry-level servers

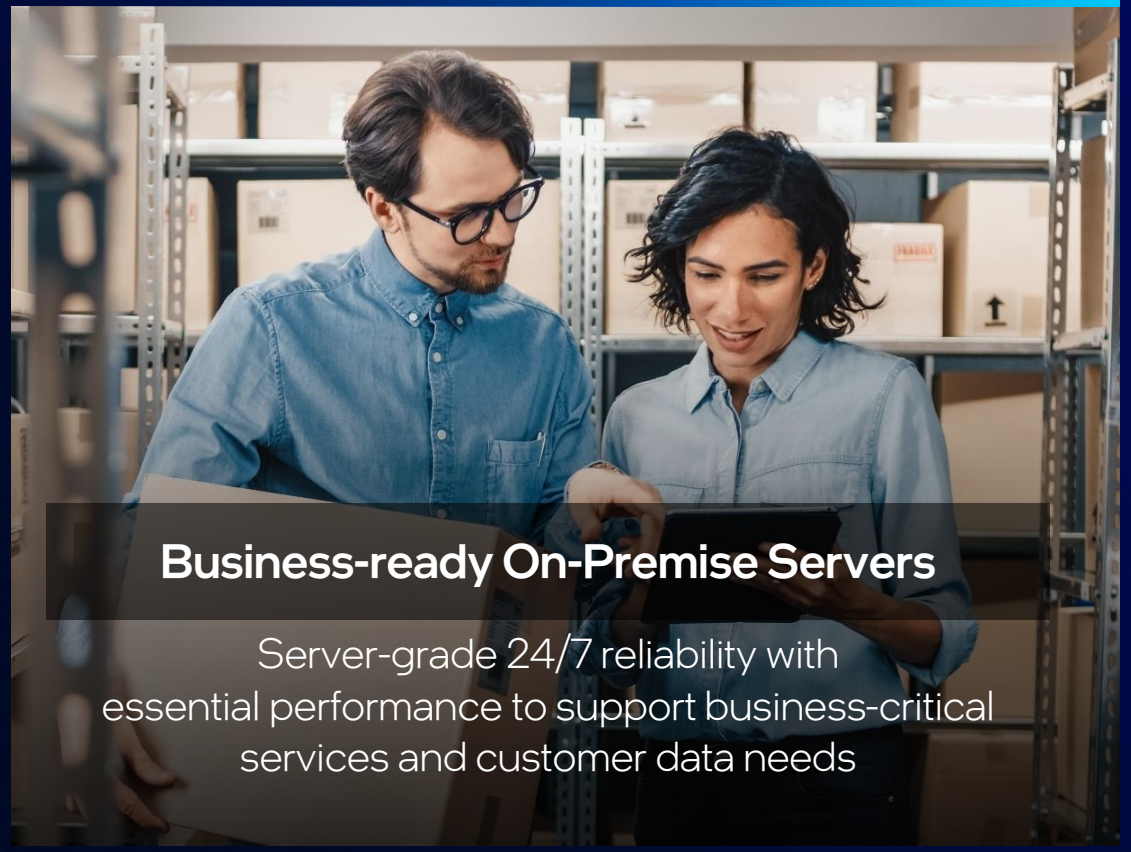
intel

1. See backup for workloads and configurations. Results may vary.

Intel® Xeon® 6300 for Entry Server Processors

Server landscape

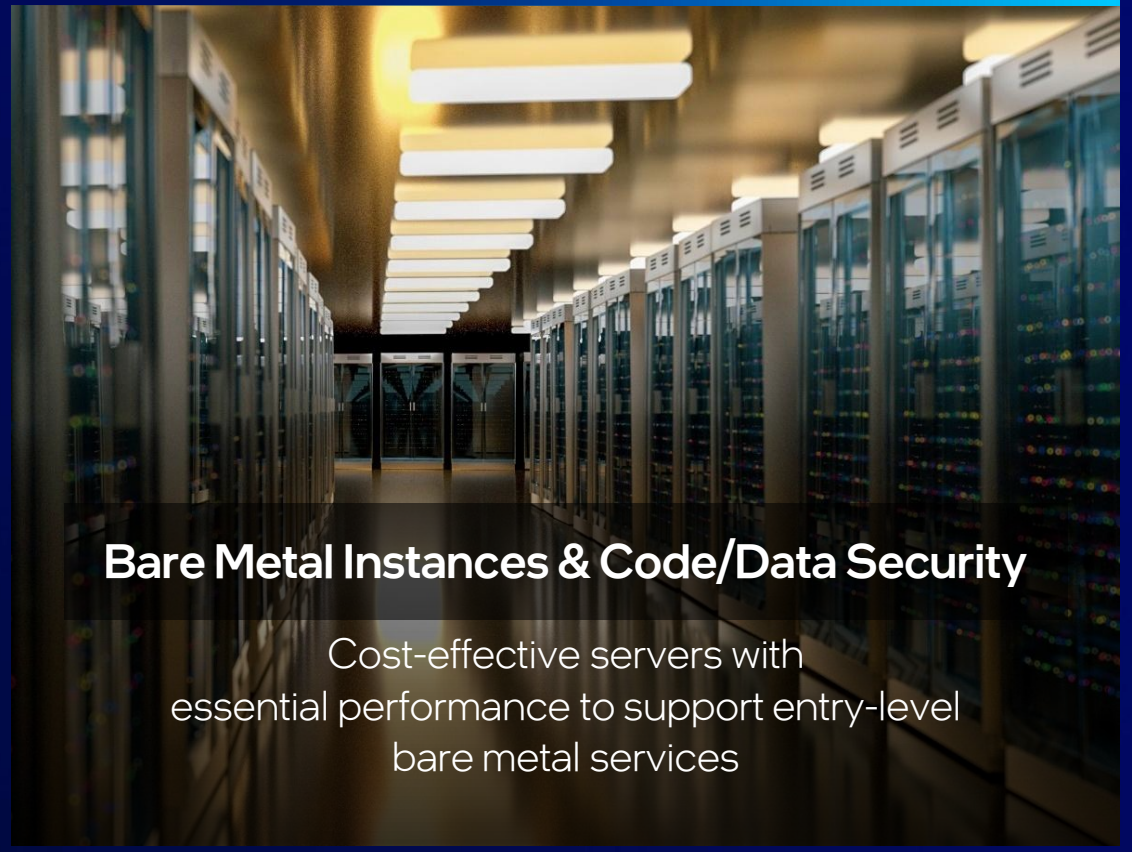
Small Businesses



Business-ready On-Premise Servers

Server-grade 24/7 reliability with essential performance to support business-critical services and customer data needs

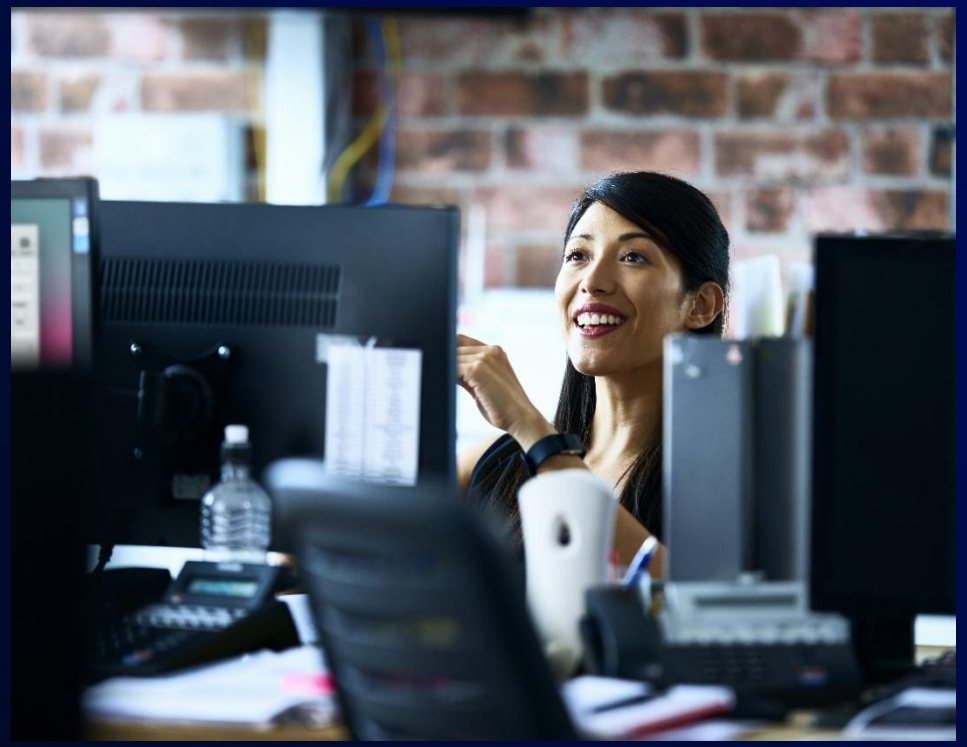
Cloud Services



Bare Metal Instances & Code/Data Security

Cost-effective servers with essential performance to support entry-level bare metal services

