

# SUPERMICRO SERVERS REFERENCE ARCHITECTURE FOR QUANTUM ACTIVE SCALE

*The Next Generation Object Storage Solution*



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## 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

Unstructured data is our customers' most valuable asset, which must be preserved and protected forever. However, relentless data growth and retention trends drive demands for more efficient, resilient, and secure Exabyte-scale storage solutions. These demands continue to pressure IT budgets and administrators. Simultaneously, organizations are looking to unlock the value of their data, making the task even more challenging. The correct storage architecture can allow organizations to leverage more of their data without requiring budgets to scale at the same pace and make facilitating data forever realistic. Jointly with our market leading, strategic partners, Supermicro® can help organizations easily transition from their legacy storage to object storage platforms.

Supermicro, in collaboration with Quantum, enables our customers to deploy any targeted size of storage infrastructure with great flexibility and scalability. Supermicro's fully integrated, pre-tested, tuned, and racked solution integrates fully with ActiveScale patented object storage software technologies.

Supermicro can offer our customers the best-in-class and fully qualified storage solution featuring Quantum ActiveScale. Our starter offering consists of 3 4U90 systems with 5PB of raw capacity, which achieved over 17GB/Sec data transfer bandwidth and 22K Obj/Sec overall performance. ActiveScale provides seamless scalability to a multi-Exabyte scale with high performance in a very cost-effective way.

### Unstructured Data Management

Build your own S3-compatible storage cloud or data lake with ActiveScale and Supermicro to simply scale and protect massive data sets from various digital sources.

### HPC, AI, and ML

ActiveScale is fully integrated with the Weka file system. The Weka file system is a flash-optimized, scale-out file system that runs across a cluster of NVME-based Supermicro servers for leadership performance of HPC, artificial intelligence, and machine learning workloads. Weka provides high performance, low latency, and consistent response time using local NVMe storage. The Weka file system can use ActiveScale object storage (based on Supermicro servers) as a secondary storage resource to store massive amounts of information at lower cost.

### Data Archiving and Long-Term Retention

Curate, consolidate and maintain cold data assets online with ActiveScale for low cost, easy access, and long-term protection. ActiveScale supports a disk-based data storage tier for fast access to active data and a cold, tape-based data storage tier for lower cost storage, protection, and online access to massive data.

## Object Storage Solution Architecture Overview

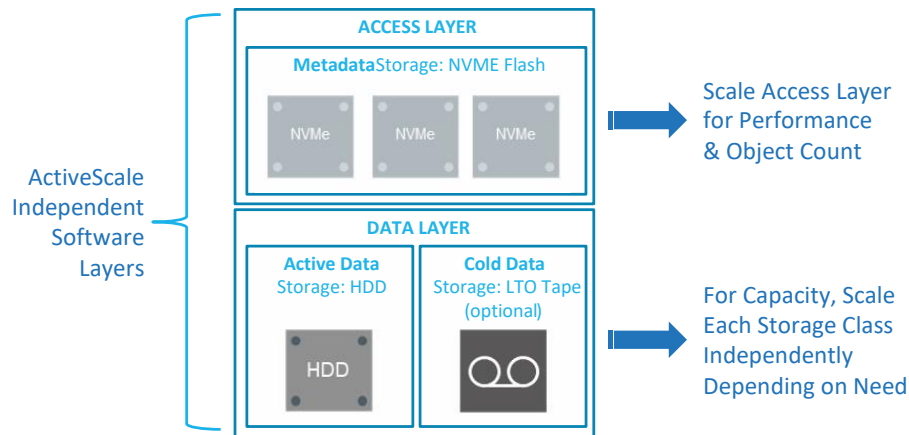


Figure 1 – ActiveScale Object Storage Architecture

## Cluster Reference Configuration Explained

Quantum ActiveScale Object Storage Software Architecture provides a software environment that can maximize storage availability and scale the system with minimal to no impact on the customer experience and performance. ActiveScale software provides a scale-out architecture that allows the environment to grow and expand by adding additional Supermicro servers. The ActiveScale software resident on each server in the cluster cooperates with all other instances of software for a seamless, single system environment and single global namespace. The software is composed of an Access Layer and a Storage Layer.

