SINGLE SOCKET SYSTEMS SUPPORT MORE WORKLOADS THAN BEFORE

CPU Performance Improvements Reduce Costs for Many Workloads

Mainstream Server
SYS-510T-MR

Wall-mount Edge Server
SYS-E403-12P-FN2T

WIO Server
SYS-520P-WTR

SUPERMICRO

Supermicro (Nasdaq: SMCI), the leading innovator in high-performance, high-efficiency server and storage technology is a premier provider of advanced server Building Block Solutions® for Enterprise Data Center, Cloud Computing, Artificial Intelligence, and Edge Computing Systems worldwide. Supermicro is committed to protecting the environment through its "We Keep IT Green®" initiative and provides customers with the most energy-efficient, environmentally-friendly solutions available on the market.

Executive Summary

Processor technology is constantly advancing, and the recently announced new processors from Intel are enabling a shift in the matching of workloads to server capacity selection. The latest 3rd Gen Intel® Xeon® Scalable processors and new Intel® Xeon® E-2300 processors are powerful enough that applications that previously required a dual socket server can now be run on single socket servers. In addition, higher core counts and higher clock rates enable a move to these single socket systems without performance degradation. As a result, organizations and enterprises can take advantage of the reliability of single-socket servers to reduce costs and service their customers better. In general, using a single socket server does not limit the types or intensity of workloads that can be assigned to that system.

Supermicro Single Socket Systems

Supermicro, with its building block architecture, can deliver systems with the latest Intel CPUs to customers with a first to market advantage. Enterprises can quickly integrate a range of single-socket servers based on anticipated workloads.

- These servers, based on 3rd Gen Intel® Xeon® Scalable processors, include:
  - SuperBlade – Highest-density multi-node

  - 5G/Edge – mobile network elements and data center-class computing at the Edge

  - Mainstream – Versatile servers for enterprise applications

  - WIO – I/O optimized servers

- The Intel Xeon E-2300 Series CPUs are available in the following systems from Supermicro.
  - MicroBlade – Versatile and scalable multi-node solutions

  - MicroCloud – High-density systems for scalable cloud hosting

     ○   WIO – Cost Effective I/O optimized servers

     ○   Mainstream – Entry-level enterprise servers

Single Socket Intel CPUs

Intel has recently announced a range of CPUs, starting with 3rd Gen Intel Xeon Scalable processors (previously known as Ice Lake). The 3rd Gen Intel Xeon Scalable processors are designed for demanding data center workloads and applications for medium to large enterprises. These CPUs can be designed into servers from one to four sockets and lead the industry in many performance categories.

The newly announced Intel Xeon E series of CPUs are aimed at Small to Medium Businesses (SMBs) and perform well on moderate workloads. The "E" series is only available for single socket servers and consumes less power than the 3rd Gen Intel Xeon Scalable processors.

Workloads for Single-Socket Systems vs. Dual-Socket Systems

Enterprise workloads range from simple applications (HR, ERP, etc.) to complex workloads that utilize all of the cores in a CPU, require AI hardware, and need fast communication with other systems. Many applications can use multiple cores simultaneously, through multithreading or through OpenMP, for example. Single socket systems can now meet the needed performance requirements for many workloads instead of a dual socket system. Below is a shortlist of popular server workloads and whether a single-socket system will suffice.

Application Workload	Single Socket	Dual Socket/Quad Socket
Database	Good for SMB	Best for Enterprise
OLTP	Suitable for SMB and Enterprise	Excellent for Enterprise
Financial/Accounting	Excellent for SMB & Enterprise	
ERP	Excellent for SMB, Good for Enterprise	Excellent for Enterprise (Training)
HPC	Suitable for small models. Low scalability (multiple servers)	Excellent; multiple servers may be needed
EDA	Excellent for chip simulations	Better for MCAE applications
AI/ML	Good for small models	Excellent with multiple GPUs
Real-time analytics	Good for small queries	Excellent for large data or multiple simultaneous users
Software Development	Suitable for small to medium sized groups	Better for larger projects
Edge Processing	Excellent for on-location	Excellent for data centers, distributed
Content Delivery	Excellent	
Storage systems	Good for SMBs	Excellent for large enterprises
Firewall Protection	Excellent based on inbound traffic	
Gaming	Excellent	A large number of clients

SMBs now have the opportunity to expand their use of AI with the availability of low-cost servers that contain the required hardware to train systems and integrate them into workflows. In addition, single-socket systems now have the performance needed to keep a moderate set of AI accelerators busy.