Intel® Xeon® 6300 for Entry Server Processors for Small Business

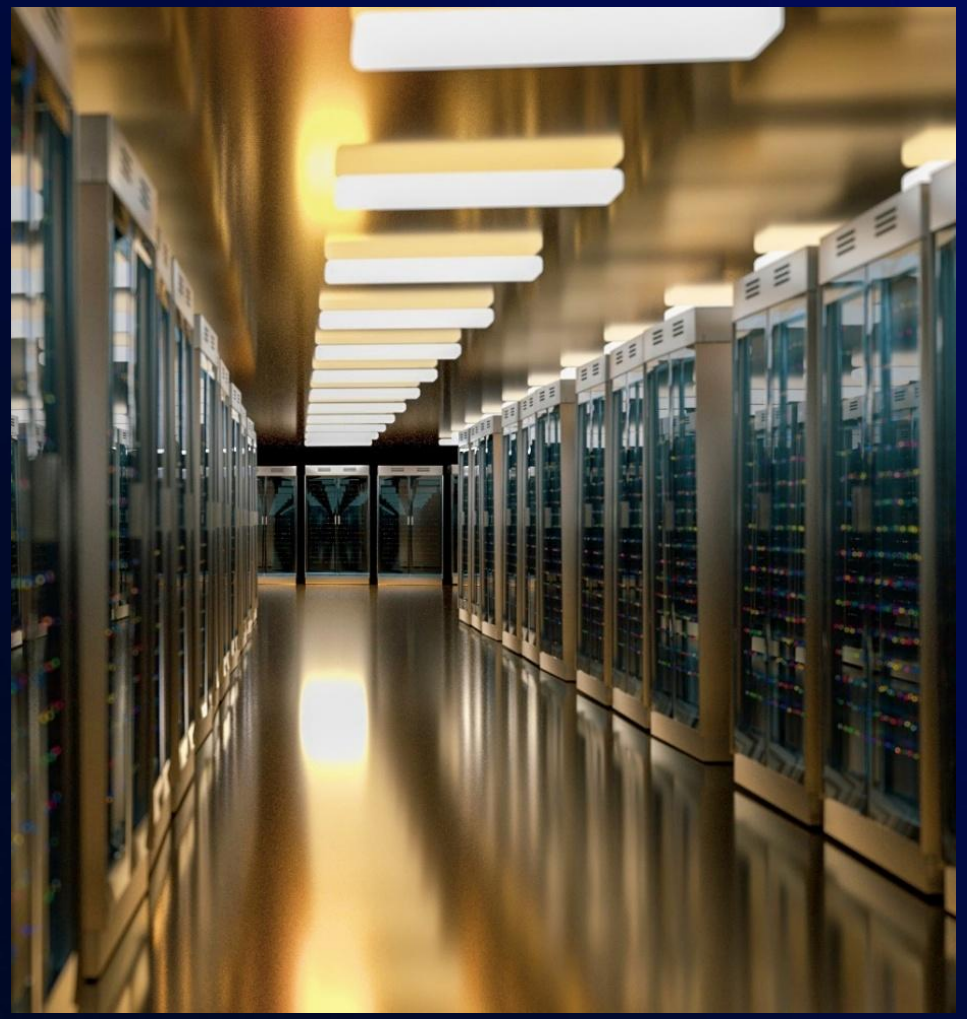


Why Upgrade Now?

- **Reduce risks**—Help protect your business data from the latest security threats with modern server hardware, features, and regular OS security patches
  - Intel Xeon 6300 series processors include support for Windows Server 2025
- **Reduce costs and downtime**—Older hardware can increase the risk of downtime and repair costs, particularly after warranties have expired
- **Improve efficiencies**—A server upgrade can offer faster, more capable support for newer business software and more users
  - Added server performance can help your business maintain a competitive edge and improve customer service
- **Be ready for remote management**—Get the IT help you need with built-in firmware support for the latest remote management tools

An investment in a professional-grade server featuring an Intel Xeon E processor is an investment in your business

Intel® Xeon® 6300 for Entry Server Processors for Cloud Services



Entry Server Bare Metal & Cloud Performance

Expand your IaaS customer base—with cost-effective, entry-level bare metal instances designed to deliver essential performance, manageability and reliability

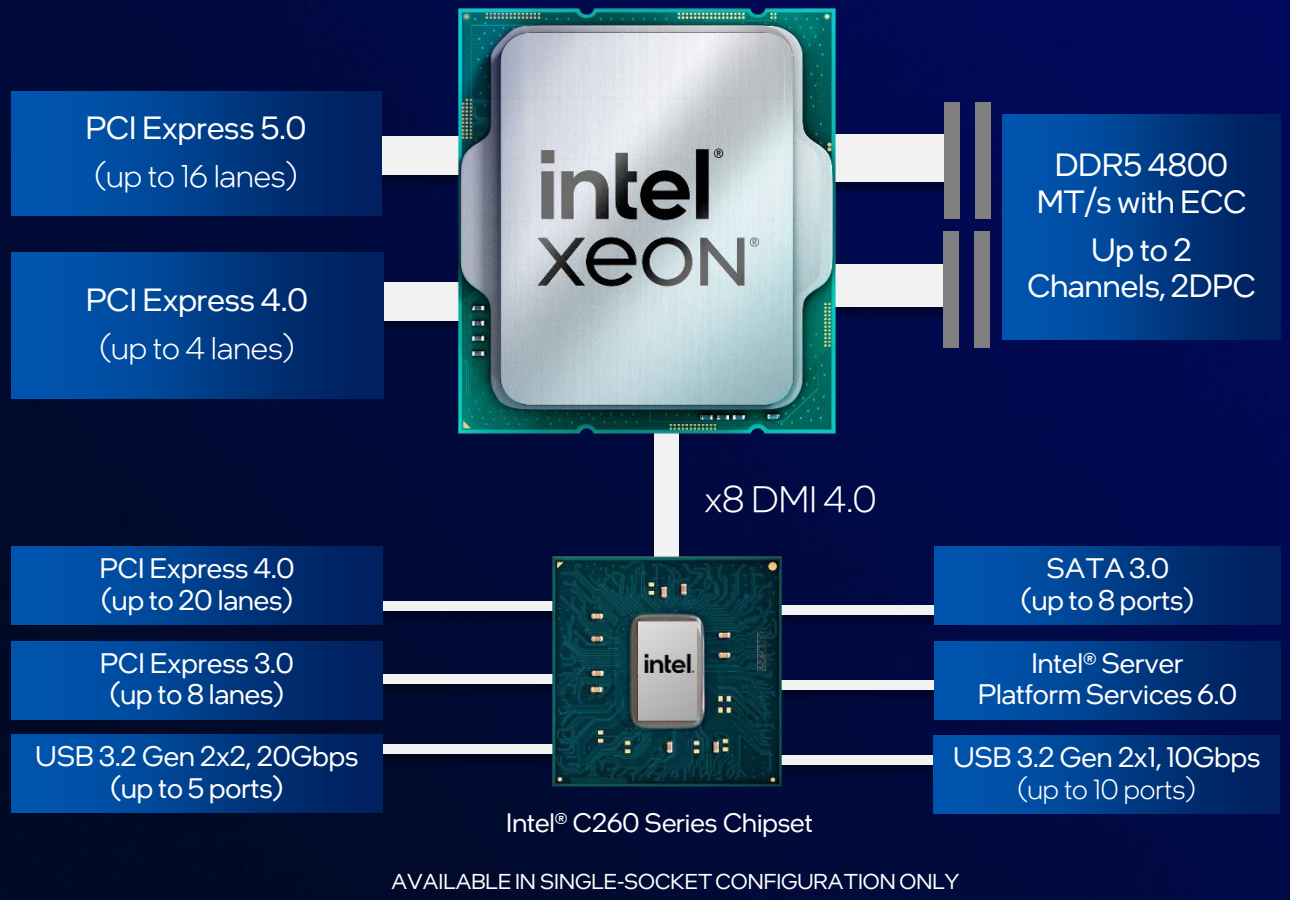
- Available with 4, 6, or 8 cores (8, 12, or 16 threads) and processor TDPs ranging from 55-95W
- Base frequencies as high as 3.6 GHz, with Intel® Turbo Boost Max Technology 3.0 frequencies up to 5.7 GHz on Intel 7 process technology
- Up to 128 GB of DDR5 memory, with speed up to 4800 MT/s, ideal for workloads and applications that require faster memory throughput
- PCIe 5.0 support provides high-speed I/O for faster storage or network connectivity

Manageability and Reliability

- Server-grade manageability with Intel® Server Platform Services 6 (Intel® SPS) supporting Intel® Node Manager
- Error Correcting Code (ECC)-enabled memory subsystem prevents inadvertent data changes or system crashes

Intel® Xeon® 6300 for Entry Server Processors

New Intel® Xeon® 6300 series processors for entry-level servers



AVAILABLE IN SINGLE-SOCKET CONFIGURATION ONLY

Maximum Core Count Supported	Up to 8 Cores
Maximum Base Frequency Supported	3.6 GHz
Maximum Intel Turbo Boost Technology 3.0 Frequency Supported	5.7 GHz
Processor Cache Memory Support	Up to 24 MB Intel® Smart Cache
Processor Performance Support	Intel® Turbo Boost Max Technology 3.0, Intel® Hyper-Threading Technology (Intel® HT)
Maximum Number of Processor Sockets Supported	One Socket
Thermal Design Point (TDP)	Up to 95 Watts
Socket Type	LGA1700 Socket
System Memory Support	2 channels of DDR5 ECC Up to 4800 MT/s 2 DPC, UDIMMs only
Maximum System Memory Supported	Up to 128 GB
Supported Chipset	Intel® C262 or C266 Chipsets
I/O	PCI Express 5.0 – Up to 16 lanes (CPU) PCI Express 4.0 – Up to 20 lanes (PCH) USB 3.2 Gen2x2 (20G) – Up to 5 ports USB 3.2 Gen2x1 (10G) – Up to 10 ports SATA 3.0 – Up to 8 ports DMI – 8 lanes, Gen 4
Intel® Server Platform Services	Intel® SPS 6.0 with Intel® NM support
Intel® VROC	SATA RAID
Support for Intel® Ethernet	1 GbE i210 (LOM/AIC) 10 GbE x710 (AIC) 25 GbE E810 (AIC)
Processor Manufacturing Process	Intel 7 process technology

intel

Processor, chipset and diagram provided for illustration purposes only.
Diagram and table are not a comprehensive of all features and capabilities.