The Access Layer coordinates a single global namespace across the entire environment. Client applications talk to the Object Storage system through using the S3 protocol. The Access Layer executes client facing functions like authentication, authorization, and encryption. It also houses a scalable object metadata database, protected by having multiple copies distributed across each server in the cluster. Metadata includes attributes and policies attached to objects or buckets, internal

data, custom object metadata added by users or applications, and other information critical to the system's operation. Metadata operations performance is critical to overall system performance, more so than the performance of the bulk storage. The ActiveScale software stores object metadata on blazing fast NVMe Flash storage within the Supermicro servers to ensure the lowest latency and highest performance.

The Storage Layer processes object data and reliably stores this data on hard disk drives (HDDs) within the Supermicro servers (or optionally on tape media resources within a Quantum Scalar tape library). HDDs have a reasonable cost per TB and perform very well when aggregated together into arrays and accessed with many parallel streams. ActiveScale Dynamic Data Placement distributes data for any one object across HDDs across the multiple servers in the cluster, ensuring reliability and availability.

Active and Cold Storage Classes. With the industry's only integrated class of storage designed for cold data, ActiveScale reduces your overall cost of storing and protecting massive data sets. ActiveScale Cold Storage class provides for simple, quick recovery of your cold data sets stored on Quantum tape library-based resources into your active working group for continuing analysis and reuse. ActiveScale software provides unlimited scalability of active and cold data at consistent levels of availability and performance at scale without rebalancing.

## Configuration

Supermicro and Quantum ActiveScale provide a high-performance object storage solution with the Supermicro 4U90 Top Loading Dual Node Storage Server. The Supermicro 4U90 Storage Server provides 90 3.5" drive bays supporting 22 TB drives, totaling 1.620 PB per 4U Rack Units. Using a standard 42U x 1200mm rack and reserving 6U for Top of Rack switches, it easily fits 9 Supermicro Top-Loading 4U90 chassis per rack, totaling 14.6PB per Data Lake Rack.

Type	Description	Qty
<b>System</b>	Supermicro X12 Dual Node Twin 90-bay Storage Server, use SSG-640SP-DE1CR90 to order	1
<b>CPU</b>	3rd Gen Intel® Xeon® Scalable processors ICX 4314 2P 16C/32T 2.4G 24M 10.4GT 135W 4189 M1 or ICX 4316 2P 20C/40T 2.3G 30M 10.4GT 150W 4189 M1	4
<b>Memory</b>	32GB DDR4-3200 2Rx4 LP ECC RDIMM, HF, RoHS	16
<b>Boot Drive</b>	Samsung PM9A3 3.8TB NVMePCIeGen4 V6 M.2 22x110M(1DWPD), HF	4
<b>Storage Drive</b>	Seagate 3.5", 22TB, 7.2K RPM, SAS3 12Gb/s, 512MB, 512e/4kn or Seagate 3.5", 18TB, 512e/4Kn (EvansBP)	90
<b>NIC</b>	Std LP 2-port 25G SFP28, Mellanox ConnectX-4 L LX EN	4
<b>SAS HBA</b>	Supermicro SAS HBA 3616 for 90 Bay system	2
<b>Management SW</b>	Supermicro System Management Software Suite Node License	2

Table 1 - System Config Specifics

Type	Description	Qty
<b>System</b>	Supermicro Top-Loading 4U 90-bay JBOD w/ dual expander, using CSE-947HE2C-R2K05JBOD to Order	1
<b>Storage Drive</b>	WD or HGST 3.5" 18TB SAS 12Gb/s 7200RPM HDD	90

## ActiveScale Performance, Proven and Validated by the Joint Lab ActiveScale Performance Setup and Measurements

- Erasure Coding (EC) policy: (18,5) (=13+5 Reed-Solomon)
- 90 HDDs per 4U Chassis (45 HDDs per Node)
- Backend Network: 12 x 25 Gbps
- Different object sizes: 64 kiB, 512 kiB, 1 MiB, 4 MiB, 8 MiB, 16 MiB
- Different number of parallel TCP connections: 384 connections, 1000 connections

