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White Paper

Best Performance and Value for Enterprise and Cloud Storage

Supermicro Density-optimized Top-loading Storage Solutions

Executive Summary

Supermicro top-loading, capacity-maximized SuperStorage family is ideal to meet growing capacity challenges, with use cases such as object storage, data backup & replication, archive and cold storage, video streaming and surveillance. The complete offering of dense servers and JBOD enclosures provides customers with more choices to deploy massive capacity in a growing software-defined ecosystem.

This paper details the design advantages of Supermicro's top-loading SuperStorage family and how our density optimized system deliver the highest performance to support data intensive workloads. In addition offering usability features to improved operational efficiency for high capacity storage deployments.



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The High Density Storage Challenge

While most of the recent innovations in storage have been focused on flash memory technology, the vast majority of data will remain on magnetic hard disk drives (HDDs) for the foreseeable future. HDDs have not only continued to increase in capacity -- from 1 TB per drive a few years ago to 14 TB today -- but are also available at 1/10 the cost of flash storage. At the same time modern CPU technology has progressed to the point where a single CPU can handle 60 to 100 HDDs with ease.

Drive for Operational Efficiency

So how does one accommodate a tripling of demand for storage in existing facilities? The answer lies with dense devices packed in high density storage systems.

Exponential Capacity Growth

Storage requirements have continued to increase. According to predictions by industry experts the total demand for storage will increase from 15,000 exabytes in 2017 to almost 45,000 exabytes in 2020. This represents a tripling of demand for storage over the next three years. The reasons are many: Big Data, IoT, AI, video surveillance, high resolution media, etc. We are less concerned about the reasons, and more with the impending problem of tripling of demand for storage in existing or modestly growing datacenters.

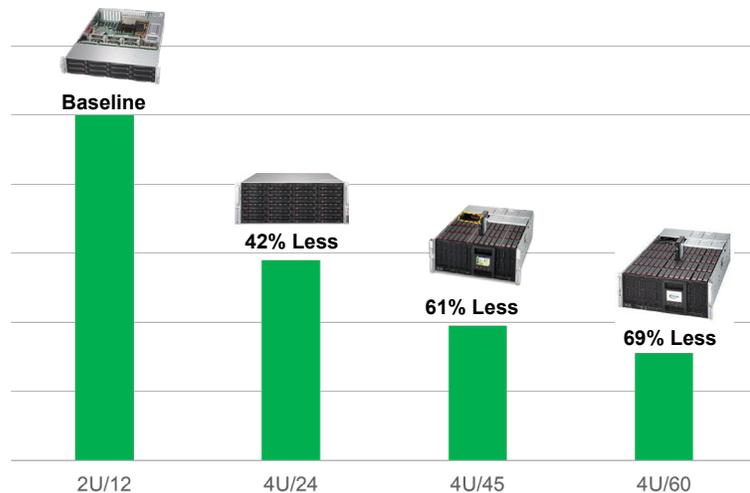


Figure 1. Comparative cost per GB Comparison with traditional front-loading servers

The acquisition cost per GB of a 4U top-loading storage system is approximately 61% percent lower than a traditional 2U 12-bay system, providing a far more economical storage cost model. With similar system configurations (CPU, memory and etc), the top-loading system provides an estimated 249GB per watt better power efficiency advantage, when compared to a traditional 2U 12-bay system. This represents around two and a half times more storage capacity per watt, reducing operating costs in data centers.

The Supermicro Top-loading Advantage

Supermicro's top-loading storage products are built on best-in-class 12GB/s SAS technology providing optimal performance for all SAS/SATA media including SSDs. In a head-to-head benchmark with a competing 60-bay system, Supermicro's robust design demonstrates aggregate performance advantages with the greatest flexibility in both media and CPU selection. Supermicro leads the top-loading category with support for dual CPUs up to 205W each and up to 3TB of memory across 24 DIMM slots.

