PRODUCT BRIEF

SUPERMICRO'S HIGHLY EFFICIENT 1OU FLEXTWIN: NEXT-GEN POWER AND COOLING FOR HIGH PERFORMANCE COMPUTING WORKLOADS

New System is Designed for OCP ORv3 Racks for Increased Data Center Compatibility

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Executive Summary

Global data centers are at a critical inflection point, as high-performance computing (HPC) and cloud service providers (CSPs) need more compute within the same facility's power envelope, which is constrained by cooling capacity and the inability to get more energy to support the business objectives.

As processors' Thermal Design Power (TDP) and rack-level computing density continue to increase with every generation, traditional air cooling and power delivery have reached their physical limits. 1U air-cooled platforms have thermal constraints, as their designs have limited heat dissipation, creating inefficiencies that matter at scale. For high-power-density environments, transitioning to Direct Liquid Cooling (DLC) is a strategic requirement to prevent thermal throttling and ensure that the latest processors and high-frequency memory maintain peak performance under sustained workloads.

Built on the Open Compute Project's ORv3 rack architecture to optimize power delivery, improve reliability and serviceability, and maximize power savings, the new Supermicro rack-scale 1OU 2-Node system is designed from the ground up for extreme compute density. Powered by the latest Intel® Xeon® processors, the system delivers higher compute per rack with balanced performance and efficiency, helping operators scale faster, with a broader spectrum of configuration choices, and future-proof infrastructure for the most demanding workloads.

Highlights

- Maximize rack performance and density without compromise. Fit more nodes and cores per rack while sustaining performance under strict power limits with a 1OU, 2-node system built on the latest Intel Xeon 6 series processors featuring P-cores (performance cores) and E-cores (efficient cores).

- Improve infrastructure efficiency at rack scale. An integrated power busbar with unified power shelves and liquid-cooled nodes reduces distribution losses and cooling overhead, helping lower operating costs.

- Future-ready design with easy deployment and operations, the OCP rack provides a clean, modular design, while hot-pluggable components streamline service, accelerate maintenance, and reduce operational risk in dense environments.

Target Customer and Use Cases

HPC / Dense Compute Performance – Optimized for Intel Xeon 6900 Series with P-cores

Built for HPC operators running compute- and memory-intensive workloads, the 1OU 2-Node provides liquid-cooled, high-performance, dense racks ideal for research, government, fintech, and higher education.

The latest HPC applications are highly distributed at the CPU level across multiple cores within the same servers, on dual-socket motherboards, and across systems. Certain applications have been designed to use thousands of cores concurrently, with high memory bandwidth, and will greatly benefit from the new Supermicro 1OU 2-Node design.

Engineered for maximum performance-per-dollar-per-watt, the X14 Supermicro 1OU 2-Node (with P-core) system is the newest liquid-cooled, rack-scale foundation that delivers sustained single-thread performance with low latency for a broad spectrum of the most demanding High-Performance Computing (HPC) workloads.

Targeted P-core use cases include:

- Manufacturing: Computational Fluid Dynamics (CFD) for aerodynamic optimization; crash simulations; and Multiphysics modeling for materials refinement and production process optimization.
- Scientific Research & Complex Modeling: Climate and weather modeling, computational physics, material and life sciences.
- Government & Defense: Mission-Critical Performance for National Security, Nuclear Science, military simulations, etc.
- Financial Services: risk analysis and market simulation.
- Oil & Gas: Seismic data processing and reservoir simulation.

CSP / Throughput Per Watt (E-core optimized):

Designed for cloud service providers, the E-core–optimized 1OU 2-Node version is ideal when maximum cores per rack (up to 288 cores/socket) are required and when better performance per dollar per watt is needed under tight facility power limits, helping reduce overall Total Cost of Ownership (TCO).

Targeted E-core use cases include:

- Cloud-native applications.
- High-concurrency Software-as-a-Service (SaaS) tiers.
- Containerized App/DevOps pipelines.
- Large-scale “always-on” consumer digital services.

Key Features

Each 1OU server integrates two independent nodes into a single rack unit and uses direct-to-CPU liquid cooling to support Intel’s highest-performance Intel Xeon series 6900 series 500W processors, enabling sustained performance without throttling.

FlexTwin ORv3 enables advanced cold plate configurations, delivering heat capture rates ranging from 61% to 90% for maximum efficiency by dissipating heat from the CPU, memory, and VRM.

It can achieve a data center-neutral thermal load when combined with advanced liquid cooling options and a Supermicro Rear Door Heat Exchanger (RDHx), thereby reducing cooling overhead and improving overall facility efficiency. Supermicro’s broader liquid-cooling portfolio includes systems that can capture up to 95–97% of heat, enabling more effective thermal management at scale.

Designed for compute density at scale, 1OU 2N is front serviceable to streamline maintenance in production racks. Front serviceable nodes, I/O, and storage are accessed entirely from the cold aisle, minimizing service time and reducing the risk of disruption to adjacent systems. By avoiding rear-aisle intervention in high-density cable zones, operators can service systems more easily because fewer power cords and hoses are required.

- Dense form factor: 1OU with 2x dual socket server nodes.
- Uncompromised performance: Intel Xeon 6900 Series processors with up to 128 P-cores (Performance cores).
- High core count: Intel Xeon 6+ processors with up to 288 cores per socket (Efficient cores).
- Larger memory configuration: 24 DIMM slots per node; up to 6TB.
- Liquid cooling: DLC systems with in-rack and in-row CDU options.
- High-speed networking:
    - 1 AIOM (OCP3.0) or 1 Standard LP PCIe 5.0 x 16 riser slot from CPU1
    - 1 FHHL PCIe 5.0 x 16 riser slot from CPU1
    - 1 FHHL PCIe 5.0 x 16 riser slot from CPU2
- Storage: 2 front hot-swap E1.S NVME drive bays, 2 M.2 internal cards.
- Easy to deploy and service 21” Rack level solution (ORv3) with integrated power busbars (SYS-122FT-DEO-LCC).
- Rack: OCP ORv3 Rack.

