



SUPERMICRO X14 HYPER SYSTEMS WITH SINGLE SOCKET INTEL® XEON® PROCESSORS DELIVER HIGH PERFORMANCE FOR SOFTWARE DEFINED STORAGE SOLUTIONS

Supermicro X14 Systems Deliver Outstanding Storage Performance and Power Efficiency for Optimal Storage Solutions in AI, HPC, and Critical Enterprise Applications.



Supermicro Hyper SuperServer SYS-212H-TN

Executive Summary

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In the AI-driven era, the massive influx of unstructured data volume outpaced legacy storage capabilities, creating a bottleneck that prevents enterprises from effectively scaling and monetizing their data assets. Supermicro's new X14 Hyper SuperServer SYS-212H-TN redefines Software-Defined Storage (SDS) infrastructure, purpose-built to crush these traditional limits. Leveraging a single-socket design powered by the Intel Xeon 6 processor, this architecture delivers extreme storage density, superior power efficiency, and unmatched PCIe bandwidth for optimal network and storage fan-out. In this article, we built and tested an 8-node solution cluster deployment as a starting point for Reference Architectures (RA).




The test done with MinIO AIStor shows unprecedented performance and excellent energy efficiency. Supermicro’s validated SDS RA empowers organizations to transition from fragmented, costly storage to a system offering exceptional scalability and durability.

Supermicro Software-Defined Storage Solution Reference Architecture

The Reference Architecture (RA) created for SDS solutions, starting from 8-nodes carrying forward Supermicro spirit: High flexibility and easy to deploy, enterprise users can expect plug and play the solution on day 1 deployment, with strong features:

- Impressive Storage Density: A reference solution configuration with 8 nodes can offer 19.6PB raw capacity with the state-of-the-art SSD technology, ready to scale easily to Exabyte capacity.
- Extreme throughput: Proven solution delivers extremely high networking throughput, fully utilizing bandwidth.
- Proven endurance: Supermicro validated RA can deliver high endurance and optimized capacity per dollar.
- High energy efficiency: When operating under full GET/PUT workloads, the energy efficiency is significantly better compared to the previous generation platforms.



Qualified Platform:	Hyper <u>SuperServer</u> SYS-212H-TN
Per System	
CPU:	Intel Xeon6 Processor
Memory:	Total 256GB DDR5-6400
Network Port Options:	2x 400GbE OSFP or 4x 200GbE QSFP112
Drive Slots:	20x Gen5 <u>NVMe</u> U.2 slots
Drive Options:	30TB/60TB/122TB TLC/ <u>QLC NVMe</u> Drives
PSU:	Dual Titanium Level 1200W PSU N+N Redundant
Networking	
High speed data Switch:	Supermicro 400G/800G switch
Management Switch:	Supermicro 10G switch

Figure 1 - Supermicro SDS solution reference architecture

Key Solution Components

SDS solutions have played a crucial role in the AI/HPC and data storage industries for many years. The key values SDS solutions bring to users include ease of scaling, intelligent data management, automation, API-driven operations, and cloud-native architecture. In addition, thanks to its well-designed architecture, SDS can deliver extreme performance for modern workloads while maintaining the highest availability.

System Details

Powered by the groundbreaking Intel Xeon 6 with P-cores as a dedicated 1-socket solution, the SYS-212H-TN delivers:

- **Simple Architecture:** Dedicated single socket design with rich I/O capabilities.
- **Unprecedented I/O:** 136 Gen 5.0 PCIe lanes
- **Massive Memory:** Up to 2TB of 6400MT/s ECC DDR5 RDIMM
- **Extreme Storage Density:** 8-24x SATA/SAS/NVMe SSDs per 2U system
- **Network Bandwidth:** PCIe Gen 5 x16 support delivers 400Gbps networking
- **Scalability:** Meets the demands of modern storage workloads with unprecedented capability

As configured for this RA, a single Hyper SuperServer SYS-212H-TN system with an Intel Xeon processor can deliver 800 Gbps of Ethernet and up to 2.4 PB of PCIe Gen5 data storage for an SDS solution, with redundant boot drives and a 1/10 Gbps management network. This capability demonstrates extremely high storage density, network throughput, and power efficiency in a single server.