Performance Gains Over Time

Both 3rd Gen Intel Xeon Scalable processors and Intel Xeon E-2300 CPUs show significant performance gains over previous generations of CPUs. The increased number of cores increased GHz, and more Instructions per Cycle (IPC) contribute to better performance than earlier generations. Over time, the real work that a CPU can perform is a function of the number of cores and the speed of the cores (in Gigahertz).

Single Socket Optimized Intel CPUs

Intel has optimized specific CPUs for single socket servers. Although all 3rd Gen Intel Xeon Scalable processors (83xx (non H models), 63xx, and 43xx) can be used in a single socket configuration, Intel has created a limited number of single-socket optimized CPUs. These include:

SKU	Cores	Base (GHz)	Cache (MB)	TDP (Watts)	Support for PMEM	SGX Enclave
8315N	36	3.5	54	225	Yes	64GB
6314U	32	3.4	48	205	Yes	64GB
6312U	24	3.6	36	185	Yes	64GB

The Intel Xeon "E" series has shown a gradual improvement over time, resulting in more workloads running on these CPUs from Intel.

Intel Xeon E-Series	E-2100	E-2200	E-2300
Name	Coffee Lake	Coffee Lake Refresh	Rocket Lake
Highest # of Cores	6	8	8
SGX Enclave	NA	NA	512MB
Memory Speed	2666MHz	2666MHz	3200MHz
Max. Memory	128GB	128GB	128GB
PCI-E	3.0 w/16 lanes	3.0 w/16 lanes	4.0 w/20 lanes
Max. Frequency (@Highest Cores)	3.8 GHz	3.7 GHz	3.2 GHz
Frequency 1-core Turbo	4.7 GHz	5.0 GHz	5.1 GHz
Graphics Support	No	No	Gen 12

Likewise, the Intel Xeon Scalable Processors show improved capacity in several metrics over time. Comparing the differences between 1st Gen, 2nd Gen, and 3rd Gen Intel Xeon Scalable Processors:

Metric	Skylake (81xx)	Cascade Lake (82xx)	Ice Lake (83xx)	Skylake to Ice Lake	Cascade Lake to Ice Lake
Max Cores	28	28	40	+42%	+42%
Max GHz (at max cores)	2.5 GHz	2.7 GHz	2.3 GHz		
Cores x GHz	70 CoreGHz	75.6 CoreGHz	92 CoreGHz	+31.4%	+21.7%
Max Mem Per Socket (DRAM Only)	.768 TB	1TB	4TB	300%	+420%
PCI-E Speed	8 GT	8 GT	16 GT	+100%	+100%
PCI-E Lanes	48	48	64	+33%	+33%
Total Aggregate PCI-E Performance	384 GT/s	384 GT/s	1024 GT/s	+166%	+167%
UPI Links x Speed	3 x 10.4 GT/s	3 x 10.4 GT/s	3 x 11.2 GT/s	+7.6%	+7.6%

Benefits from the Intel® models 81xx to 82xx to 83xx :

- More cores → More work can get done
- More GHz → Work gets done faster
- More and Faster PCI-E Generation and Lanes → Faster I/O can be performed for many workloads
- More Memory → Larger data sets can be processed, faster

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3rd Gen Intel Xeon Scalable Processor Benefits:

The 3rd Gen Intel® Xeon® Scalable processors have many benefits over previous generations of CPUs. These include:

- More cores compared to the previous generation, with up to 40 cores per socket.
- Optimized for various workloads, including cloud, enterprise, HPC, network, security, and IoT.
- Security includes Intel Crypto Acceleration and Intel SGX to protect data and application code while in use.
- Built-in AI acceleration
- New Instructions that speed up HPC applications, AVX-512
- Intel Speed Select Technology which allows CPUs to do more