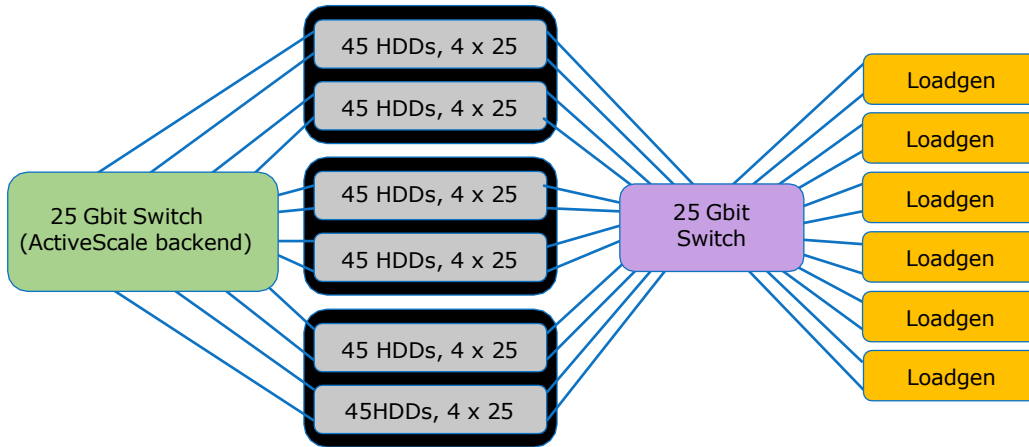


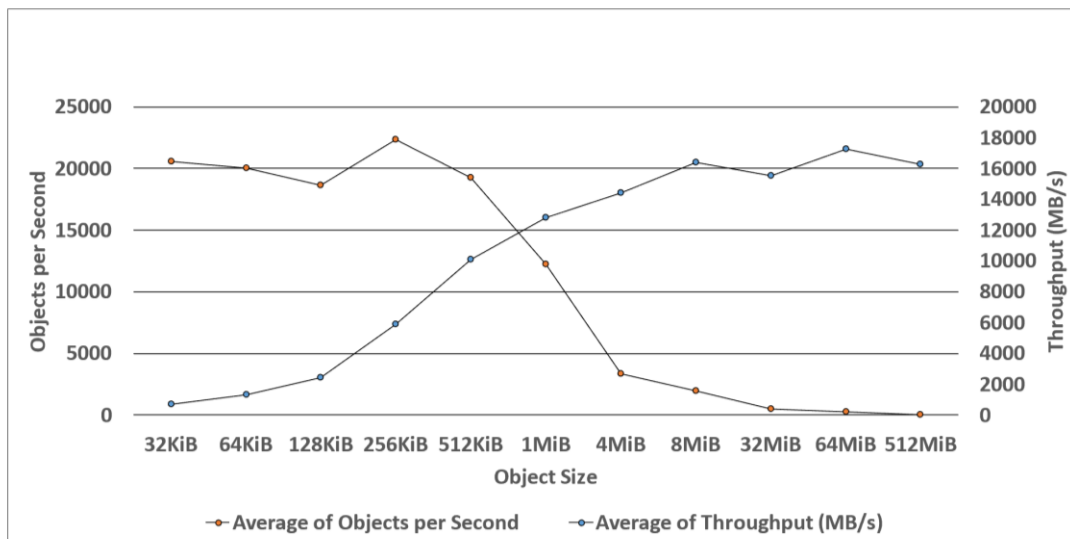
Figure 2 - Solution Network Topology

## Performance Results

### 1-GEO 100% GET (1200 Connections)

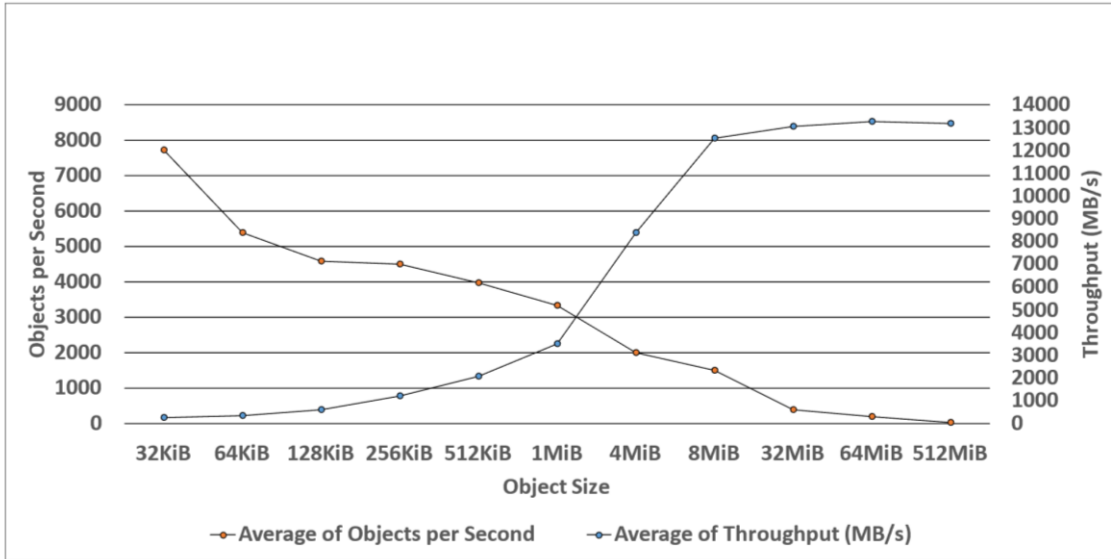
Supermicro [SSG-640SP-DE1CR90](#) (3x4U chassis, 6-nodes, 270 HDD's)

The performance graph below presents performance for GET OBJECT performance for a range of Object Sizes. Performance is expressed in terms of total