Software Details

MinIO AIStor is an S3-compatible, exascale object store for AI data designed for enterprise on-premises environments. It delivers high performance, scalability, and cost efficiency for data-intensive workloads such as AI, analytics, and data lakehouses—enabling organizations to maximize the value of their existing AI and data investments.

MinIO WARP is an open-source, high-performance S3 benchmarking tool for measuring object storage throughput and latency. It supports realistic workloads (PUT/GET/MIXED), distributed testing across multiple clients, comprehensive analysis of results, and flexible configuration for object size and concurrency on any S3-compatible system.

Extremely High Performance and Power Efficiency for SDS nodes

Supermicro deployed an 8-node SDS solution cluster in its validation lab to qualify the solution under real-world conditions. MinIO was selected as a key technology partner based on its high-performance characteristics and comprehensive S3 compatibility. Validation testing spanned multiple days and included both performance benchmarking and energy consumption analysis across a range of workload scenarios.

Component	Description	QTY installed per node
Storage Server	Hyper SuperServer SYS-212H-TN	1
CPU	Intel Xeon 6 6761P 64core Processor 350W	1
Memory	DDR5-6400 32G	8
Data Drive	NVMe Gen5 QLC/TLC	20
Boot Drive	NVMe M.2	2
NIC	AIOM 2-port 10G/1GBase-T / ConnectX-7 400GbE	1 / 2

Table 1 – Supermicro SDS solution reference architecture – single Hyper SuperServer configuration

Test Environment:

- 400G/800G non-blocking Ethernet switch; 10G management switch.
- MinIO cluster with eight (8) nodes SYS-212H-TN, each equipped with dual 400G NIC for data traffic and a 10G NIC for operation.
- Eight (8) load generation client machines, each with dual 400G NICs for data traffic and a 10G NIC for operation.

To extract maximum performance from the SDS cluster, a holistic optimization approach was employed. BIOS-level tuning was executed to precisely balance of Intel Xeon compute, memory, and PCIe bandwidth. This ensured optimal alignment between NVMe drive access and NIC network traffic, followed by fine-tuning of hardware and software interactions across all nodes to maximize cluster-wide efficiency.

During sustained GET operations with 4096 concurrent requests with 64MiB objects, the cluster achieved up to 390.5GiB/s of throughput using MinIO WARP. This throughput is exceptionally high for an eight (8) node configuration operating under realistic conditions. This performance demonstrates that the RA fully maximizes platform resource and bandwidth utilization, guaranteeing an outstanding return on investment.

Power Consumption Metrics

In addition to performance testing, we measured energy consumption across multiple operating conditions, and all results show significant efficiency improvements compared to previous-generation platforms. The estimated average power consumption of the MinIO eight-node cluster in idle mode is about 3.5kW per node (~432W).