Prior Platform Comparison

New capabilities from Tatlow to Catlow in **Bolded Blue**
New capabilities from Tatlow/Catlow to Catlow Refresh in **Bolded Purple**

Platform	Tatlow	Catlow	Catlow – Refresh
CPU	Rocket Lake-E	**Raptor Lake-E**	**Raptor Lake-E Refresh (6300)**
Socket	LGA 1200	**LGA 1700**	**LGA 1700**
Scalability	1S	1S	1S
Core	Up to 8 Cores Gen12 Graphics Support	Up to 8 Cores **(Raptor Cove)**	Up to 8 Cores **(Raptor Cove)**
Memory	2 channels DDR4 2 DPC UDIMM ECC Up to 3200 MT/s	2 channels **DDR5** 2 DPC UDIMM ECC **Up to 4800 MT/s**	2 channels **DDR5** 2 DPC UDIMM ECC **Up to 4800 MT/s**
PCIe	20 lanes PCIe 4.0 Bifurcation support: 1x16+1x4, 2x8+1x4, 1x8+3x4	**16 lanes PCIe 5.0** 4 lanes PCIe 4.0 Bifurcation support: 1x16+1x4, 2x8+1x4	**16 lanes PCIe 5.0** 4 lanes PCIe 4.0 Bifurcation support: 1x16+1x4, 2x8+1x4
ISE Support	SSE4.1, SSE4.2, AVX, AVX2, AVX3	SSE4.1, SSE4.2, AVX, AVX2	SSE4.1, SSE4.2, AVX, AVX2
PCH	Rocket Lake PCH-H DMI x8 3.0 Up to 8 SATA ports Up to 24 PCIe 3.0 lanes USB 3.2 Gen 2x1 (10 Gb) up to 10 ports USB 3.2 Gen 2x2 (20 Gb) up to 3 ports USB 2.0 (5 Gb) up to 14 ports eSPI supported	**Raptor Lake PCH-S** DMI x8 **4.0** Up to 8 SATA ports Up to **20 PCIe 4.0** and 8 PCIe 3.0 lanes USB 3.2 Gen 2x1 (10 Gb) up to 10 ports **USB 3.2 Gen 2x2 (20 Gb) up to 5 ports** USB 2.0 up to 14 ports eSPI supported	**Raptor Lake PCH-S** DMI x8 **4.0** Up to 8 SATA ports **Up to 20 PCIe 4.0** and 8 PCIe 3.0 lanes USB 3.2 Gen 2x1 (10 Gb) up to 10 ports **USB 3.2 Gen 2x2 (20 Gb) up to 5 ports** USB 2.0 up to 14 ports eSPI supported
AMT Server	Yes	No	No
SGX	Yes	No	No

Intel® Xeon® 6300 Processors for Entry Server

Entry SKUs

SKU	CORES	BASE (GHz)	ALL CORE TURBO (GHz)	Max TURBO (GHz)	L3 CACHE (MB)	TDP (Watts)	Max. Scala.	Memory Channels	DDR5 Memory Speed	MRDIMM Speed	Default Accel. Devices	Intel TDX Keys (Per CPU)	UPI Links Enab.	PCIe Lanes	Price
6369P	8	3.3	5.3	5.7	24	95	1S	2	4800	NA	NA	NA	NA	16	$545
6357P	8	3.0	4.7	5.4	24	80									$500
6353P	8	2.7	4.6	5.4	24	65									$383
6349P	6	3.6	5.3	5.7	18	95									$455
6337P	6	3.5	4.8	5.4	18	80									$337
6333P	6	3.1	4.6	5.2	18	65									$287
6325P	4	3.5	4.8	5.2	12	55									$253
6315P	4	2.8	4.5	4.7	12	55									$199

*Intel® Turbo Boost Max Technology 3.0 may not be available on all SKUs.
**Intel Xeon E-2414 processors does not support Intel® Hyper-Threading Technology (Intel® HT technology).
See intel.com/products/processor_number for details.
Processor details, features, cost and availability are subject to change without notice. Please visit intel.com/xeone for the latest product information.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Performance varies by use, configuration and other factors. Learn more on the Performance Index site.

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Your costs and results may vary.

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Appendix



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Intel® Xeon® 6700/6500 P-core Performance SKUs

	CPU Cores				Cache	Power & Scalability		Memory			Accelerators & Security		I/O		
SKU	Cores	Base (GHz)	All core Turbo (GHz)	Max Turbo (GHz)	L3 cache (MB)	TDP (Watts)	Max. Scalability	Memory Channels	DDR5 Memory Speed	MRDIMM Speed	Default Accel. Devices	Intel TDX Keys (Per CPU)	UPI Links Enab.	PCIe Lanes	Price
6787P	86	2	3.2	3.8	336	350	2S	8	8000	8000	4/4/4/4	2048	4	88	$10,400
6776P (PCT)	64	2.3	3.6	3.9	336	350	2S	8	8000	8000	2/2/2/2	2048	4	88	$11,060
6774P (PCT)	64	2.5	3.6	3.9	336	350	2S	8	8000	8000	2/2/2/2	2048	4	136	$7,571
6767P	64	2.4	3.6	3.9	336	350	2S	8	8000	8000	4/4/4/4	2048	4	88	$9,595
6747P	48	2.7	3.8	3.9	288	330	2S	8	8000	8000	4/4/4/4	2048	4	88	$6,497
6745P	32	3.1	4.1	4.3	336	300	2S	8	6400	NA	4/4/4/4	2048	4	88	$5,250
6737P	32	2.9	4	4	144	270	2S	8	6400	NA	4/4/4/4	2048	4	88	$4,995
6736P	36	2	3.4	4.1	144	205	2S	8	6400	NA	4/4/4/4	2048	4	88	$3,351
6730P	32	2.5	3.6	3.8	288	250	2S	8	6400	NA	4/4/4/4	2048	4	88	$3,726
6527P	24	3	4.2	4.2	144	255	2S	8	6400	NA	4/4/4/4	2048	4	88	$2828
6517P	16	3.2	4	4.2	72	190	2S	8	6400	NA	2/2/2/2	2048	3	88	$1,195
6507P	8	3.5	4.3	4.3	48	150	2S	8	6400	NA	2/2/2/2	2048	3	88	$765

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*Accelerators List Order:
DSA, IAA, QAT, DLB
Intel® AMX featured in each core

Intel® Xeon® 6700/6500 P-core Mainline & Scalable SKUs

SKU	CPU Cores				Cache	Power & Scalability		Memory			Accelerators & Security		I/O		Price
	Cores	Base (GHz)	All core Turbo (GHz)	Max Turbo (GHz)	L3 cache (MB)	TDP (Watts)	Max. Scalability	Memory Channels	DDR5 Memory Speed	MRDIMM Speed	Default Accel. Devices	Intel TDX Keys (Per CPU)	UPI Links Enab.	PCIe Lanes	
6788P	86	2	3.2	3.8	336	350	8S	8	6400	NA	4/4/4/4	1024	4	88	$19,000
6768P	64	2.4	3.6	3.9	336	330	8S	8	6400	NA	4/4/4/4	1024	4	88	$16,000
6748P	48	2.5	3.8	4.1	192	300	8S	8	6400	NA	4/4/4/4	1024	4	88	$12,702
6738P	32	2.9	4.1	4.2	144	270	8S	8	6400	NA	4/4/4/4	1024	4	88	$6,540
6728P	24	2.7	3.9	4.1	144	210	8S	8	6400	NA	4/4/4/4	1024	4	88	$2,478
6724P	16	3.6	4.2	4.3	72	210	8S	8	6400	NA	2/2/2/2	1024	3	88	$3,622
6714P	8	4	4.3	4.3	48	165	8S	8	6400	NA	2/2/2/2	1024	3	88	$2,816
6760P	64	2.2	3.4	3.8	320	330	2S	8	6400	NA	2/2/2/2	1024	4	88	$7,803
6740P	48	2.1	3.3	3.8	288	270	2S	8	6400	NA	2/2/2/2	1024	4	88	$4,650
6530P	32	2.3	3.7	4.1	144	225	2S	8	6400	NA	2/2/2/2	1024	4	88	$2,234
6520P	24	2.4	3.4	4	144	210	2S	8	6400	NA	2/2/2/2	1024	4	88	$1,295
6515P	16	2.3	3.8	3.8	72	150	2S	8	6400	NA	2/2/2/2	1024	3	88	$740
6505P	12	2.2	3.9	4.1	48	150	2S	8	6400	NA	2/2/2/2	1024	3	88	$563

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*Accelerators List Order:
DSA, IAA, QAT, DLB
Intel® AMX featured in each core

Intel® Xeon® 6700/6500 P-core 1 Socket (1S) SKUs

	CPU Cores				Cache	Power & Scalability		Memory			Accelerators & Security		I/O		
SKU	Cores	Base (GHz)	All core Turbo (GHz)	Max Turbo (GHz)	L3 cache (MB)	TDP (Watts)	Max. Scalability	Memory Channels	DDR5 Memory Speed	MRDIMM Speed	Default Accel. Devices	Intel TDX Keys (Per CPU)	UPI Links Enab.	PCIe Lanes	Price
6781P	80	2	3.2	3.8	336	350	1S	8	8000	8000	3/3/3/3	1024	0	136	$8,960
6761P	64	2.5	3.6	3.9	336	350	1S	8	8000	8000	3/3/3/3	1024	0	136	$6,570
6741P	48	2.5	3.7	3.8	288	300	1S	8	6400	NA	3/3/3/3	1024	0	136	$4,421
6731P	32	2.5	3.9	4.1	144	245	1S	8	6400	NA	3/3/3/3	1024	0	136	$2,700
6521P	24	2.6	4.1	4.1	144	225	1S	8	6400	NA	3/3/3/3	1024	0	136	$1,250
6511P	16	2.3	4.1	4.2	72	150	1S	8	6400	NA	2/2/2/2	1024	0	136	$815

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*Accelerators List Order:
DSA, IAA, QAT, DLB
Intel® AMX featured in each core

