FUNGIBLE FS1600 STORAGE NODE
High Performance, Secure, NVMe-oF, Scale-Out Storage

BENEFITS

Unrivaled economics: 10x the performance and 5x the ROI compared to existing solutions[1].

Best-in-class performance: 105M aggregate IOPS and 420 GB/s throughput, provided by seven FS1600 storage target nodes.

Fastest in-line data services: Data reduction, data durability, and data security at full line rate.

Cost optimized: 5x media savings compared to triple-replication with erasure coding, compression, and higher utilization.

Elastic scale-out, disaggregated storage: Shared and pooled capacity for business flexibility, high utilization, and efficiency.

No-compromise security: Immutable root of trust, line rate end-to-end encryption, and fine-grained QoS.

Robust software stack: Optimized for maximum performance and flexibility.

Industry standard compliance: Smooth deployment in existing data centers.

USE CASES

High-Performance Storage Target: IaaS, scale-out databases, AI/ML, real-time analytics, IoT, and financial/trading applications.

Disaggregated, Pooled Storage: At local NVMe drive level performance.

[1] Internal comparison with software-defined storage solutions, which provide durability through triple-replication.


FS1600 High Performance Storage Node

OVERVIEW

Storage advancements over the last decade have been driven to meet the most stringent requirements of hyperscale cloud service providers (CSPs), whose efficient data centers and infrastructures must support modern large-scale cloud-native applications. CSPs and enterprises of all sizes require highly performant and efficient infrastructures, and by extension, the optimal storage solution.

The Fungible Storage Cluster (FSC) offers the agility, scalability, capacity, security, reliability, and cost of the ideal storage solution for CSPs and other enterprises. As the world's fastest disaggregated storage platform, the FSC features best-in-class performance characteristics in the smallest footprint and lowest power envelope. FSC implements a clear separation of storage control and data planes for the highest management and operational efficiencies.

A key component of the FSC, the Fungible FS1600 is a high performance, secure, scale-out NVMe-oF storage node. The FS1600 is powered by two Fungible Data Processing Units™ (DPUs). A unique Fungible innovation, the DPU represents a new class of microprocessors, designed from the ground up to deliver unrivaled performance and efficiency in running infrastructure services such as storage, networking, analytics, and security. This foundational technology makes the FS1600 the most flexible and robust storage platform, capable of handling extreme workload variability and the demands for high performance, secure, and protected storage in organizations of all sizes.

Fungible Composer
(Out of Band Management / Control Plane)

NVME-oF
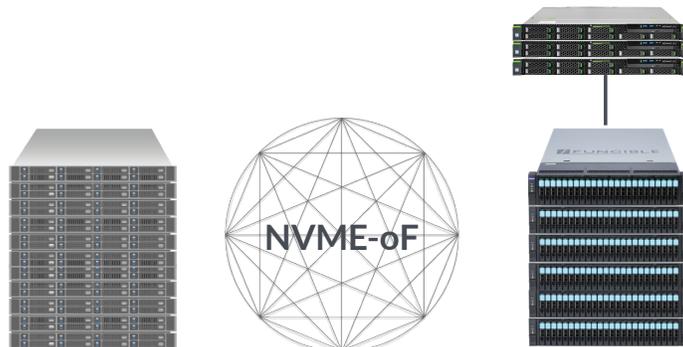
Compute Servers

Fungible Storage Cluster

REVOLUTIONARY PERFORMANCE

While most storage platforms are x86-based, the FS1600 is rooted in foundational Fungible technology, the DPU. Designed specifically to run data-centric workloads an order of magnitude more efficiently than CPUs, the DPU enables the FS1600 to deliver unrivaled performance in the most demanding scenarios. The FS1600 features a random read rate of 15M IOPS (4KB), throughput of 60 GB/s, and read latencies of +10µs for performance much more efficient than direct attached storage (DAS) systems. It delivers 96.5% Performance Efficiency Percentage (PEP)[2].

The DPU hardware accelerators (including compression, erasure coding, encryption, regular expression, deep packet inspection, and DMA) operate at a line rate of 800 Gb/s. Innovative compression engines allow compression speed that is more than 30x faster at 112% of the compression ratio of GZIP, or more than 100x faster at 97% of the compression ratio of BROTLI. JPEG files can be further compressed, reducing file sizes by 25%.

EASE-OF-ADOPTION

The FS1600 can be a drop-in replacement for existing storage systems. It is fully compliant with industry standards such as NVMe and NVMe over Fabrics (NVMe-oF), and it works with management software through the industry standard Container Storage Interface (CSI) for Kubernetes and Openstack for VMs. There are no requirements for special agents that use host CPU resources, only a standard NVMe-oF driver is required. And existing applications require no changes.

BUILT-IN SECURITY

The FS1600 is designed to protect the core data center infrastructure with security capabilities such as cryptography, secure enclave, and physically unclonable function (PUF). Data encryption at rest and in motion runs at a full line rate of 800 Gb/s and provides end-to-end security with per volume keys.

HIGH RESILIENCY AND AVAILABILITY

The Fungible Storage Cluster comprising two or more FS1600 nodes is resilient and highly available. With erasure coding, if a node fails, data is rebuilt using parity and data chunks from other nodes. The host provides an alternative path to access the data through multi-pathing.

ROBUST STORAGE SOFTWARE

The FS1600 software architecture maintains a flexible control plane while enabling a fast data plane. The FS1600 supports raw volumes, durable volumes with erasure coding and replication, compression, encryption at rest and in motion, and multi-tenancy, all at volume-level granularity. It also supports high IOPS, low latency, and high throughput workloads. A Fungible REST API and CSI plugin are available for integrating the FS1600 into existing management layers, and a GUI provides easy configuration and management of the FS1600.