number of Objects per Second and total throughput in Megabytes per Second.



1-GEO 100% PUT (1200 Connections)  
 Supermicro SSG-640SP-DE1CR90 (3x4U chassis, 6-nodes, 270 HDD's)

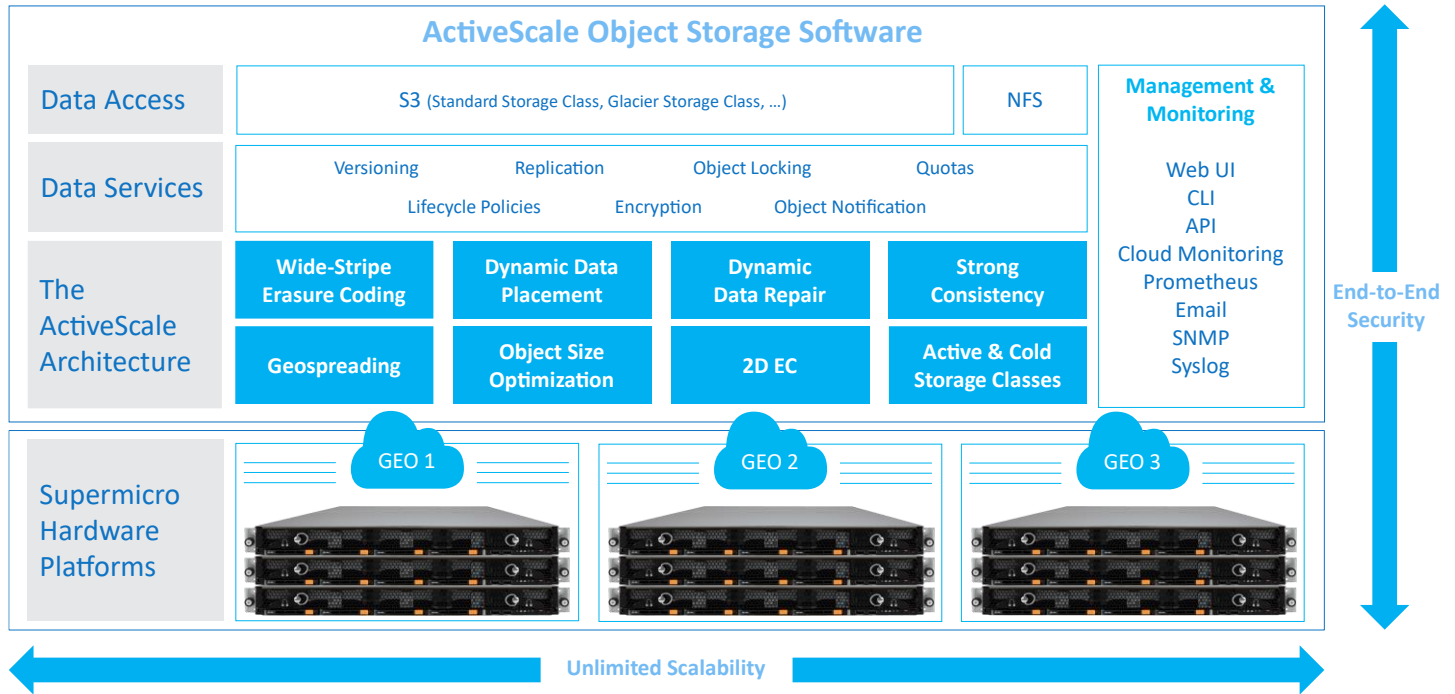
The performance graph below presents performance for PUT OBJECT performance for a range of Object Sizes. Performance is expressed in terms of total number of Objects per Second and total throughput in Megabytes per Second.