Intel® Xeon® 6300 Entry SKUs

SKU	CPU Cores				Cache	Power & Scalability		Memory			Accelerators & Security		I/O		
	Cores	Base (GHz)	All core Turbo (GHz)	Max Turbo (GHz)	L3 cache (MB)	TDP (Watts)	Max. Scalability	Memory Channels	DDR5 Memory Speed	MRDIMM Speed	Default Accel. Devices	Intel TDX Keys (Per CPU)	UPI Links Enab.	PCIe Lanes	
6369P	8	3.3	5.3	5.7	24	95	1S	2	4800	NA	NA	NA	NA	16	$545
6357P	8	3	4.7	5.4	24	80	1S	2	4800	NA	NA	NA	NA	16	$500
6353P	8	2.7	4.6	5.4	24	65	1S	2	4800	NA	NA	NA	NA	16	$383
6349P	6	3.6	5.3	5.7	18	95	1S	2	4800	NA	NA	NA	NA	16	$455
6337P	6	3.5	4.8	5.4	18	80	1S	2	4800	NA	NA	NA	NA	16	$337
6333P	6	3.1	4.6	5.2	18	65	1S	2	4800	NA	NA	NA	NA	16	$287
6325P	4	3.5	4.8	5.2	12	55	1S	2	4800	NA	NA	NA	NA	16	$253
6315P	4	2.8	4.5	4.7	12	55	1S	2	4800	NA	NA	NA	NA	16	$199

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Accelerators List Order:
DSA, IAA, QAT, DLB
Intel® AMX featured in each core

Intel® Xeon® 6900P Performance SKUs

SKU	CPU Cores				Cache	Power & Scalability		Memory			Accelerators & Security		I/O		Price
	Cores	Base (GHz)	All core Turbo (GHz)	Max Turbo (GHz)	L3 cache (MB)	TDP (Watts)	Max. Scalability	Memory Channels	DDR5 Memory Speed	MRDIMM Speed	Default Accel. Devices	Intel TDX Keys (Per CPU)	UPI Links Enab.	PCIe Lanes	
6980P	128	2	3.2	3.9	504	500	2S	12	6400	8800	4/4/4/4	1024	6	96	$12,460
6979P	120	2.1	3.2	3.9	504	500	2S	12	6400	8800	4/4/4/4	1024	6	96	$11,025
6972P	96	2.4	3.5	3.9	480	500	2S	12	6400	8800	4/4/4/4	1024	6	96	$10,220
6952P	96	2.1	3.2	3.9	480	400	2S	12	6400	8800	4/4/4/4	1024	6	96	$9,115
6960P	72	2.7	3.8	3.9	432	500	2S	12	6400	8800	4/4/4/4	1024	6	96	$9,625
6944P	72	1.8	3.1	3.9	432	350	2S	12	6400	NA	0/0/0/0	1024	6	96	$6,850

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Accelerators List Order:
DSA, IAA, QAT, DLB
Intel® AMX featured in each core

Intel® Xeon® 6 SOC SKUs

SKU	CPU Cores					Memory		I/O	Accelerators				Support		Price
	Cores	TDP (W)	Base (GHz)	All Core Turbo (GHz)	Uncore	#Mem Channels	DDR5	Integrated Ethernet	Intel® QAT Support	Intel® vRAN Boost	Intel® Media Transcode Accelerator	Intel® AMX	Extended Temp	10yr support option	
6726P-B	42	235	2.3	2.9	1.6	4	6400	200G	Yes	Yes		Yes		Yes	$3795
6716P-B	40 SST	235	2.3	2.9	1.6	4	6400	200G	Yes	Yes		Yes		Yes	$3519
6706P-B	40	235	2.5	2.9	1.6	4	6400	200G	Yes	Yes		Yes		Yes	$3519
6563P-B	38	235	2.4	3.1	1.8	4	6400	200G	Yes		Yes	Yes		Yes	$2616
6556P-B	36	215	2.3	2.9	1.6	4	6400	200G	Yes	Yes		Yes	Option	Yes	$2628
6553P-B	36	235	2.6	3.4	1.6	4	6400	200G	Yes		Yes	Yes		Yes	$2402
6546P-B	32	195	2.3	2.9	1.6	4	6400	200G	Yes	Yes		Yes		Yes	$2368
6543P-B	32	160	2	2.6	1.4	4	5600	100G	Yes			Yes		Yes	$2206
6533P-B	32	205	2.2	2.6	1.6	4	5600	None	Yes			Yes		Yes	$2100
6523P-B	24	175	2.5	3.3	1.8	4	5600	100G	Yes			Yes		Yes	$1450
6516P-B	20	145	2.3	2.9	1.6	4	4800	200G	Yes	Yes		Yes		Yes	$1544
6513P-B	20	130	2	2.6	1.4	4	5600	100G	Yes			Yes		Yes	$1399
6503P-B	12	110	2	2.6	1.4	4	4800	100G	Yes			Yes		Yes	$934

Additional higher core count SKUs available in Q4'25

Intel may make changes to specifications and product descriptions at any time, without notice. Note: Intel® AMX featured in each core

Please visit intel.com/xeon or contact your Intel representative to obtain the latest product specifications. Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. All processors support Intel Virtualization Technology (Intel VT-x).

Intel® Xeon® 6 Processors

Compute Efficiency

Topology Aware Power Management Interface (TPMI)

Simplifying power management by providing an architectural MMIO-based solution designed to PCIe standards which affords flexibility, expandability, software reuse from generation to generation

Intel® Resource Director Technology (Intel® RDT)

Supports control and visibility over how shared resources are used, which is crucial to optimizing workloads and lowering a data center's total cost of ownership (TCO)

Active Idle Power Mode

Lowering Uncore frequency in low activity scenarios where a minimal utilization point is set and thresholds to minimize impact to workload performance

Intel Accelerator Engines

Intel Dynamic Load Balancer (Intel DLB)
Intel In-Memory Analytics Accelerator (Intel IAA)
Intel QuickAssist Technology (Intel QAT)
Intel Data Streaming Accelerators (Intel DSA)



Intel Flat Memory Mode

Using logic in the CPU to keep frequently used data in DRAM where performance is best and swapping out less frequently used data to CXL memory

Intel Platform Monitoring Technology (Intel PMT)

Extensive, flexible, industry-leading platform telemetry for server fleet management and facility orchestration

Seamless Firmware Update

Increasing server uptime, reduces user disruptions while deploying server platform updates and mitigating potential security vulnerabilities in a few seconds

Reliability Availability Serviceability (RAS)

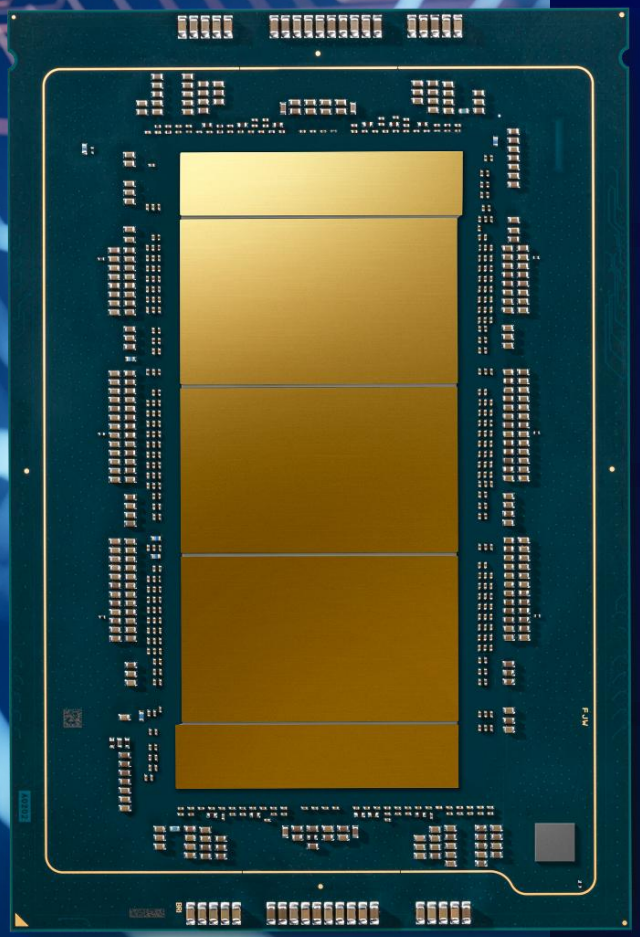
Maximizing system uptime by using features for error detection and correction, runtime repair and recover, resulting in an improved total cost of ownership

Operational Efficiency

INTEL® XEON® 6 PROCESSORS Performance Core		INTEL® XEON® 6 PROCESSORS Efficient Core
up to 86 cores (6700 series) or 128 cores (6900 series)	Cores	up to 144 cores (6700 series) or 288 cores (6900 series)
1S, 2S, 4S, 8S	Sockets	1S, 2S
150 to 500W	Max TDP	205 to 500W
up to 12 channels DDR5 | MRDIMM	Memory	up to 12 channels DDR5
8000 (1 DPC) | 6000 (2 DPC) | 8800 MR (1 DPC)	Max Memory Speed	6400 (1 DPC) | 5200 (2 DPC)
up to 6 UPI 2.0 | up to 24 GT/s per lane	Intel® UPI	up to 4 UPI 2.0 | up to 24 GT/s per lane
up to 96 lanes PCIe 5.0 (x16, x8, x4, x2) R1S: up to 136 lanes PCIe 5.0 for single socket designs	PCI Express	up to 96 lanes PCIe 5.0 (x16, x8, x4, x2)
up to 64 lanes CXL 2.0	Compute Express Link	up to 64 lanes CXL 2.0
52/57	Physical/Virtual Address Bits	52/48
Intel Advanced Matrix Extensions (INT8, BF16, FP16) Intel Advanced Vector Extensions 512 (VNNI/INT8)	AI Acceleration Intel® Deep Learning Boost	Intel Advanced Vector Extensions 2 (VNNI/INT8)
Intel Software Guard Extensions, Intel Trusted Domain Extensions	Security	Intel Software Guard Extensions, Intel Trusted Domain Extensions
Vector AES, SHA2-256 extensions, VPMADD52	Crypto	Vector AES, SHA2-256 extensions, VPMADD52
Intel QuickAssist Technology, Intel Dynamic Load Balancer, Intel Data Streaming Accelerator, Intel In-memory Analytics Accelerator	Integrated Accelerators	Intel QuickAssist Technology, Intel Dynamic Load Balancer, Intel Data Streaming Accelerator, Intel In-memory Analytics Accelerator

