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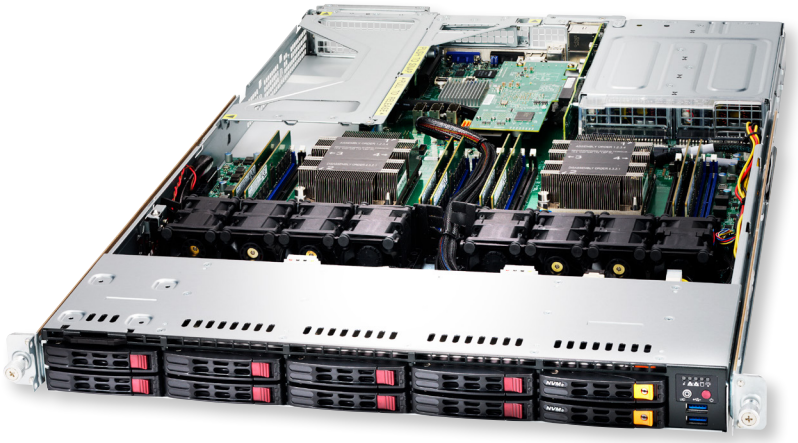
White Paper

New Generation Servers Optimized for Extreme Low-Latency Trading

Supermicro's 5th Generation Hyper-Speed SuperServers Set World Record Performance Mark with Double-Digit Latency Improvement on Financial Applications



Super Micro Computer, Inc.
980 Rock Avenue
San Jose, CA 95131 USA
www.supermicro.com

Low-Latency: The Key to Success

Recently, the upsurge in low-latency trading has allowed investors to achieve tremendous profitability by executing trades at blazing-fast speed. With securities transactions occurring in microseconds and approaching nanoseconds, securities firms whose trading machines are capable of rapidly capturing market data and creating orders will prosper, while slower competitors will fall behind. For this reason, extreme low-latency has become not only key to building trading infrastructures, but also critical to successful investment-banking and hedge-fund operations.

Staying Competitive

To stay competitive in the low-latency trading world, securities firms must deploy the fastest and most powerful servers. These servers, collocated in the same premises as the servers in the securities exchanges, retrieve massive market information from these exchange servers, analyze it with trading strategies, create orders for execution, and send them back to the exchange servers (Figure 1).

While achieving low latency is critical, servers must also deliver consistent trading performance. Jitter in data transmission can cause orders to lag or algorithms to corrupt, leading to undesirable results and significant losses at the end of trading. Thus, careful hardware optimization is necessary to design low-latency, jitter-free servers so securities firms can gain competitive advantage.

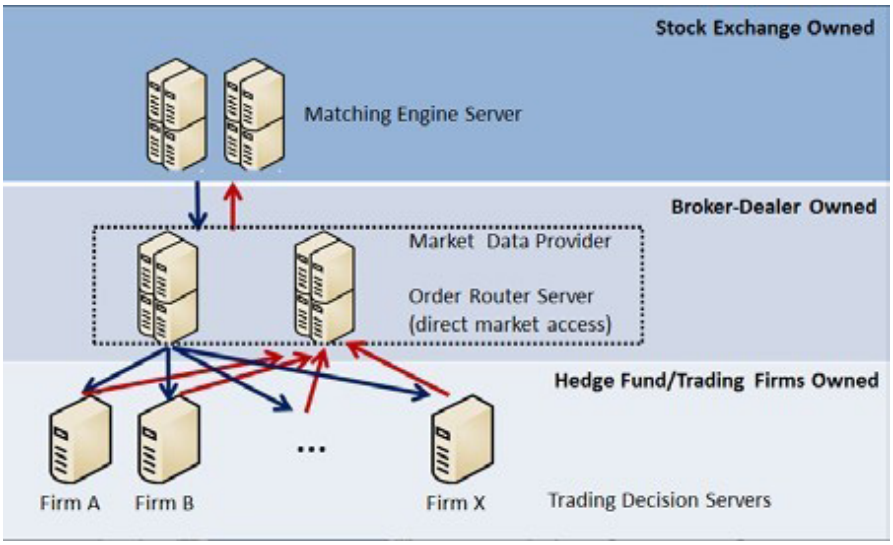


Figure 1. *High Performance Trading Network Diagram*

Supermicro's 5th generation Hyper-Speed & Hyper-Turbo Technologies for Extreme Low-Latency Trading

Dedicated to serving customers in the financial industry, Supermicro introduces the 5th generation Hyper-Speed and Hyper-Turbo technologies: proprietary server-board level optimizations for extreme low-latency trading. These technologies are made possible with the latest VRMs as well as optimized firmware to focus on flexible tuning.

With Hyper-Speed, the CPUs, memory, and PCI-E cards are pre-accelerated in lockstep mode for the most reliable performance. Coupled with Hyper-Speed, Hyper-Turbo allows server system CPUs to maintain maximum Turbo Mode frequency under intense workloads.