	Other Tier1	Supermicro	Why?
Processor	16-22 cores (80W-165W)	Up to 28 core CPU (205W)	Supports intensive workloads - Ability to do more
Memory	Up to 2 TB (12-16 DIMMs)	Up to 3 TB (24 DIMMs)	Flexible population – From Maximum to Cost Optimized
Networking	Dual 10GBase-T On board	Flexible SIOM networking	More bandwidth – Up to 3x PCI-E 3.0 x16
Disks	60 HDD + 8 NVMe or 36 HDD+24 SSD + 8 NVMe	45 or 60 HDD + SSD + 6 NVMe	More bandwidth – Flexible controller options
Depth (excluding CMA)	42"	26" for 45-bay server & JBOD 30" for 60-bay server & JBOD	Short depth - Fits hyper-scale DC to on premise SMB
Cooling & Vibration	4 fans	5 fans (higher CFM)	Supports More Powerful System - More Performance
Price / Performance	Single vendor HDD support, fixed configuration.	Media from all vendors (off the shelf), flexible configurations.	Configure to order! – Flexible user choices

Advance x16 SAS connectivity -Top-load+ models

For the ultimate SAS/SATA media performance Supermicro is introducing the Top-load+ models that use a Broadcom 3216 based controllers that feature PCI-E 3.0 x16 lanes to 16 port SAS3 architecture. SSG-6049P-E1CR45 H/L+ , SSG-6049P-E1CR60 H/L+ models are especially good at driving latency performance on applications with lower client thread counts or low concurrent I/O queues, like data backup or other applications that access the storage through a gateway.

Supermicro supports the fastest x86 CPU and Memory

While other Tier-1 vendors top-loading systems support limited archival applications the Supermicro Top-loading storage server offers the highest x86 specifications for both CPU and memory, making it an ideal platform for the latest software defined storage applications.

Supermicro top-loading storage systems support up to the highest performance Intel® Xeon® Scalable processors with 205W TDP, providing the more cores at higher base frequencies to deliver optimal system performance for both throughput and IOP intensive workloads.

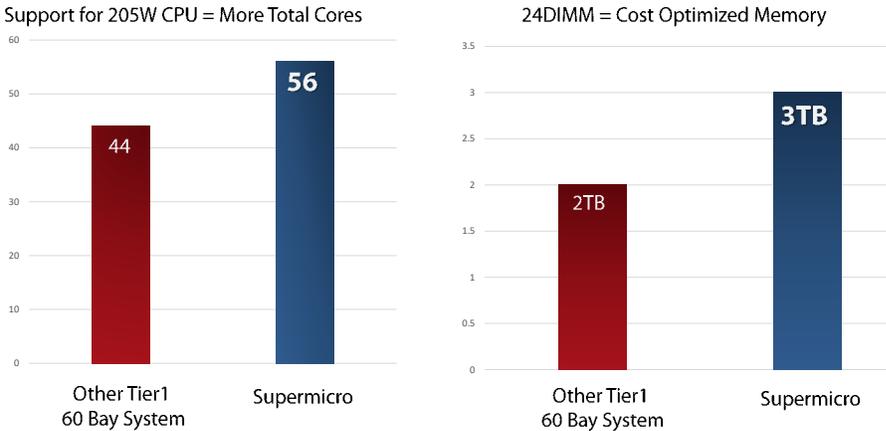
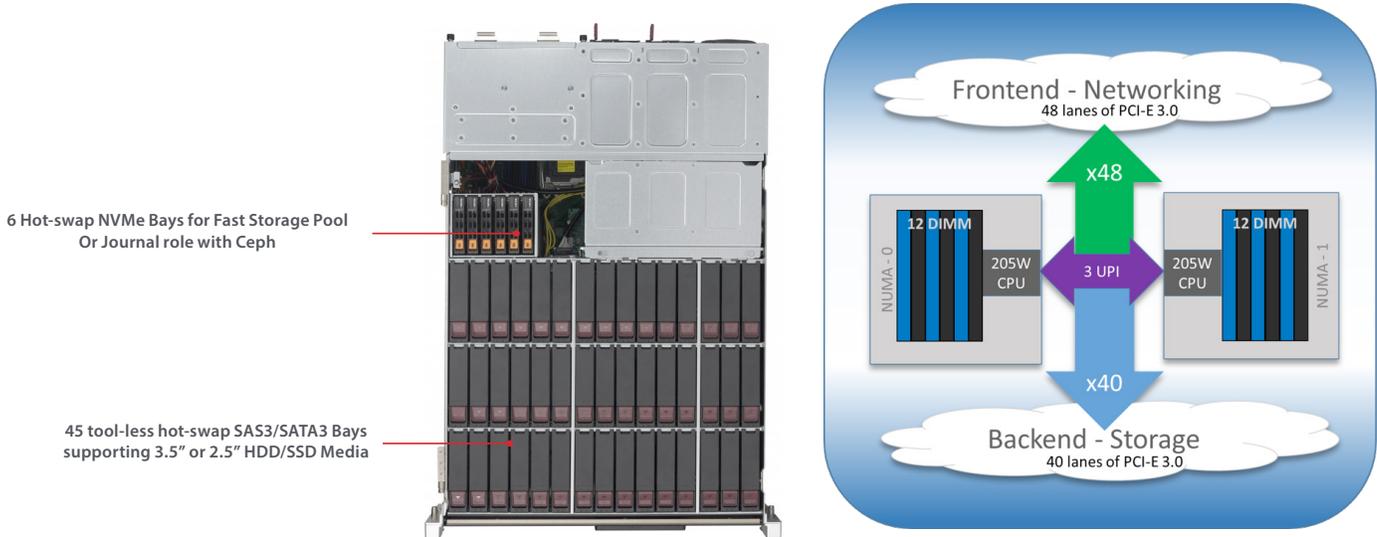