Overcoming
Challenges in the Modern Datacenter

Intel® Xeon® 6 processor with Performance-cores (P-cores)



Significant performance leaps for compute-intensive workloads like AI, HPC, and database

Lower power consumption while meeting SLAs for performance and uptime

Scale AI everywhere, with the best CPU for AI

Hardware- based security features, confidential computing, and trust services to help protect your data

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Configuration: 13

P-core



[13] MRDIMMs Excel for Bandwidth Intensive Workloads

a) Ansys Fluent (aircraft_wing_14m, aircraft_wing_2m, combustor_12m, combustor_16m, combustor_71m, exhaust_system_33m, fluidized_bed_2m, ice_2m, landing_gear_15m, oil_rig_7m, pump_2m, rotor_3m, sedan_4m)
6980P, MRDIMM: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB MRDIMM-8800, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, Ansys Fluent 2024R1
6980P, DDR5: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB DDR5-6400, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, Ansys Fluent 2024R1

b) WRF (CONUS-12km, CONUS-2.5km)
6980P, MRDIMM : Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB MRDIMM-8800, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, WRF v4.5.2,
6980P, DDR5: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB DDR5-6400, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, WRF v4.5.2,

c) OpenFOAM (motorbike-20m, motorbike-42m)
6980P, MRDIMM : Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB MRDIMM-8800, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, OpenFOAM v2312
6980P, DDR5: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB DDR5-6400, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, OpenFOAM v2312

d) Stream Triad
6980P with DDR5: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB DDR5-6400, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, App Version: v5.10
6980P with MRDIMM : Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB MRDIMM-8800, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, App Version: v5.10

e) HPCG:
6980P, MRDIMM : Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB MRDIMM-8800, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, HPCG from Intel_Optimized_MKL_v2024.1
6980P, DDR5: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB DDR5-6400, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, HPCG from Intel_Optimized_MKL_v2024.1

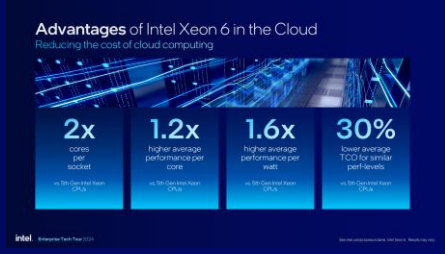
f) ResNet50:
6972P, MRDIMM, 1-node, 2x Intel(R) Xeon(R) 6972P, 96 cores, 500W TDP, HT On, Turbo On, Total Memory 1536GB (24x64GB MRDIMM 8800 MT/s [8800 MT/s]), BIOS BHSDCRB1.IPC.0033.D57.2406240014, microcode 0x11000290, 2x Ethernet Controller 10-Gigabit X540-AT2, 1x 1.7T SAMSUNG MZQL21T9HCJR-00A07, Ubuntu 24.04 LTS, 6.8.0-31-generic. Test by Intel as of 07/10/24.
6972P, DDR5: 1-node, 2x Intel(R) Xeon(R) 6972P, 96 cores, HT On, Turbo On, Total Memory 1536GB (24x64GB DDR5 6400 MT/s [6400 MT/s]), BIOS BHSDCRB1.IPC.0033.D57.2406240014, microcode 0x11000290, Dual-Media 10G RDMA Ethernet Controller, 1x 1.7T SAMSUNG MZQL21T9HCJR-00A07, Ubuntu 24.04 LTS, 6.8.0-31-generic, Test by Intel as of 08/13/24.
Software: ResNet50 v1.5, Inference: int8, bs=1 (sla=15ms), Dataset: ImageNet, Framework: PyTorch:2.4.0, IPEX: 2.4.0, OneDNN: v3.4.2, Modelzoo: https://github.com/intel/ai-reference-models

g) Gen AI - LLM:
6980P, MRDIMM: 1-node, 2x Intel Xeon 6980P, 128 cores, 500W TDP, HT On, Turbo On, Total Memory 1536GB (24x64GB MRDIMM 8800 MT/s [8800 MT/s]), BIOS BHSDCRB1.IPC.0033.D57.2406240014, microcode 0x11000290, 2x Ethernet Controller X710 for 10GBASE-T, 1x 1.7T Micron_7400_MTFDKCC1T9TDZ, Ubuntu 24.04 LTS, 6.8.0-31-generic. Test by Intel as of 07/11/24.
6980P, DDR: 1-node, 2x Intel Xeon 6980P, 128 cores, 500W TDP, HT On, Turbo On, Total Memory 1536GB (24x64GB DDR5 6400 MT/s [6400 MT/s]), BIOS BHSDCRB1.IPC.0033.D57.2406240014, microcode 0x11000290, 2x Ethernet Controller 10-Gigabit X540-AT2, 1x 3.5T Micron_7450_MTFDKCB3T8TFR, Ubuntu 24.04 LTS, 6.8.0-31-generic. Test by Intel as of 07/23/24.
Software: Llama3 8B: int8, P90<=100ms, bs=1,x (1024/128), PyTorch:2.3.0, IPEX: 2.3.0, OneDNN: v3.4.2, Modelzoo: https://github.com/intel/ai-reference-models

intel

Configuration: 16

P-core



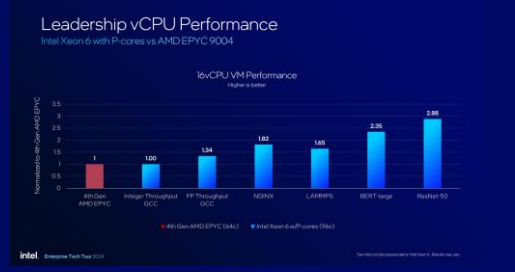
c) Claim: Intel® Xeon® 6 with P-cores delivers up to 39% lower total cost of ownership (TCO) than Intel® Xeon® 8592+ based servers running a OpenFOAM (Geomean of 2) workload.
Use 10 racks (80 servers) of Intel® Xeon® 6980P based servers instead of 14 racks (196 servers) of 8592+ based servers running OpenFOAM (Geomean of 2) and save 3464 MWh of energy, reduce carbon footprint by 1469 metric tons CO2, and save $4578K in total cost of ownership over 4-years. Intel Xeon 6980P delivers 2.43x higher performance and 1.42x higher performance/watt per server vs Intel Xeon 8592+ on OpenFOAM (Geomean of 2).
6980P w/MRDIMM: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB MRDIMM-8800, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, OpenFOAM v2312
8592+: Test by Intel as of March 2024, 1 node, 2x Intel Xeon 8592+, HT On, Turbo On, SNC2, 512GB DDR5-5600, BIOS 3B07.TEL2P1, ucode 0x21000200, Ubuntu 23.10, Kernel 6.5.0, OpenFOAM v2312
Assumptions: 1x 42U, 15KW Rack, supporting 20x 2U rack servers, 1x TOR switch, 1.6 PUE, kWh to kg CO2 factor 0.42394.
For 14 racks of Intel Xeon 8592+ based servers over 4-years, estimated as of Sep 2024: CapEx costs: $8027k, OpEx costs (4 year, includes power and cooling utility costs, infrastructure and hardware maintenance costs): $3526k, Energy use: 11538MWh, CO2 emissions: 4891 metric tons.
For 10 rack of Intel Xeon 6980P based servers over 4-years, estimated as of Sep 2024: CapEx costs: $5098k, OpEx costs (4 year, includes power and cooling utility costs, infrastructure and hardware maintenance costs): $1876k: Energy use: 8073MWh, CO2 emissions: 3423 metric tons.
Costs based on Intel estimates and information from thinkmate.com as of Sep 2024.
This offering is not approved or endorsed by OpenCFD Limited, producer and distributor of the OpenFOAM software via www.openfoam.com, and owner of the OPENFOAM® and OpenCFD® trademark

d) Claim: Intel® Xeon® 6 with P-cores delivers up to 20% lower total cost of ownership (TCO) than Intel® Xeon® 8592+ based servers running a ResNet50 workload.
Use 10 racks (80 servers) of Intel® Xeon® 6980P based servers instead of 10 racks (150 servers) of 8592+ based servers running ResNet50 and save 173 MWh of energy, reduce carbon footprint by 73 metric tons CO2, and save $1791K in total cost of ownership over 4-years. Intel Xeon 6980P delivers 1.83x higher performance and 1x higher performance/watt per server vs Intel Xeon 8592+ on ResNet50.
6980P w/MRDIMM: 1-node, pre-production platform, 2x Intel(R) 6980P, 128 cores, 500W TDP, HT On, Turbo On, Total Memory 1536GB (24x64GB MRDIMM 8800MT/s [8800 MT/s]), BIOS BHSDCRB1.IPC.0033.D57.2406240014, microcode 0x11000290, 2x Ethernet Controller X550, 1x 1.7T SAMSUNG MZQL21T9HCJR-00A07, Ubuntu 24.04 LTS, 6.8.0-31-generic. Test by Intel as of 08/20/24.
8592+: 1-node, 2x Intel Xeon Platinum 8592+, 64 cores, 350W TDP, HT On, Turbo On, Total Memory 1024GB (16x64GB DDR5 5600 MT/s [5600 MT/s]), BIOS 3B07.TEL2P1, microcode 0x21000230, 2x Ethernet Controller X710 for 10GBASE-T, 1x Ethernet interface, 1x 1.7T SAMSUNG MZQL21T9HCJR-00A07, Ubuntu 24.04 LTS, 6.8.0-31-generic. Test by Intel as of 08/05/24.
Software: ResNet50 PT: ResNet50 v1.5, Inference: int8, bs=x, Dataset: ImageNet, Framework: PyTorch:2.4.0, IPEX: 2.4.0, OneDNN: v3.4.2, Modelzoo: https://github.com/intel/ai-reference-models
Assumptions: 1x 42U, 15KW Rack, supporting 20x 2U rack servers, 1x TOR switch, 1.6 PUE, kWh to kg CO2 factor 0.42394.
For 10 racks of Intel Xeon 8592+ based servers over 4-years, estimated as of Sep 2024: CapEx costs: $6143k, OpEx costs (4 year, includes power and cooling utility costs, infrastructure and hardware maintenance costs): $2629k, Energy use: 8300MWh, CO2 emissions: 3519 metric tons.
For 10 rack of Intel Xeon 6980P based servers over 4-years, estimated as of Sep 2024: CapEx costs: $5098k, OpEx costs (4 year, includes power and cooling utility costs, infrastructure and hardware maintenance costs): $1883k: Energy use: 8127MWh, CO2 emissions: 3445 metric tons.
Costs based on Intel estimates and information from thinkmate.com as of Sep 2024.

intel

Configuration: 17

P-core



[17] 16vcPU Performance

Intel Xeon 6972P: 1-node, 2x Intel(R) Xeon(R) 6972P, 96 cores, HT On, Turbo On, Total Memory 1536GB (24x64GB DDR5 6400 MT/s [6400 MT/s]), BIOS BHSDCRB1.IPC.0033.D57.2406240014, microcode 0x11000290, 2x Ethernet Controller E810-C for QSFP, 2x 1.5T INTEL SSDPE2KE016T8, Ubuntu 22.04.3 LTS, 6.2.0-39-generic,QEMU emulator version 8.2.2libvirt 10.0.0, VM setup:1x 16vcpu DUT + 46x 8vcpu noisy neighbor at 50% utilization. Test by Intel as of 08/26/24.