Figure 1 - Supermicro 1OU FlexTwin Server

Solution Overview/Differentiation

The new Supermicro 1OU 2-Node system is a flexible design delivered as a fully integrated ORv3 rack-scale solution optimized for high-density deployments in a 44OU rack. A single 44OU rack can accommodate up to 40 Supermicro X14 1OU 2-Node systems or 80 nodes and 46,080 cores.

The 21" ORv3-based rack infrastructure integrates power shelves with blind-mate power and cooling, eliminating PSU/PDU complexity at the system level while enabling higher power density and more compute per rack. This approach reduces the number of power components, lowers cost, and improves MTBF compared with standard 19" rack versions.

Supermicro's ORv3 racks include integrated power busbars and DLC manifolds that support both in-rack and in-row CDUs. The power busbar design helps eliminate back-of-rack serviceability and cabling requirements. Busbar racks simplify and improve efficiency by delivering power directly through the rack, so each 1OU server does not need its own power unit. This frees up space for more compute, reduces complexity, and helps customers increase rack density while improving overall power efficiency. To ensure consistent performance and reliability, each cluster is factory-built to Supermicro quality standards and undergoes comprehensive validation—including stress testing and coolant pressure checks—before shipment.

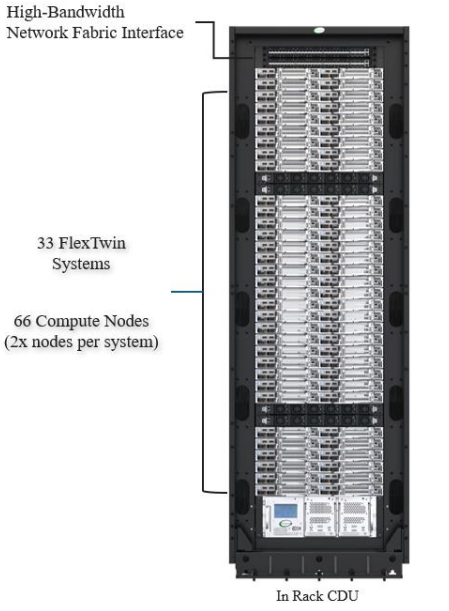

Figure 2 - Rack of 1OU 33 FlexTwins (66 Compute Nodes) with In-Rack CDU

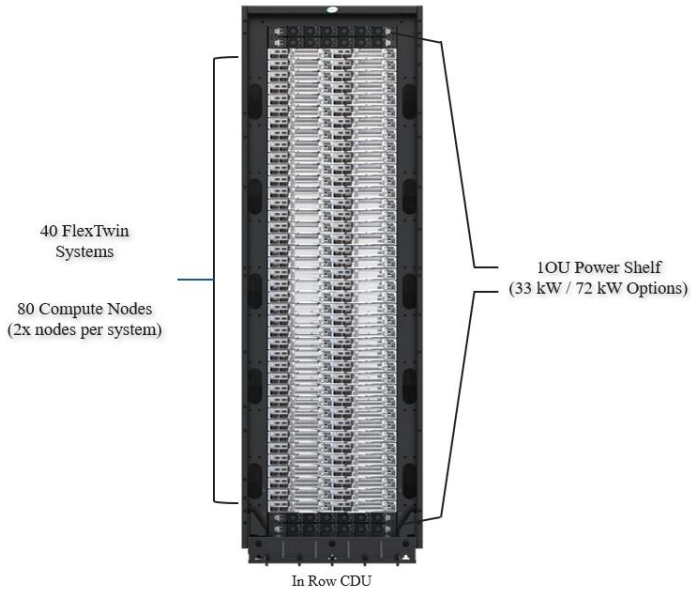

Figure 3 - Rack of 1OU 40 FlexTwins (80 Compute Nodes) Utilizing In-Row CDU (Not Shown)

Large-Scale Computing Environments

Enterprise HPC environments are meant to be shared by many organizations. While some HPC applications can scale to hundreds of cores, a single FlexTwin rack can scale to thousands of cores. And when configured in a cluster, hundreds of thousands of cores are available for HPC workloads. To maximize the footprint, using an in-row CDU allows more FlexTwin servers per sq. ft. of floor space.

Figure 4 - 12 Racks of FlexTwin Server with 2 Networking Racks and an In-Row CDU (960 Compute Nodes)

Conclusion

Modern HPC and CSP operators can now achieve performance, efficiency, density, and serviceability together. The new 1OU 2-Node rack-scale system is built for organizations that need uncompromising compute in power-constrained data centers, delivering a scalable, sustainable, and flexible platform that is easier to deploy, operate, and expand.

Designed from the ground up around OCP ORv3 standards, it modernizes the rack as the unit of optimization, enabling consistent integration, cost optimization, simplified expansion, and a clear path to future generations of processors, memory, and high-speed infrastructure.

Supporting up to 80 nodes per 44OU rack, 1OU 2-Node increases compute density while improving power delivery efficiency through an integrated busbar and unified power shelves. Liquid cooling further reduces thermal constraints, helping operators run higher rack power levels with greater predictability. Front-access serviceability and hot-pluggable components accelerate maintenance, reduce operational risk in dense environments, and strengthen overall reliability. The result is a compelling rack-scale foundation for organizations scaling HPC and CSP workloads—meeting the performance, efficiency, and uptime demands of mission-critical operations.

For More Information:

Supermicro FlexTwin: https://www.supermicro.com/en/products/flextwin

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