Figure 2. Comparative CPU Cores in Total Supported Memory, Supermicro vs Tier 1 Competitor

Balanced System Resources for Maximum I/O



With equivalent I/O bandwidth on both the frontend and backend, users get great performance from the start. This also enables advanced users the ability to configure the hardware and optimize their software to meet their application requirements.

With 24 DIMM slots, users have most options for memory population, allowing up to 3TB of memory to be installed or the flexibility to populate with lower capacity DIMMs for the best value / TCO.

Innovative technology

Free floating drive bay design not only eliminate weight and vibration from the drives, it also improve system airflow, which allow lower fan speeds, lower noise, and lower power consumption.



Designed for Efficiency & Performance

The optimized opening of the 3.5" drive bay structure provides the best air flow, allowing for efficient heat transfer to cool the drive. This structure also physically supports the media to reduce stress between the drive bays and the backplane, isolating each bay from the rotational vibration of its neighboring drive bay.

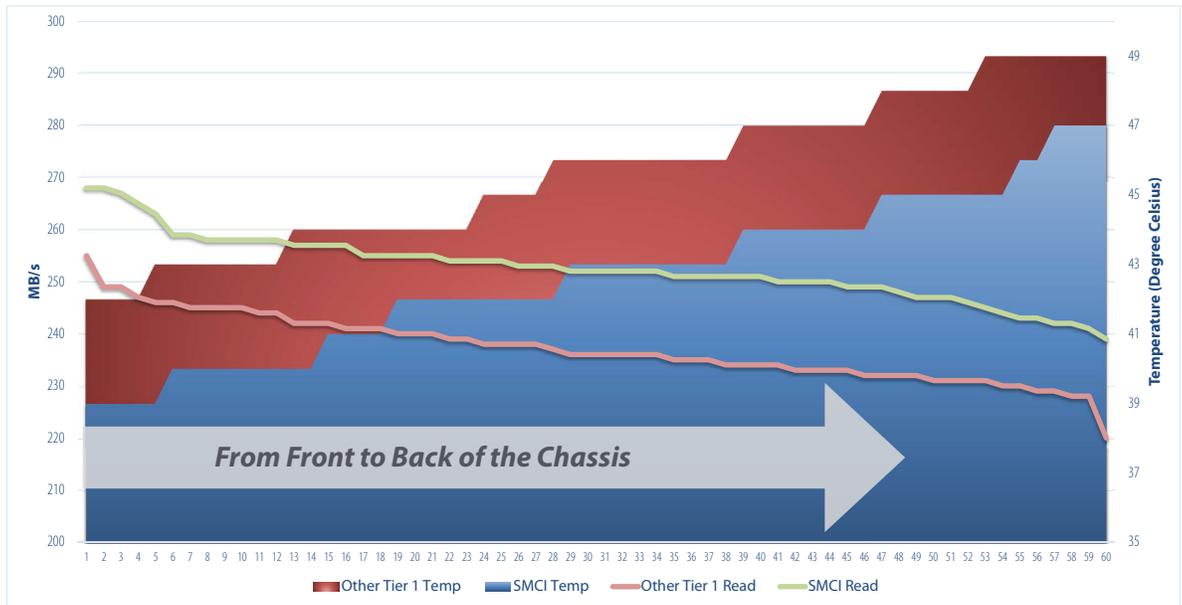
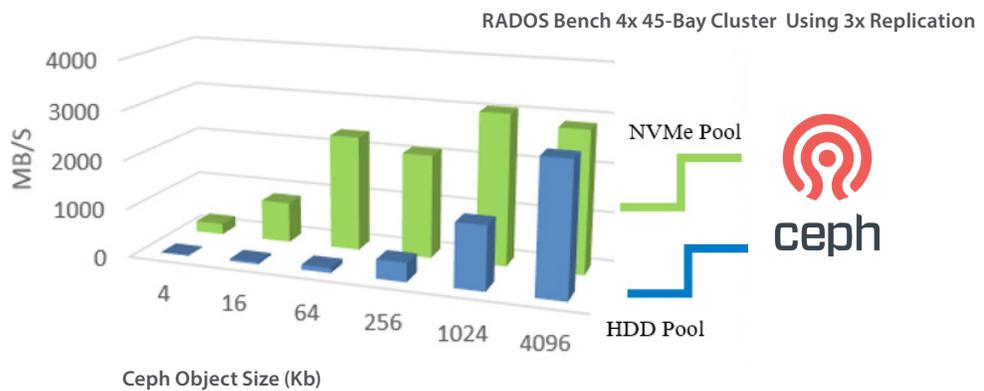