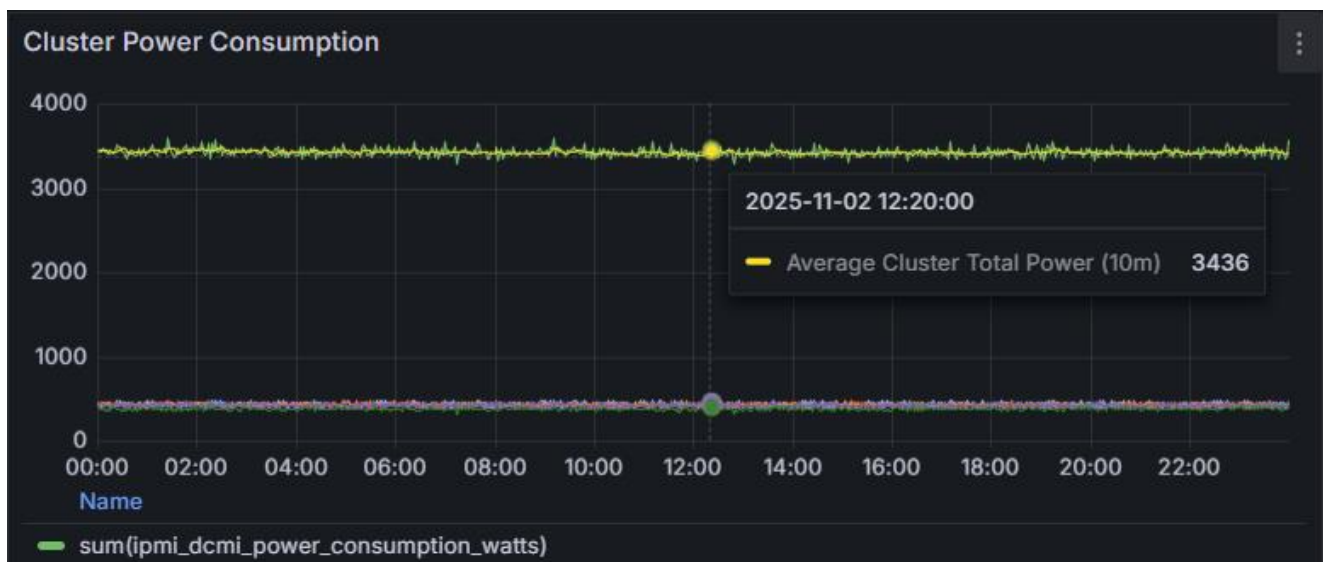


Figure 2 – Average Power Consumption of the Eight-node Test Cluster in Idle Mode

During sustained GET operations, the measured energy consumption was approximately 5264W across all eight nodes, or ~660W per node.

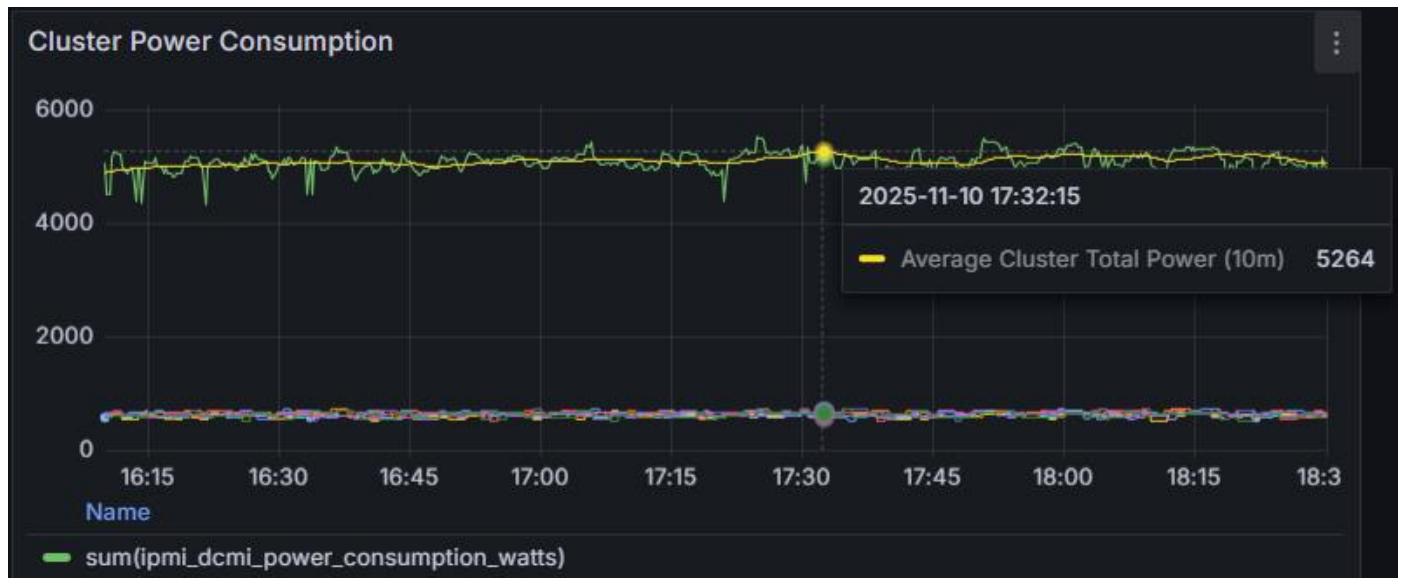


Figure 3 – Average Power Consumption of the Eight-node Test Cluster in Sustained GET Mode

During sustained PUT operations, the measured energy consumption was approximately 6500W across all eight nodes, or ~813W per node.