DATA CENTER-LEVEL SCALABILITY

Each FS1600 supports up to 24 U.2 NVMe SSDs, and the performance scales linearly. Up to thousands of FS1600 nodes can be included in a single storage cluster.

POWER-EFFICIENT GREEN TECHNOLOGY

The FS1600 node's power consumption with 24 SSDs is 750 W (typical) and 850 W (peak). Performing at 71 MBps/W and 17,647 IOPS/W, the FS1600 is the most power-efficient storage node in the market today.

BENEFITS OF DISAGGREGATED STORAGE

Free stranded resources for improved utilization. In the directattached storage (DAS) model, storage resources often are stranded behind compute (CPU) resources. Attempts have been made to pool resources through software-defined storage (SDS) technologies, but utilization continues to be poor. Disaggregating storage allows for storage pooling across the network, enabling dynamic provisioning of storage as needed by multiple host CPUs. This approach increases storage utilization and reduces the need to duplicate high demand content, thus saving storage capacity.

Takes full advantage of NVMe performance potential. While DAS guarantees the lowest latencies between CPU and storage resources, the overall performance of the storage system remains a function of the CPU performance. With modern NVMe SSDs, CPUs often become bottlenecks, delivering less than optimal overall storage performance. By decoupling storage from compute resources, CPU bottlenecks and overall software complexity are reduced on host systems and target storage nodes. Latencies become more uniform, resulting in overall higher performance.

Simplified and cost-efficient IT infrastructure management. With the disaggregation of storage resources from compute resources, IT administrators can scale these resources separately. Compute and storage resources can be provisioned as needed, enabling better control of resources and expenses. Composability of resources becomes simpler when compute and storage resources are not tightly coupled as the need to maintain many server configurations with different compute and storage configurations is greatly reduced. Storage provisioning can be automated and streamlined to deliver the right type and amount of storage at the right time to the right server.

EMBRACE THE WORLD'S MOST EFFICIENT STORAGE PLATFORM

The FS1600 addresses the constraints that have traditionally limited true storage disaggregation by delivering DAS like performance, linearly scaled in large clusters. Its advantages in areas such as performance, resiliency, security, agility, and cost savings help make the FS1600 the world's most efficient storage platform.
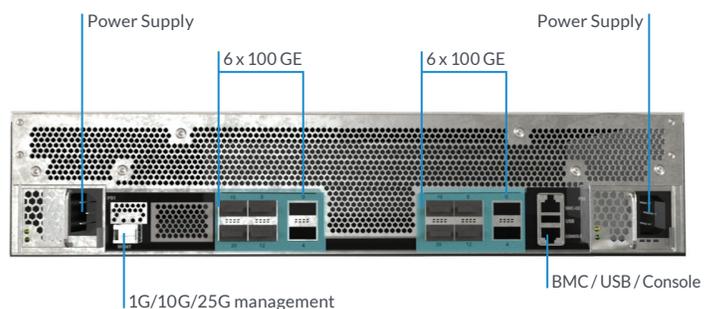
FS1600 Back Panel

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[2] Learn more about Performance Efficiency Percentage.

KEY FEATURES

ROBUST STORAGE SOFTWARE

- Optimized for maximum performance and flexibility
- Fully compliant with industry standards
- NVME/NVMe-oF support (V1.4)
- NVMe over TCP
- Block storage protocol support
- High performance raw and durable volumes
- Erasure coding @ line rate of 800 Gbps
- Compression and decompression @ line rate of 800 Gbps; GZIP, DEFLATE, ZLIB, and LZMA support
- Lossless compression of JPEG files (25% file size reduction)
- Virtualized secure multi-tenant support
- REST API and Container Storage Interface (CSI)
- GUI for provisioning and management tasks with smart placement
- IPMI
- Redfish

BREAKTHROUGH PERFORMANCE

- 15M IOPS read (random 4KB)
- 6M IOPS write (random 4KB)
- +10µs read latency compared to DAS
- 60 GB/s read (random 4KB)
- 24 GB/s write (random 4KB)
- Up to 1.2 Tbps network connectivity
- Full line rate compression, crypto and erasure coding accelerators with the Fungible DPU

BUILT-IN SECURITY

- End-to-end encryption with per volume key
- Secure enclave
- Physically unclonable function
- Encryption in motion and at rest
- Built-in line rate firewall

PHYSICAL

- Support for up to 24x U.2 NVME SSD bays with raw capacity options of 46, 92 and 184 TB per FS1600 node
- H x W x D: 3.5" (88 mm) x 17.4" (440 mm) x 30.6" (776 mm)
- Weight: 43.4 lb (20 Kg) without SSDs
- Rack unit: 2RU
- Power input/supply: (Redundant) 2 x 1500 W AC to DC power-factor-corrected (PFC), Universal Input Voltage Range: 90–246 VAC
- Power usage: 750 W/node (typical) , 850 W/node (peak)
- Network: 12 x 100 Gb/s Ethernet ports
- Management: 1 x 1/10 Gb/s Ethernet port, 1 x 1Gb/s Ethernet IPMI/BMC port

ABOUT FUNGIBLE

Silicon Valley-based Fungible is reimagining the performance, economics, reliability, security and agiliy of today's data centers.

CONTACT US

sales@fungible.com

FUNGIBLE, INC.

3201 Scott Blvd., Santa Clara, CA 95054, USA
669-292-5522

www.fungible.com

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