Figure 3. Drive Performance vs Temperature, Supermicro vs Other Tier 1 Competitor

1M Read & Write with iodepth = 32
The FIO version is 3.1.

Designed for Mixed Workloads

One of the key server features is the support for up to six NVMe drives. NVMe can deliver a massive performance boost for IOP intensive operations. In application testing using the 45-Bay system with Ceph, we have found that 6x NVMe configured as a fast pool of storage, the NVMe pool has even greater performance than all 45 HDDs. By including NVMe in the design, the Supermicro top-loaders can meet a wider number of application requirements.



Right-depth to Fit Every Rack

The popularity of the mainstream top-loading servers for large scale data centers inspired Supermicro designers to develop a top-loading server family that will fit in any server rack.

Top-loading JBOD enclosures for storage expansion

The 4U top-loading storage enclosures provide JBOD expansion options with the latest SAS3 12Gb/s expander provided industry best available performance and storage density. Storage expansion can lower overall TCO of storage deployments.

These top-loading enclosures feature double-slide rails with cable management arm for easy access to the each drive bay without interrupting system power and network connectivity. With HDD LED indicators on each drive bay, user can easily locate bad drives and tool-less lock/ release clip make the swap of drive a breeze.

Both SuperStorage systems and JBOD enclosures can be easily managed via a dedicated IPMI interface with SNMP for remote system power on/off control and system monitoring such as backplane and power supply temperature, power supply health status, and fan speed monitor and control. Standard IPMI protocol allows users to manage multiple systems and JBOD enclosures with a single utility.

The 45- and 60-bay servers offer identical server specification, including Dual Intel Xeon Scalable processors with up to 24 DIMM slots for powerful no-compromise compute performance. The 45-bay server is designed to fit in even the tightest co-location environments with only 26" chassis depth.

A front-mounted LCD control panel gives the status of all critical components such as power supplies, disk drives, network connections, and environmental monitoring. This makes servicing any failed component much faster, as it can be quickly identified and addressed.



Figure 4. SuperStorage Top-Loading 45- or 60-Bay Storage Server (Front View)

Supermicro onboard SIOM offers flexible high performance networking up to 100GbE, Infiniband, OmniPath, and more while simultaneously saving a PCI-E slot for other add-on cards. Three PCI-E slots are provided; two with 16 lanes, and one with 8 lanes.

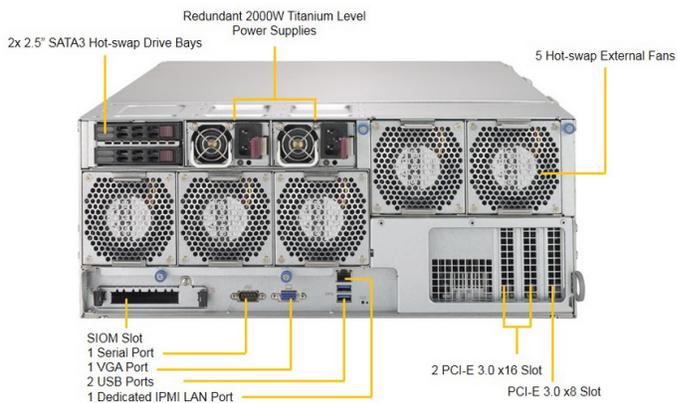


Figure 5. SuperStorage Top-Loading 45- or 60-Bay Storage Server (Rear View)

This combination of processing power, large memory support, NVMe, and SIOM networking, coupled with the capacity of up to 60 drives, allows these storage servers to handle the most demanding applications.

Five rear exhaust fans and two power supplies are provided for redundancy, and all are hot-swappable.