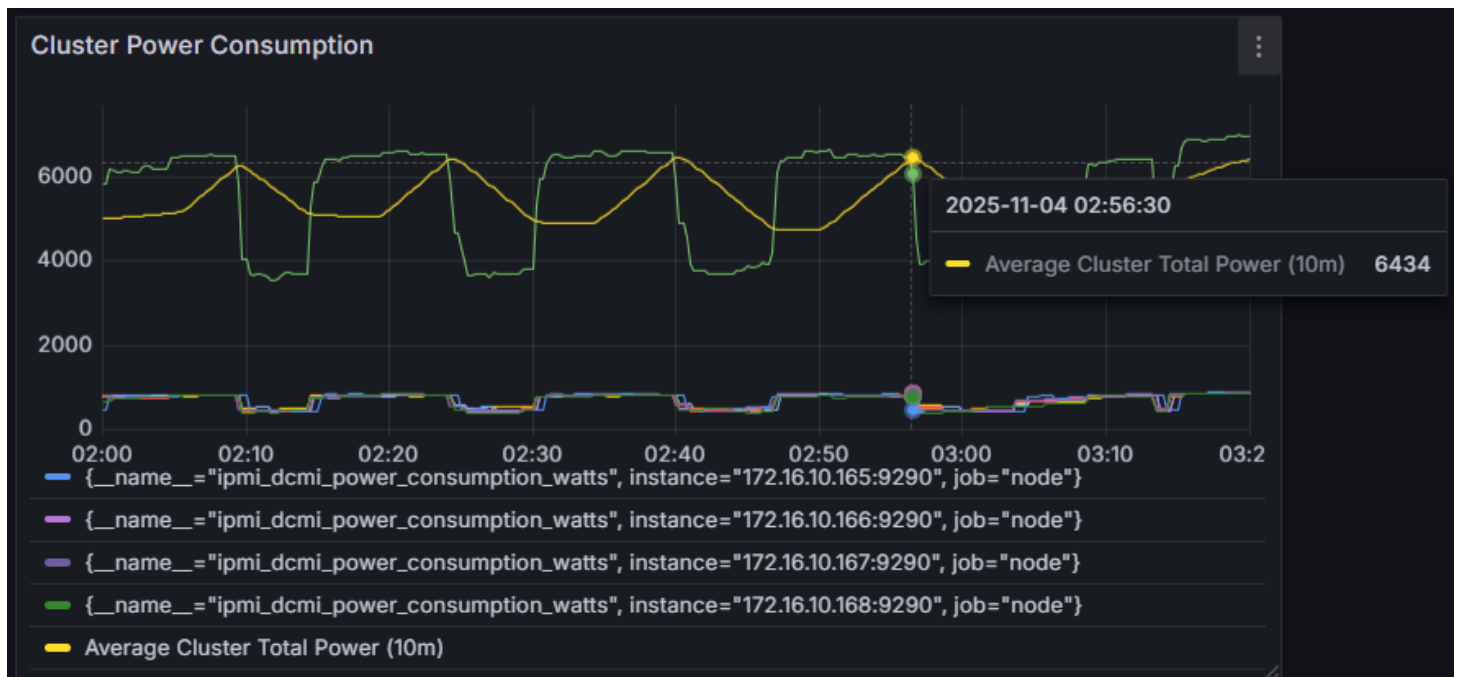


Figure 4 - Average Power Consumption of Eight-node Test Cluster in Sustained PUT Mode

Summary

The Supermicro Software-Defined Storage (SDS) RA, powered by the Hyper SuperServer SYS-212H-TN and Intel Xeon processor, delivers a winning combination of performance and efficiency. The system architecture meets the sweet spots of storage and networking distribution. Validation with MinIO AIStor demonstrated industry-leading throughput and outstanding power efficiency, resulting in lower operating costs. Customers benefit from plug-and-play day-one deployment and a flexible architecture that significantly reduces maintenance effort. The solution's unprecedented throughput of 390.5 GiB/s is perfectly tailored to meet the demanding requirements of modern AI infrastructure.

Further Information

<https://www.supermicro.com/en/products/system/hyper/2u/sys-212h-tn>

<https://www.min.io/>

<https://www.intel.com/content/www/us/en/products/details/processors/xeon.html>

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