The performance testing on three (3) Supermicro Dual-Node 4U90 storage servers, SSG-640SP-DE1CR90 with 18TB Drives, showed impressive results with both PUT and GET operations. The system achieved 17.4 GB/s READs and 13.0 GB/s WRITES. Random read requests were above 20K Objects/Sec. Much higher performance can be achieved by using more nodes as performance scales linearly.

## ActiveScale Software Overview

Quantum Corporation focuses on creating innovative technology and solutions to help our customers get the most value from their data. Quantum is proud to offer the ActiveScale Object Storage system in its portfolio. ActiveScale Object Storage is an early pioneer in the Object Storage market, emphasizing fully consistent, very low touch, and easy-to-scale object storage solutions. ActiveScale software runs in many customer environments, from less than a PB to multiple 100s of PBs under management.



## Software

Operating system software	ActiveScale OS 6.5
Management interfaces	Real-time System Management Console, CLI, RESTful API
System analytics	Cloud Based Monitoring, Prometheus, Email, SNMP, Syslog
Security	Data encryption in flight SSL/TLS using AES-256, Data encryption at rest using AES-256
Data protection	Advanced Erasure Coding, Dynamic Data Placement, Versioning, Object Locking, Geospreading
Data durability	Up to 19 nines, Dynamic Data Repair, Wide Stripe
Storage Tiers and Classes	Metadata: NVME, Active: HDD, Cold: Tape
SW/FW upgrades	Non-disruptive rolling upgrades