4th Gen AMD EPYC 9554: 1-node, 2x AMD EPYC 9554 64-Core Processor, 64 cores, SMT on, Turbo On, Total Memory 1536GB (24x64GB DDR5 4800 MT/s [4800 MT/s]), BIOS 1.9, microcode 0xa101148, 4x Ethernet Controller E810-C for QSFP, 1x 349.3G INTEL SSDPEL1K375GA, 2x 1.5T INTEL SSDPE2KE016T8, Ubuntu 22.04.3 LTS, 6.2.0-39-generic, QEMU emulator version 8.2.2libvirt 10.0.0... VM setup: 1x 16 vcpu DUT + 30x 8vcpu noisy neighbor at 50% utilization. Test by Intel as of 08/26/24.

Software:

Integer, Floating Point Throughput: est. SPECCpu2017 int/fp rate, gcc13.1.

LAMMPS: version 2023.2.0-49438, MKL 2023.2.0, Geomean of Rhodo, Tersoff, Stillinger-Weber).

NGINX: SSL3, OOB(AMD) QAT_SW v24.30 (Intel), TLS1.3.

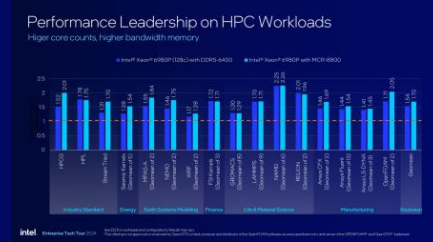
Resnet50: v1.5, BS =64, CPI= 4, Data= ImageNet, Inference= Int8, DL boost 2024_ww26, torch v 2.4.0, ipex v2.4.0.

Bert Large: BS =64, CPI= 16, Data= SQuAD1.1, Inference= Int8, DL boost 2024_ww26, torch v 2.4.0, ipex v2.4.0.

intel

P-core

Configuration: 22



[22] HPC

a) HPCG

Intel Xeon 6980P with DDR5: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB DDR5-6400, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, HPCG from Intel_Optimized_MKL_v2024.1

Intel Xeon 6980P with MRDIMM : Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB MRDIMM-8800, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, HPCG from Intel_Optimized_MKL_v2024.1

AMD EPYC 9654: Test by Intel as of August 2024, 1 node, 2x AMD EPYC 9654, SMT On, Boost On, NPS4, 1536 GB DDR5-4800, BIOS 1.9, ucode 0xa101148, Ubuntu 24.04, Kernel 6.8.0, App Version: AMD_Prebuilt

b) HPL

Intel Xeon 6980P with DDR5: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB DDR5-6400, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, HPL from Intel_Optimized_MKL_v2022.1.0

Intel Xeon 6980P with MRDIMM : Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB MRDIMM-8800, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, HPL from Intel_Optimized_MKL_v2022.1.0

AMD EPYC 9654: Test by Intel as of August 2024, 1 node, 2x AMD EPYC 9654, SMT On, Boost On, NPS4, 1536 GB DDR5-4800, BIOS 1.9, ucode 0xa101148, Ubuntu 24.04, Kernel 6.8.0, App Version: AMD_Prebuilt

c) Stream Triad

Intel Xeon 6980P with DDR5: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB DDR5-6400, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, App Version: v5.10

Intel Xeon 6980P with MRDIMM : Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB MRDIMM-8800, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, App Version: v5.10

AMD EPYC 9654: Test by Intel as of April 2024, 1 node, 2x AMD EPYC 9654, SMT On, Boost On, NPS4, 1536 GB DDR5-4800, BIOS 1.9, ucode 0xa101148, Ubuntu 24.04, Kernel 6.8.0, App Version: v5.10

d) Seismic Kernels run via YASK (AWP; 640^3 grid, Iso3DFD; 1280^3 grid, SSG; 768^3 grid, wave-eq 2D; 32768^2 grid)

Intel Xeon 6980P with DDR5: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB DDR5-6400, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, YASK 4.05.01

Intel Xeon 6980P with MRDIMM : Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB MRDIMM-8800, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, YASK 4.05.01

AMD EPYC 9654: Test by Intel as of April 2024, 1 node, 2x AMD EPYC 9654, SMT On, Boost On, NPS4, 1536 GB DDR5-4800, BIOS 1.9, ucode 0xa101148, Ubuntu 24.04, Kernel 6.8.0, YASK 4.05.01

e) MPAS-A (60-km dycore, 60-km dycore+Physics)

Intel Xeon 6980P with DDR5: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB DDR5-6400, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, MPAS-A v7.3

Intel Xeon 6980P with MRDIMM : Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB MRDIMM-8800, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, MPAS-A v7.3

AMD EPYC 9654: Test by Intel as of April 2024, 1 node, 2x AMD EPYC 9654, SMT On, Boost On, NPS4, 1536 GB DDR5-4800, BIOS 1.9, ucode 0xa101148, Ubuntu 24.04, Kernel 6.8.0, MPAS-A v7.3

f) NEMO (BENCH ORCA-1, GYRE_PISCES_25)

Intel Xeon 6980P with DDR5: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB DDR5-6400, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, NEMO v4.2

Intel Xeon 6980P with MRDIMM : Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB MRDIMM-8800, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, NEMO v4.2

AMD EPYC 9654: Test by Intel as of April 2024, 1 node, 2x AMD EPYC 9654, SMT On, Boost On, NPS4, 1536 GB DDR5-4800, BIOS 1.9, ucode 0xa101148, Ubuntu 24.04, Kernel 6.8.0, NEMO v4.2

g) WRF (CONUS-12km, CONUS-2.5km)

Intel Xeon 6980P with DDR5: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB DDR5-6400, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, WRF v4.5.2,

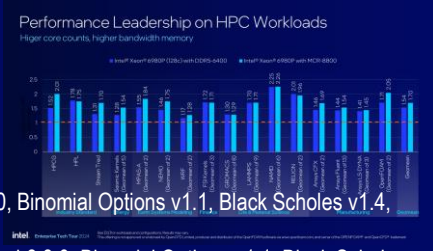
Intel Xeon 6980P with MRDIMM : Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB MRDIMM-8800, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, WRF v4.5.2,

AMD EPYC 9654: Test by Intel as of April 2024, 1 node, 2x AMD EPYC 9654, SMT On, Boost On, NPS4, 1536 GB DDR5-4800, BIOS 1.9, ucode 0xa101148, Ubuntu 24.04, Kernel 6.8.0, App Version: v4.5.2

intel

Configuration: 22

P-core



h) FSI Kernels (Binomial Options, Black Scholes, Monte Carlo)
Intel Xeon 6980P with DDR5: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB DDR5-6400, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, Binomial Options v1.1, Black Scholes v1.4, Monte Carlo: v1.2
Intel Xeon 6980P with MRDIMM : Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB MRDIMM-8800, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, Binomial Options v1.1, Black Scholes v1.4, Monte Carlo: v1.2
AMD EPYC 9654: Test by Intel as of April 2024, 1 node, 2x AMD EPYC 9654, SMT On, Boost On, NPS4, 1536 GB DDR5-4800, BIOS 1.9, ucode 0xa101148, Ubuntu 24.04, Kernel 6.8.0, Binomial Options v1.1, Black Scholes v1.4, Monte Carlo: v1.2.

i) GROMACS (benchPEP, benchPEP-h, benchRIB, ion_channel_pme_large, lignocellulose_rf_large, stmv, water1.5M_pme_large,water1.5M_rf_large)
Intel Xeon 6980P with DDR5: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB DDR5-6400, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, GROMACS v2024.1
Intel Xeon 6980P with MRDIMM : Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB MRDIMM-8800, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, GROMACS v2024.1
AMD EPYC 9654: Test by Intel as of August 2024, 1 node, 2x AMD EPYC 9654, SMT On, Boost On, NPS4, 1536 GB DDR5-4800, BIOS 1.9, ucode 0xa101148, Ubuntu 24.04, Kernel 6.8.0, GROMACS v2024.1.