Single Socket System Benefits

a. The reduced initial cost for running workloads – Single socket systems can deliver agreed upon SLAs for given workloads due to the increased performance compared to previous generations of CPUs. As a result, single-socket systems are less costly than dual socket systems.

b. Reduced OPEX – Single socket systems produce less heat and consume less power than dual socket systems. Less overall power is consumed in a data center with a typical PUE of 1.2 than dual socket systems. A newer single socket system will consume much less power than an older dual processor system if the workload meets SLAs.

c. Easy upgrades – Over time, a single socket system can easily upgrade the CPU due to the Supermicro Building Block® Solutions design methodology.

d. Faster than previous dual-socket systems – With the incorporation of PCI-E 4.0, I/O operations can be faster than previous generation dual-socket systems that do not have PCI-E 4.0 capability.

e. Additional Security Features – The latest 3rd Gen Intel Xeon Scalable processors have security features that protect data when the data resides in memory.

f. Intel Optane Persistent Memory – 3rd Gen Intel Xeon Scalable processors can address the latest Intel PMem hardware, increasing available memory at a lower cost or as a persistent data storage for critical and hot data.

Summary

Single socket systems now have the raw performance and associated I/O capabilities to serve a wide range of workloads for SMBs and individual departments within large enterprises. The latest generation of processors, including the 3rd Gen Intel Xeon Scalable processors and the Intel Xeon E series, can handle workloads that previously required dual socket systems. By investigating the opportunity to run enterprise workloads on single socket systems, costs can be reduced, and SLAs can easily be met.

Detailed Examples of Supermicro Single Socket Servers

Mainstream Server SYS-510T-MR	Wall-mount Edge Server SYS-E403-12P-FN2T	WIO Server SYS-520P-WTR
• Single Socket H supports Intel® Xeon® E-2300 series processor • 4 DIMMs; Up to 128GB of DDR4 ECC UDIMM memory with speeds of up to 3200MHz • 1 PCI-E 4.0 x16 or 2 PCI-E 4.0 x8 (FHFL); • 1 PCI-E 3.0 x4 (in x8 LP) • Intel® Ethernet Controller X550 2x 10GbE RJ45 • 4x hot-swap 3.5'' Hybrid SATA3/NVMe drive bays, SAS3 with additional controller card; Onboard 2x NVMe M.2 (with Xeon CPU) or 1x NVMe M.2 (with Pentium CPU) • Redundant Platinum 500W Power Supply	• Single Socket 3rd Gen Intel® Xeon Scalable processor up to 32 Cores • 3x PCI-E4.0 x16 slot • 2x 10 Gigabit Ethernet Ports • 4x 2.5" Internal Drive Bays • 4x USB 3.0, 2x USB 2.0	• Single Socket P+ (LGA-4189) 3rd Gen Intel® Xeon® Scalable processor. Up to 270W TDP. • 8 DIMMs; Supports 3DS DDR4-3200: RDIMM/LRDIMM/Intel® Optane® Persistent Memory • 2 PCI-E 4.0 x16 (FHFL) slots, 2 PCI-E 4.0 x8 (LP) slots • Intel® Ethernet Controller X550 2x 10GbE RJ45 • 8x hot-swap 3.5'' SATA3 drive bays, SAS3 with additional SAS controller card, Optional 2x 2.5'' Gen4 NVMe drives at rear; Onboard 1x NVMe/SATA M.2 • Redundant Platinum 650W Power Supply
Key Applications: • Virtualization • Cloud Computing • Enterprise Server • Data Center Optimized	Key Applications: • Multi-Access Edge Computing (MEC) • Universal Customer Premise Equipment (uCPE) • Network Function Virtualization (NFV) • Artificial Intelligence (AI) on Edge, Machine Learning (ML) • Industrial Automation, Retail, Smart Medical Expert Systems	Key Applications: • Data Center Optimized • Database Processing and Storage • Network Appliance

Resources

a. www.supermicro.com/X12

b. www.supermicro.com/xeon-e

c. https://ark.intel.com/content/www/us/en/ark/products/series/204098/3rd-generation-intel-xeon-scalable-processors.html

d. https://www.intel.com/content/www/us/en/products/docs/processors/xeon/3rd-gen-xeon-scalable-processors-brief.html