Figure 2. *Figure 2: SuperServer® 1029UX-LL1/2/3-S16*

Supermicro Hyper-Speed Ultra Solution

The Hyper-Speed Ultra server system is offered as a total customer solution. It consists of a SuperServer® 1029UX- LL1/2/3-S16 Ultra 1U rackmount server system, featuring three of the latest Intel® Xeon® Scalable Processors (Table 1): Gold 6144 processors (TDP 150W) for the –LL1 offering, Gold 6146 processors (TDP 165W) for the –LL2 offering, and Gold 6154 processors (TDP 200W) for the –LL3 offering.

Furthermore, the server includes 192GB of ECC DDR4-2666MHz RDIMM memory in 12 DIMM slots for the highest bandwidth, 3 PCI- E 3.0 slots that support up to 2 full-height, full-length cards for the fastest I/O throughput, SAS3 hot-swappable SSDs/HDDs, IPMI 2.0 server management over dedicated LAN with Supermicro's suite of out-of-band management software, and redundant 750W Platinum Level (95%+) Digital Switching high-efficiency power supplies.

Table 1. *CPU Specifications with All Cores Enabled*

SKU	-LL1	-LL2	-LL3
CPU	6144	6146	6154
Enabled Cores	8	12	18
Turbo Frequency with Hyper-Speed	4.18GHz	4.00 GHz	3.78 GHz
AVX 2.0 Turbo Frequency	3.57 GHz	3.36 GHz	3.36 GHz

Table 2. *CPU Specifications with 2 Cores Enabled*

SKU	-LL1	-LL2	-LL3
CPU	6144	6146	6154
Enabled Cores	2	2	2
Turbo Frequency with Hyper-Speed	4.28 GHz	4.28 GHz	3.78 GHz
AVX 2.0 Turbo Frequency	3.67 GHz	3.67 GHz	3.67 GHz

Enterprise-class Quality & Reliability

To enhance the quality and reliability of Hyper-Speed Ultra servers, the processors, memory, NICs, and serverboard are pre-screened during integration and each system must pass a rigorous burn-in process. Supermicro pre-accelerates CPUs and memory so customers can focus their resources on software development and tuning. This service is complimented by Supermicro's warranty terms, available onsite services, and dedicated technical support.

Benchmarks

LINPACK is a benchmark that measures a system's floating point computing power. With Skylake CPUs, the new generation Hyper-Speed Ultra servers were able to outperform the previous generation by approximately 53% with the same number of core count.

Table 3. *Hyper-Speed Ultra Gen-4 LINPACK Results*

SKU	-LL1	-LL2	-LL3
CPU	E5-2643 v4	E5-2687W v4	E5-2689 v4
GFLOPS	586.46	1175.21	985.53

Table 4. *Hyper-Speed Ultra Gen-5 LINPACK Results*

SKU	-LL1	-LL2	-LL3
CPU	6144	6146	6154
GFLOPS	1257.12	1797.56	2159.27

Sockperf is a network testing tool that measures network latency and network latency spikes. UDP 64-byte packets were ping-ponged at 600K messages per second between two Hyper-Speed Ultra –LL1 servers via Mellanox MCX354A. The new Supermicro Hyper-Speed Ultra server has improved significantly in jitter (difference of median latency and 99.99% latency) reduction by nearly 80% from its previous generation (Figure 3).

```
sockperf: ---> percentile 99.999 =   1.410
sockperf: ---> percentile 99.990 =   1.303
sockperf: ---> percentile 99.900 =   1.289
sockperf: ---> percentile 99.000 =   1.271
sockperf: ---> percentile 90.000 =   1.067
sockperf: ---> percentile 75.000 =   1.058
sockperf: ---> percentile 50.000 =   1.051
sockperf: ---> percentile 25.000 =   1.045
```

Figure 3. *1029UX-LL1-S16 Sockperf Results*

STAC-N1 is a benchmark developed by STAC (Securities Technology Analysis Center) that measures the performance of a host network stack using a market data style workload. This benchmark was performed on a pair of Supermicro SYS-1029UX-LL1-S16 servers, each with dual 8-core Intel® Xeon® Scalable 6144 (Gold) processors overclocked to 4.18GHz. Both servers were also loaded with Red Hat Enterprise Linux 7.5 and Solarflare X2522 Adapters.

Compared to all prior publicly released STAC-N1 results, the bare metal system demonstrated the lowest mean latency of 2.3 microseconds at both the base rate (100k messages per second) and the highest rate tested ever (1 million mps).