j) LAMMPS (Atomic Fluid, Copper, DPD, Liquid Crystal, Polyethylene, Protein, Stillinger-Weber, Tersoff, Water)
Intel Xeon 6980P with DDR5: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB DDR5-6400, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, LAMMPS v2024-03-07_dev
Intel Xeon 6980P with MRDIMM : Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB MRDIMM-8800, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, LAMMPS v2024-03-07_dev
AMD EPYC 9654: Test by Intel as of April 2024, 1 node, 2x AMD EPYC 9654, SMT On, Boost On, NPS4, 1536 GB DDR5-4800, BIOS 1.9, ucode 0xa101148, Ubuntu 24.04, Kernel 6.8.0, LAMMPS v2024-03-07_dev

l) RELION (Plasmodium Ribosome 2D classification, Plasmodium Ribosome 3D classification)
Intel Xeon 6980P with DDR5: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB DDR5-6400, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, RELION 5.0-beta-2
Intel Xeon 6980P with MRDIMM : Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB MRDIMM-8800, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, RELION 5.0-beta-2
AMD EPYC 9654: Test by Intel as of April 2024, 1 node, 2x AMD EPYC 9654, SMT On, Boost On, NPS4, 1536 GB DDR5-4800, BIOS 1.9, ucode 0xa101148, Ubuntu 24.04, Kernel 6.8.0, RELION 5.0-beta-2

m) Ansys CFX (CFX-Airfoil_10M, CFX-Airfoil_100M)
Intel Xeon 6980P with DDR5: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB DDR5-6400, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, Ansys CFX 2022 R1
Intel Xeon 6980P with MRDIMM : Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB MRDIMM-8800, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, Ansys CFX 2022 R1
AMD EPYC 9654: Test by Intel as of August 2024, 1 node, 2x AMD EPYC 9654, SMT On, Boost On, NPS4, 1536 GB DDR5-4800, BIOS 1.9, ucode 0xa101148, Ubuntu 24.04, Kernel 6.8.0, Ansys Fluent CFX 2022 R1

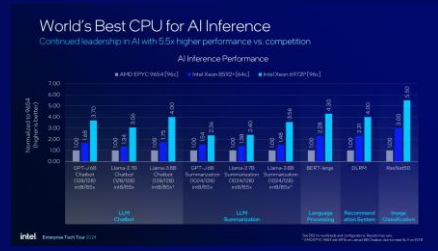
n) Ansys Fluent (aircraft_wing_14m, aircraft_wing_2m, combustor_12m, combustor_16m, combustor_71m, exhaust_system_33m, fluidized_bed_2m, ice_2m, landing_gear_15m, oil_rig_7m, pump_2m, rotor_3m, sedan_4m)
Intel Xeon 6980P with DDR5: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB DDR5-6400, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, Ansys Fluent 2024R1
Intel Xeon 6980P with MRDIMM : Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB MRDIMM-8800, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, Ansys Fluent 2024R1
AMD EPYC 9654: Test by Intel as of April 2024, 1 node, 2x AMD EPYC 9654, SMT On, Boost On, NPS4, 1536 GB DDR5-4800, BIOS 1.9, ucode 0xa101148, Ubuntu 24.04, Kernel 6.8.0, Ansys Fluent 2024R1

o) Ansys LS-DYNA (3cars-150ms, car2car-120ms, ODB_10M-30ms)
Intel Xeon 6980P with DDR5: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB DDR5-6400, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, Ansys LS-DYNA R11
Intel Xeon 6980P with MRDIMM: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB MRDIMM-8800, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, Ansys LS-DYNA R11
AMD EPYC 9654: Test by Intel as of April 2024, 1 node, 2x AMD EPYC 9654, SMT On, Boost On, NPS4, 1536 GB DDR5-4800, BIOS 1.9, ucode 0xa101148, Ubuntu 24.04, Kernel 6.8.0, Ansys LS-DYNA R11

p) OpenFOAM (motorbike-20m, motorbike-42m)
Intel Xeon 6980P with DDR5: Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB DDR5-6400, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, OpenFOAM v2312
Intel Xeon 6980P with MRDIMM : Test by Intel as of July 2024, 1 node, 2x Intel Xeon 6980P, HT On, Turbo On, SNC3, 1536 GB MRDIMM-8800, BIOS BHSDREL1.86B.0033.D40.2406180419, ucode=0x11000280, Ubuntu 24.04, Kernel 6.8.0, OpenFOAM v2312
AMD EPYC 9654: Test by Intel as of April 2024, 1 node, 2x AMD EPYC 9654, SMT On, Boost On, NPS4, 1536 GB DDR5-4800, BIOS 1.9, ucode 0xa101148, Ubuntu 24.04, Kernel 6.8.0, OpenFOAM v2312

P-core

Configuration: 18



[18] World's Best CPU for AI Inference
a) LLM: GPT-J 6B, Llama2 7B, Llama3 8B
6972P w/MRDIMM:1-node, pre-production platform, 2x Intel(R) Xeon(R) 6972P, 96 cores, 500W TDP, HT On, Turbo On, Total Memory 1536GB (24x64GB MRDIMM 8800MT/s [8800 MT/s]), BIOS BHSDCRB1.IPC.0033.D57.2406240014, microcode 0x11000290, 2x Ethernet Controller 10-Gigabit X540-AT2, 1x 1.7T SAMSUNG MZQL21T9HCJR-00A07, Ubuntu 24.04 LTS, 6.8.0-31-generic. Test by Intel as of 07/10/24.
8592+: 1-node, 2x Intel Xeon Platinum 8592+, 64 cores, 350W TDP, HT On, Turbo On, Total Memory 1024GB (16x64GB DDR5 5600 MT/s [5600 MT/s]), BIOS 3B07.TEL2P1, microcode 0x21000200, 1x Ethernet interface, 2x Ethernet Controller 10-Gigabit X540-AT2, 1x 3.5T Micron_7450_MTFDKCB3T8TFR, Ubuntu 24.04 LTS, 6.8.0-31-generic. Test by Intel as of 07/11/24.
AMD EPYC 9654: 1-node, 2x AMD EPYC 9654, 96 cores, 360W TDP, SMT On, Boost On, Total Memory 1536GB (24x64GB DDR5 4800 MT/s [4800 MT/s]), BIOS 1.6, microcode 0xa101144, 2x Ethernet Controller X550, 1x 3.5T SAMSUNG MZWLJ3T8HBLS-00007, Ubuntu 24.04 LTS, 6.8.0-31-generic. Test by Intel as of 07/09/24.
GPT-J 6B: int8, P90<=100ms, bs=x (128/128), bs=x (1024/128), PyTorch:2.4.0, IPEX: 2.4.0, OneDNN: v3.4.2, Modelzoo: https://github.com/intel/ai-reference-models
Llama2 7B: int8, P90<=100ms, bs=x (128/128), bs=x (1024/128), PyTorch:2.4.0, IPEX: 2.4.0, OneDNN: v3.4.2, Modelzoo:https://github.com/intel/ai-reference-models
Llama3 8B: int8, P90<=100ms, bs=x (128/128), bs=x (1024/128), PyTorch:2.3.0, IPEX: 2.3.0, OneDNN: v3.4.2, Modelzoo: https://github.com/intel/ai-reference-models

b) Inference: BertLarge, ResNet-50, DLRM
6980P w/MRDIMM:1-node, pre-production, 2x Intel(R) 6980P, 128 cores, 500W TDP, HT On, Turbo On, Total Memory 1536GB (24x64GB MRDIMM 8800MT/s [8800 MT/s]), BIOS BHSDCRB1.IPC.0033.D57.2406240014, microcode 0x11000290, 2x Ethernet Controller X550, 1x 1.7T SAMSUNG MZQL21T9HCJR-00A07, Ubuntu 24.04 LTS, 6.8.0-31-generic. Test by Intel as of 08/20/24.
8592+: 1-node, 2x Intel Xeon Platinum 8592+, 64 cores, 350W TDP, HT On, Turbo On, Total Memory 1024GB (16x64GB DDR5 5600 MT/s [5600 MT/s]), BIOS 3B07.TEL2P1, microcode 0x21000230, 2x Ethernet Controller X710 for 10GBASE-T, 1x Ethernet interface, 1x 1.7T SAMSUNG MZQL21T9HCJR-00A07, Ubuntu 24.04 LTS, 6.8.0-31-generic. Test by Intel as of 08/05/24.
AMD EPYC 9654: 1-node, 2x AMD EPYC 9654, 96 cores, 360W TDP, SMT On, Boost On, Total Memory 1536GB (24x64GB DDR5 4800 MT/s [4800 MT/s]), BIOS 1.6, microcode 0xa101144, 2x Ethernet Controller X550, 1x 3.5T Micron_7450_MTFDKCB3T8TFR, Ubuntu 24.04 LTS, 6.8.0-31-generic. Test by Intel as of 08/07/24.
Bert-large: BERT-large, Inference: int8, bs=x, Dataset: SQuAD1.1, Framework: PyTorch:2.4.0, IPEX: 2.4.0, OneDNN: v3.4.2, Modelzoo: https://github.com/intel/ai-reference-models
ResNet50: ResNet50 v1.5, Inference: int8, bs=x, Dataset: ImageNet, Framework: PyTorch:2.4.0, IPEX: 2.4.0, OneDNN: v3.4.2, Modelzoo: https://github.com/intel/ai-reference-models
DLRM: DLRMv2, Inference: int8, bs=x, Dataset: Criteo Terabyte, Framework: PyTorch:2.4.0, IPEX: 2.4.0, OneDNN: v3.4.2, Modelzoo: https://github.com/intel/ai-reference-models

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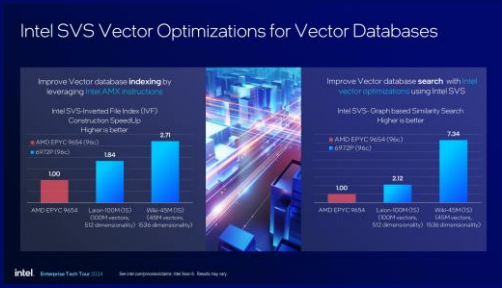
P-core