## Supermicro Server Overview



## Supermicro SSG-640SP-DE1CR90 Object Storageserver

<b>Process Support</b>
<ul style="list-style-type: none"> <li>Dual 3rd Gen Intel® Xeon® Scalable processors</li> </ul>
<b>Memory Capacity</b>
<ul style="list-style-type: none"> <li>16x DIMM slots, up to 4TB 3200MHz ECC DDR4 RDIMM</li> <li>Supports Intel Optane PMem 200 Series</li> </ul>
<b>Expansion</b>
<ul style="list-style-type: none"> <li>3x PCIe 4.0 x16 LP slot(s)</li> <li>2x PCIe 4.0 x2 NVMe M.2 slots</li> </ul>
<b>Networking &amp; I/O</b>
<ul style="list-style-type: none"> <li>2x 10GbE Base-T LAN ports</li> <li>1x RJ45 Dedicated IPMI LAN port</li> <li>2x USB 3.0 ports, 1x VGA ports and 1x Serial port</li> </ul>
<b>Drive Bays</b>
<ul style="list-style-type: none"> <li>90 x3.5" hot-swap SAS3/SATA3 drive bays (each node controls 45 drives)</li> <li>2x 7mm or one 15mm internal NVMe drive bays (optional)</li> <li>2x internal 2.5" SATA3 drive bays (per node)</li> <li>2x NVMe M.2 (per node)</li> </ul>
<b>Storage Controller</b>
<ul style="list-style-type: none"> <li>Storage 3616 controller for serviceable60/90baysystems.</li> </ul>
<b>System Cooling</b>
<ul style="list-style-type: none"> <li>6x 8cm hot-swap counter-rotate redundant PWM cooling fans</li> </ul>
<b>Power Supply</b>
<ul style="list-style-type: none"> <li>2600W Redundant Power Supplies Titanium Level (96%)</li> </ul>
<b>System Management</b>
<ul style="list-style-type: none"> <li>Built-in Server management tool(IPMI 2.0, KVM/media over LAN) with dedicated LAN port</li> </ul>
<b>Dimensions</b>
<ul style="list-style-type: none"> <li>17.6"(W)x 7"(H)x 42.1"(D)</li> </ul>

## Value Proposition

- Density: Highest density storage and computing power
- Performance
  - Dual node configuration provides dual processors and DRAM performance
  - Multiple expanders architecture maximizes drive performance.
- Flexibility
  - Capacity and TCO optimized software-defined scale-out object storage
  - Flexible configurations to match different workloads
- Quality
  - The architecture SW+HW is fully redundant (No Single Point of Failure)
  - Component compatibility verification
  - Enterprise serviceability with hot-swappable drives, fans, and power supplies
  - Server nodes can be replaced hot without disruption of other nodes in the chassis.
- Building Block modular design with the highest drive capacity

## Supermicro Top Loading Storage Design Enhancement

- Design for Easy Field Serviceability
- Passive Mid-plane, Backplane
- No Contiguous Memory Allocator required
- Tool-less access
- Drawer type design
- Twin server nodes can be hot swapped without disruption to other nodes (share nothing)

## Services

Supermicro's Global Services can support customers requiring rack integration/configuration, installation, training, and post-deployment hardware/software maintenance.

## Summary

With no slowdown in sight for data growth, it is imperative to find more efficient and effective ways to store and protect the organization's vast store of valuable data. The correct storage architecture must simplify complexity and help organizations take advantage of their data without requiring budgets to scale at the same pace as data growth. It should deliver disk-based access performance from anywhere in the world, protect the data from loss with high durability, scale without limits, and be easy to manage. ActiveScale, a new class of storage built on patented object storage technology, addresses these needs. Its architecture supports exabyte solutions and beyond with high data durability and high data integrity that disperse erasure encoded chunks across drives, chassis, and geographies, protecting against data loss and data corruption. The distributed scale-out design supports high-throughput performance even in a geo-dispersed deployment. ActiveScale provides better resiliency and seamless adoption of new capacity as customers grow into the future.

With just 3 Supermicro 4U90 Storage Servers, over 17GB/sec of I/O bandwidth can already be achieved. With more nodes, the solution can quickly achieve 100's GB/s of aggregate data transfer bandwidth. With industry leading \$/GB, the storage capacity of 14.5 PB per rack, and combined CapEx and OpEx savings, Supermicro and Quantum have proven a complete integrated rack, tested, ready-to-deploy Activescale object storage solutions to customers immediately. Supermicro presents a best-in-class, cost effective, highly available object storage platform from 5PB on 3 4Ux90 to multiple exabytes with Quantum Activescale which enables customers to deploy any target Data Lake size with great confidence.

## Additional Resources

Supermicro Storage Servers <https://www.supermicro.com/en/products/top-loading-storage>

Supermicro Storage Servers <https://www.supermicro.com/en/products/storage>

Quantum ActiveScale [www.quantum.com/object-storage](http://www.quantum.com/object-storage)

Supermicro Quantum Active Scale Solution: [Supermicro solution for Quantum ActiveScale | Supermicro](#)