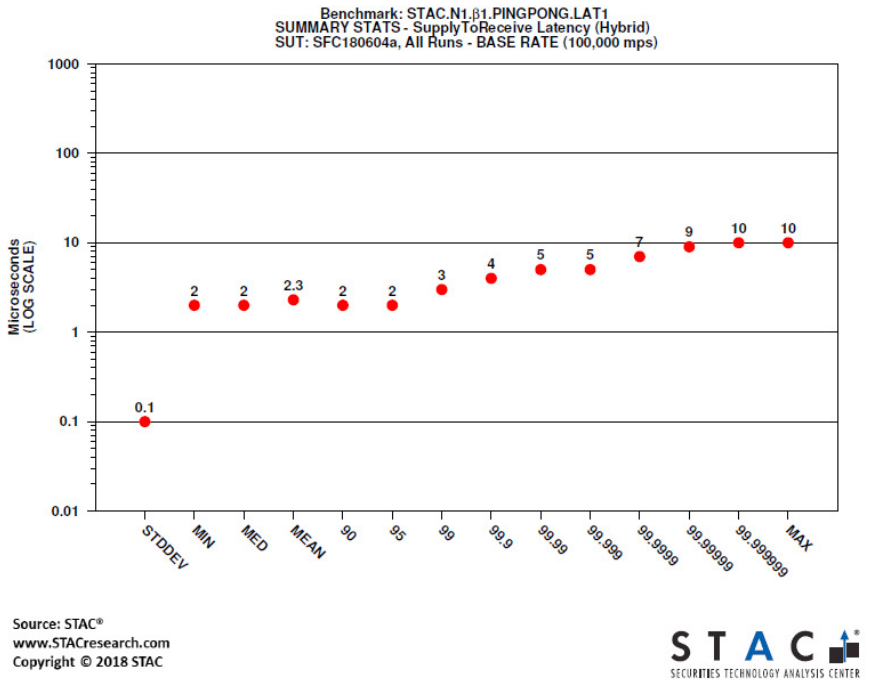
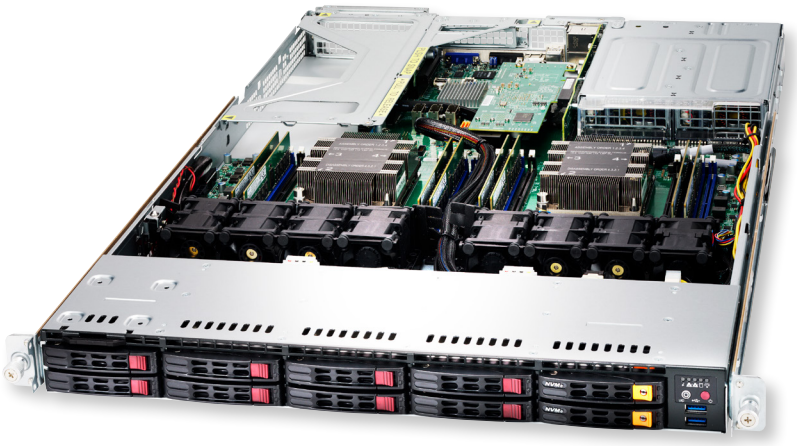


Figure 4. *1029UX-LL1-S8 STAC-N1 Results*

Hyper-Speed Ultra Benefits Review



In addition to providing a reliable server solution with the lowest latency, the least jitter, and the best performance, Supermicro continues its mission to help its customers to lower costs as well as maximize revenues.

The Hyper-Speed Ultra architecture supports the most powerful Xeon 205W CPUs in a dense 1U form factor. Hyper-Speed Ultra also houses 2 full-height, full-length cards, 1 low-profile card, and an integrated SAS3 card. This expandability is further backed by efficient air-cooling to maintain optimal system performance and stability.

Designed as a turnkey system, the Hyper-Speed Ultra server saves customers time and manpower needed for integration, tuning, and testing. Supermicro has also pre- qualified NIC cards and pre-screened components before factory installation. Supermicro's extensive system testing and tuning ensure that every Hyper-Speed Ultra will operate flawlessly out-of-the-box.

Since securities firms often have limited access to their collocated servers, Supermicro supports remote management in the Hyper-Speed Ultra servers. Integrated with IPMI 2.0, the Hyper-Speed Ultra server includes a dedicated IPMI LAN port and a suite of enterprise-class management utilities: standard features which enable users to control, monitor, and automate updates to their servers in remote and effortless fashion.

Having access to the most advanced hardware with planned refresh cycles allows securities firms to outpace their opponents in low-latency trading. As an industry- leading server supplier, Supermicro is committed to providing the latest technology and will continue to build on its reputation with the Hyper-Speed Ultra platform.

For more information, visit www.supermicro/Hyper-Speed

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About Super Micro Computer, Inc.

Supermicro® (NASDAQ: SMCI), the leading innovator in high-performance, high-efficiency server technology is a premier provider of advanced server Building Block Solutions® for Data Center, Cloud Computing, Enterprise IT, Hadoop/Big Data, HPC and Embedded 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.

Learn more on www.supermicro.com

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