Configuration: 20

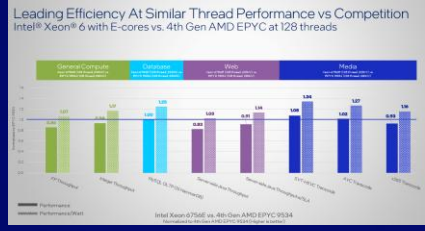
[20] Intel SVS Vector Optimizations for Vector Databases
a) Intel SVS Inverted File Index Construction for Vector Search
6972P: 1-node, pre-production platform, 2x (1used) Intel(R) Xeon(R) 6972P, 96 cores, HT On, Turbo On, Total Memory 1536GB (24x64GB DDR5 6400 MT/s [6400 MT/s]), BIOS BHSDCRB1.IPC.0034.D82.2408060239, microcode 0x10002d0, 1x I210 Gigabit Network Connection, 1x 7T INTEL SSDPE2NV076T8, 1x 894.3G SAMSUNG MZ1L2960HCJR-00A07, Ubuntu 24.04 LTS, 6.8.0-41-generic. Test by Intel as of 09/07/24.
AMD EPYC 9654:1-node, 2x (1used) AMD EPYC 9654 96-Core Processor, 96 cores, SMT On, Boost On, Total Memory 1536GB (24x64GB DDR5 4800 MT/s [4800 MT/s]), BIOS 1.6, microcode 0xa10113e, 2x Ethernet Controller 10G X550T, 1x 5.8T INTEL SSDPE2KE064T8, 1x 1.7T SAMSUNG MZQL21T9HCJR-00A07, Ubuntu 22.04.1 LTS, 5.15.0-119-generic.Test by Intel as of 08/28/24.
Software: IVF based index construction for vector search, SVS IVF BF16, AMD AOCL 4.2.0 for AMD , OneMKL for Intel, Build times are an average of 5 runs, Number of centroids used: 70K for Wiki-45M and 100K for Laion-100M.

b) Intel SVS – Similarity Search
6972P: 1-node, pre-production platform, 2x (1used) Intel(R) Xeon(R) 6972P, 96 cores, HT On, Turbo On, Total Memory 1536GB (24x64GB DDR5 6400 MT/s [6400 MT/s]), BIOS BHSDCRB1.IPC.0033.D57.2406240014, microcode 0x11000290, 2x Ethernet Controller 10-Gigabit X540-AT2, 1x 1.7T SAMSUNG MZQL21T9HCJR-00A07, 1x 5.8T INTEL SSDPE2KE064T8, Ubuntu 22.04.1 LTS, 5.15.0-118-generic. Test by Intel as of 08/28/24.
AMD EPYC 9654:1-node, 2x (1used) AMD EPYC 9654 96-Core Processor, 96 cores, SMT On, Boost On, Total Memory 1536GB (24x64GB DDR5 4800 MT/s [4800 MT/s]), BIOS 1.6, microcode 0xa10113e, 2x Ethernet Controller 10G X550T, 1x 5.8T INTEL SSDPE2KE064T8, 1x 1.7T SAMSUNG MZQL21T9HCJR-00A07, Ubuntu 22.04.1 LTS, 5.15.0-119-generic.Test by Intel as of 08/28/24.
Software: Graph based similarity search on DataSets Wiki45M(45 million vectors, 1536 dimensionality) and Laion-100M(100 million vectors, 512 dimensionality), SVS-FP16(Genoa) SVS-VectorCompression with Intel optimizations(Intel),
Library : robinmap/fmtlib/eve/tomlplusplus/pybind11/MKL/spdlog/catch2/GSL narrow - https://github.com/intel/ScalableVectorSearch/blob/main/THIRD-PARTY-PROGRAMS



E-core

Configurations: Competitive Summary Performance Similar Threads/TDP



Performance varies by use, configuration and other factors. Results may vary. Power used is TDP.
General Compute:
6756E: 1-node, pre-production platform, 2x Intel(R) Xeon(R) 6756E, 128 cores, 225W, HT n/a, Turbo On, Total Memory 1024GB (16x64GB DDR5 6400 MT/s [6400 MT/s]), microcode 0x13000131, 2x BCM57416 NetXtreme-E Dual-Media 10G RDMA Ethernet Controller, 1x 894.3G Micron_7450_MTFDKBG960TFR, Ubuntu 22.04.2 LTS, 6.5.0-28-generic, Test by Intel as of 05/09/24.
9534: 1-node, 2x AMD EPYC 9534 64-Core Processor, 64 cores, 280W, SMT On, Turbo On, Total Memory 1536GB (24x64GB DDR5 4800 MT/s [4800 MT/s]), microcode 0xa10113e, 2x Ethernet Controller 10G X550T, 1x 1.7T SAMSUNG MZWLJ1T9HBJR-00007, Ubuntu 22.04.4 LTS, 6.5.0-26-generic, Test by Intel as of 05/10/24.
Software: est. SPECcpu 2017 int/fp rate: gcc13.1

HammerDB MySQL:
6756E: 1-node, pre-production platform, 2x Intel(R) Xeon(R) 6756E, 128 cores, 225W, HT n/a, Turbo On, Total Memory 1024GB (16x64GB DDR5 6400 MT/s [6400 MT/s]), microcode 0x13000131, 2x Ethernet Controller 10-Gigabit X540-AT2, 1x 1.7T SAMSUNG MZWLJ1T9HBJR-00007, 2x 1.7T KIOXIA KCD8XPUG1T92, 2x 1.7T KIOXIA KCD81PUG1T92, Ubuntu 22.04.4 LTS, 6.5.0-21-generic, Test by Intel as of 05/10/24.
9534: 1-node, 2x AMD EPYC 9534 64-Core Processor, 64 cores, 280W, SMT On, Turbo On, Total Memory 1536GB (24x64GB DDR5 4800 MT/s [4800 MT/s]), microcode 0xa10113e, 2x Ethernet Controller 10G X550T, 4x 1.7T KIOXIA KCD8XPUG1T92, 1x 1.7T SAMSUNG MZWLJ1T9HBJR-00007, Ubuntu 22.04.1 LTS, 6.5.0-21-generic, Test by Intel as of 05/09/24."
Software: HammerDB TPROC-C, MySQL 8.0.33, multi-instance

Server-Side Java:
6756E: 1-node, pre-production platform, 2x Intel(R) Xeon(R) 6756E, 128 cores, HT N/A, Turbo On, Total Memory 1024GB (16x64GB DDR5 6400 MT/s [6400 MT/s]), microcode 0x13000131, 2x Ethernet Controller 10-Gigabit X540-AT2, 2x BCM57416 NetXtreme-E Dual-Media 10G RDMA Ethernet Controller, 1x 1.7T SAMSUNG MZWLJ1T9HBJR-00007, Ubuntu 22.04.4 LTS, 6.5.0-26-generic. Test by Intel as of 05/09/24.
9534: 1-node, 2x AMD EPYC 9534 64-Core Processor, 64 cores, SMT On, Turbo On, Total Memory 1536GB (24x64GB DDR5 4800 MT/s [4800 MT/s]), BIOS 1.6a, microcode 0xa10113e, 2x Ethernet Controller 10G X550T, 1x 3.5T SAMSUNG MZWLJ3T8HBLS-00007, 1x 1.7T SAMSUNG MZQL21T9HCJR-00A07, Ubuntu 22.04.4 LTS, 6.5.0-26-generic. Test by Intel as of 05/10/24.
Software: Server-Side Java, JDK: OpenJDK 21.0.2

Media Transcode:
6756E: 1-node, pre-production platform, 2x Intel(R) Xeon(R) 6756E, 128 cores, HT n/a, Turbo On, Total Memory 1024GB (16x64GB DDR5 6400 MT/s [6400 MT/s]), microcode 0x13000131, 1x I210 Gigabit Network Connection, 1x 3.5T INTEL SSDPF2KX038TZ, Ubuntu 22.04.4 LTS, 6.5.0-25-generic, Test by Intel as of 05/10/24.
9534: 1-node, 2x AMD EPYC 9534 64-Core Processor, 64 cores, SMT On, Turbo On, Total Memory 1536GB (24x64GB DDR5 4800 MT/s [4800 MT/s]), BIOS 1.6, microcode 0xa10113e, 1x Ethernet Controller E810-XXV for SFP, 2x Ethernet Controller 10G X550T, 1x 1.7T SAMSUNG MZWLJ1T9HBJR-00007, Ubuntu 22.04.4 LTS, 6.5.0-26-generic, Test by Intel as of 05/09/24.
Software: FFMPEG: LIBX264_baee400fa9ced6f5481a728138fed6e867b0ff7f, LIBX265_Release_3.5. Geomean HEVC [SVT-HEVC-1080p-preset1,SVT-HEVC-1080p-preset5,SVT-HEVC-1080p-preset7,SVT-HEVC-1080p-preset9,SVT-HEVC-4k-preset5,SVT-HEVC-4k-preset9], AVC [AVC-1080p-fast,AVC-1080p-medium,AVC-1080p-veryslow], x265[x265-1080p-medium,x265-1080p-slow,x265-4k-veryslow].

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Configuration Details

1. “Up to a 1.3x performance improvement compared to the prior generation.”
   – Baseline: 1-node, 1x Intel(R) Xeon(R) E-2314 CPU @ 2.80GHz, 4 cores, HT Off, Turbo On, NUMA 1, Total Memory 128GB (4x32GB DDR4 3200 MT/s [2933 MT/s]), BIOS RKLSE2I1.R00.2124.A18.2303010847, microcode 0x59, 1x I210 Gigabit Network Connection, 1x 894.3G INTEL SSDSC2KG96, Red Hat Enterprise Linux 8.9 (Ootpa), 4.18.0-504.el8.x86_64, est_SPEC CPU2017, Intel IC20232.3 Test by Intel as of November 2023.
   – New: 1-node, 1x Intel(R) Xeon(R) E E-2414, 4 cores, HT Off, Turbo On, NUMA 1, Total Memory 128GB (4x32GB DDR5 4800 MT/s [3600 MT/s]), BIOS CTLSFWI1.R00.3240.A00.2306111911, microcode 0x118, 2x I210 Gigabit Network Connection, 1x Ethernet interface, 1x 894.3G INTEL SSDSC2KG96, Red Hat Enterprise Linux 8.9 (Ootpa), 4.18.0-504.el8.x86_64, est_SPEC CPU2017, Intel IC20232.3 Test by Intel as of November 2023.