High Capacity in a Compact Package

The 45- and 60-bay short depth servers are the ultimate storage products for existing infrastructure or limited colocation facilities. The 45-bay with its compact 26-inch depth makes it very easy to deploy in any rack environment. The server will fit in a standard 40" depth standard rack, even accounting for cable arms. This is substantially less depth than other top loading enclosures and even some of the most popular servers in the market place. This allows a more efficient utilization of space in the datacenter, reducing infrastructure costs.

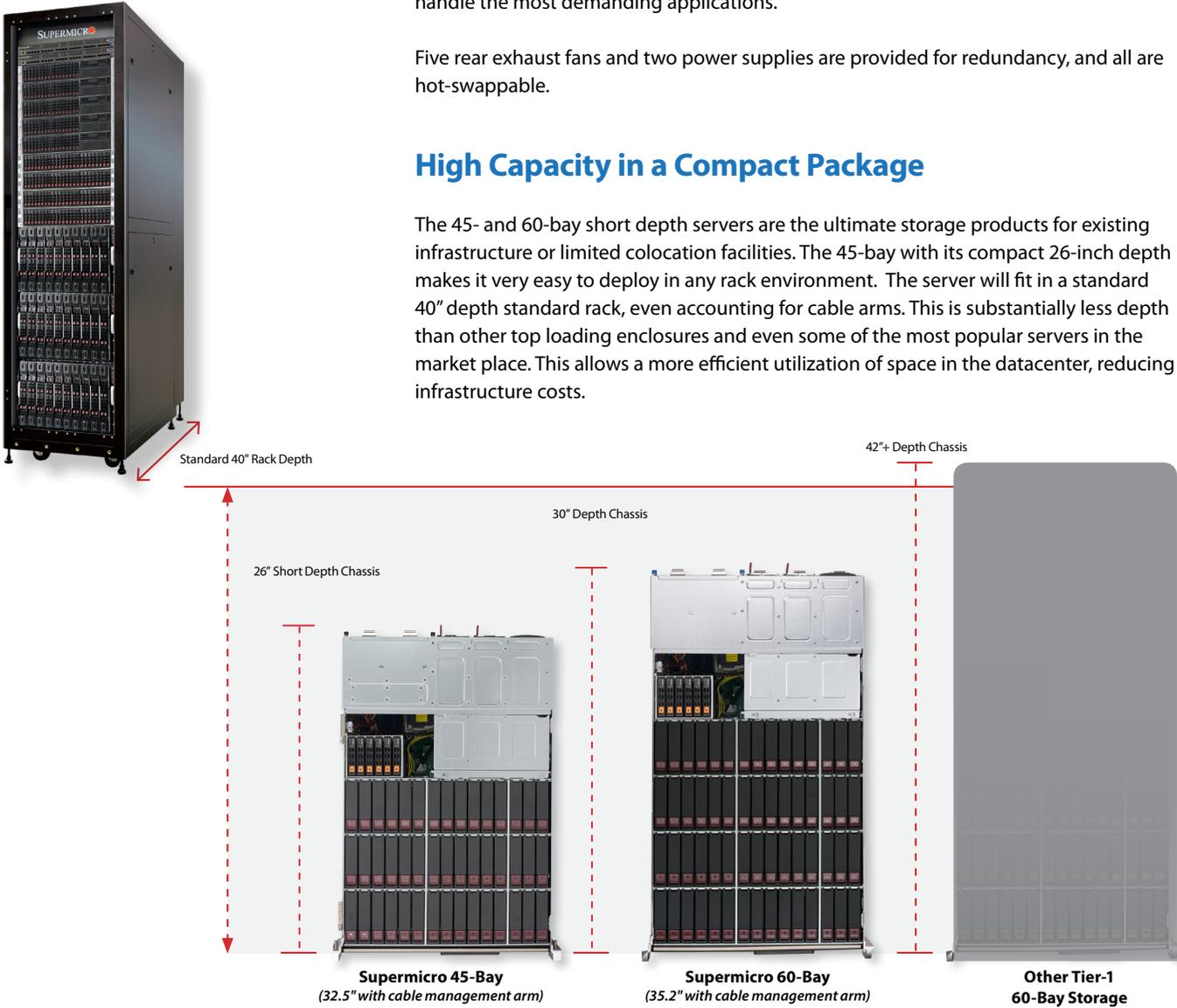


Figure 6. An illustration of server depths in a data center setting

These storage servers are ideal for enterprise applications such as high capacity container and virtual server applications, HPC, and large scale-out object stores such as Ceph. Because of its feature rich Dual CPU/ 24DIMM main board as well as NVMe support it can handle the most demanding environments.

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.

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