

# HYPERDISAGGREGATE NEXT GEN CLOUD STORAGE WITH THE FUNGIBLE STORAGE CLUSTER

## Achieve Higher Infrastructure Agility, Security, Reliability and Lower TCO with DAS-like Performance and Latency for Modern Workloads

Hyperconverged servers have held the fort for smaller scale-out deployments, but cracks are starting to show as modern applications drive increasingly high performance and massive scalability. These newer cloud-native applications are architected as microservices where an interacting pool of servers work together to run different microservices, then aggregate results for the application. This architecture requires a significantly larger amount of data interchange amongst the servers. When this architecture is overlaid onto a pool of hyperconverged servers, the challenges become apparent. The CPUs in the hyperconverged servers become choke-points when it comes to processing and moving data between servers. The direct-attached storage (DAS) becomes stranded and subservient to the CPU. Stranded storage of course suffers from low utilization. Further, the software-defined storage software that manages storage virtualization becomes increasingly complex. The result is an infrastructure that is lethargic in performance, low in agility and scalability, while unnecessarily costly in both CAPEX and OPEX.

Infrastructure and Operations leaders face mounting pressure to not only meet these stringent application requirements, but to also improve infrastructure agility, security and reliability, while keeping costs down.

### DISAGGREGATION IS OLD. LET'S HYPERDISAGGREGATE.

The solution to this conundrum is to break the shackles of compute and storage to enable much simpler storage virtualization. Isn't this just storage disaggregation? Not really! Storage disaggregation today cannot be done efficiently when the CPU continues to be the critical bottleneck and network inefficiencies limit scale and drive average and tail latencies up!

The unique approach that Fungible has taken is to design from ground up a new class of microprocessor - the Fungible Data Processing Unit™, that is optimized specifically to run infrastructure computations, including the storage, network and security stacks and services. Firstly, the Fungible DPU executes these computations an order of magnitude more efficiently than general purpose CPUs, effectively displacing x86-based storage controllers in disaggregated solutions. Secondly, the Fungible DPU implements the end point of a high performance TrueFabric that provides deterministic low latency, full cross-section bandwidth, congestion and error control, and high security across a wide scale of deployments. TrueFabric is fully standards compliant and interoperable with all standard Spine-Leaf Switches. Lastly, the Fungible DPU is architected to implement a clean separation of control and data plane. The simplicity in this approach enables not just higher performance, but also super linear performance characteristics when compute or storage nodes are added.

With the Fungible DPU, we achieve hyperdisaggregation – that is the ability to disaggregate infrastructure at **massive scale**, while **achieving DAS-like performance and latencies**.

### THE FUNGIBLE STORAGE CLUSTER - A STATE-OF-THE-ART HYPERDISAGGREGATED STORAGE PLATFORM

Powered by the Fungible DPU, the Fungible Storage Cluster (FSC) is the highest performance, secure, scale-out disaggregated all-flash storage platform in the market today. The FSC comprises a cluster of two or more Fungible FS1600 storage target nodes and three Fungible Composer nodes. The control plane is managed by the Fungible Composer software, a centralized management solution that configures, manages, orchestrates, controls and deploys the Fungible Storage Cluster.

### PERFORMANCE AND LATENCY

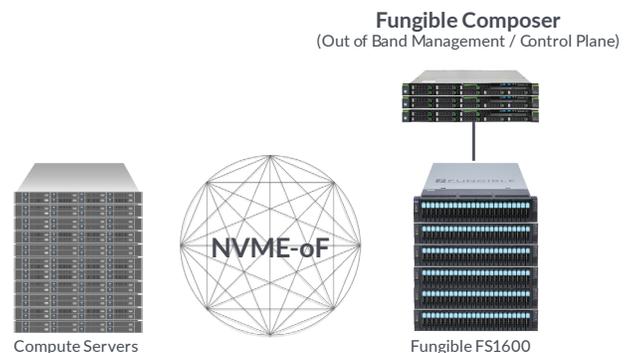
Each FS1600 storage node in the Fungible Storage Cluster provides an unprecedented high-performance of 15MIOPs (4KB random read) and low latency (+10us compared to DAS) across the storage cluster. Further, data services such as data reduction, data durability and data security, are enabled in-line and at line rate. Performance also scales linearly with predictable low tail latencies as storage nodes are added.

The Fungible Storage Cluster delivers a high performance, low latency NVMe-oF disaggregated storage solution that is also fully transparent to high level applications.

### INFRASTRUCTURE AGILITY

Customer storage requirements vary based on use cases and can oftentimes be highly unpredictable. Today, adding storage capacity requires dispatching a technician to identify the correct server in the rack, power down the server, replace the existing SSDs with new larger SSDs (after all the data is backed up), power up the server and finally, hand control back to the customer. This is a long and tedious process that is also highly prone to human errors.

The FSC is designed on the principles of scale-out, supporting scalability on multiple dimensions, including dynamic volume expansion (from GB to 10s of TB) and node scalability from few storage nodes to racks of storage nodes. The Fungible Composer enhances infrastructure agility by abstracting away the complexities of data management and enabling allocation of new capacity easily through API calls.



## ECONOMICS

The Fungible Storage Cluster delivers reduction in capital expenses along three dimensions. The ability to enable data reduction techniques, such as compression and deduplication for both hot and warm data significantly saves media capacity. The innovative network erasure coding at line rate enables better reliability at lower cost compared to equivalent protection for replication. Further, the consolidation of workloads into storage pools increases media utilization, thus lowering costs.

Separately, IT leaders are also constantly in search of a better operational model. Rigid IT configurations undermine the business' ability to rapidly respond to changing conditions and burden the business with bloated fixed costs. The ability to rapidly and efficiently provision storage at lower operating costs is critical. The FSC reduces OPEX by enabling full automation of storage provisioning and deployment.

Storage Requirements: 1PB

	HYPERCONVERGED with Direct Attached Storage		DISAGGREGATED	
	Method	Media Required	Method	Required Media
REQUIRED STORAGE (TB)		1000		1000
UTILIZATION	50%	2000	80%	1250
DATA PROTECTION	3x Replication	6000	4+2 EC	1875
COMPRESSION & DEDUPLICATION	3x	2000	5x	375



**INSTANT SAVINGS:  
5X!**

Additional  
Agility, Flexibility, Security Benefits!

## RELIABILITY AND BLAST RADIUS

Transitioning from DAS to a disaggregated storage places a higher requirement on data reliability. Node failure can potentially impact a large number of users if not designed correctly. Adding data durability features is essential to protect user data.

The FSC supports both reliability options:

- 2-way and 3-way replication, where a single volume is compressed and replicated across 2 or 3 FS1600 nodes
- Network Erasure Coding, where parity blocks are created and sharded across a number of FS1600 nodes. Fungible supports multiple EC configurations from 2,1 to 32,8. The probability of data loss for a cross-node 12,3 erasure coding scheme compared to RF=3 is 5 orders of magnitude lower, while the cost reduction is 8x.

The network EC distribution of data across racks reduces blast radius and increases reliability.

## MULTI-TENANCY: SECURITY AND QUALITY OF SERVICE

The FSC is designed to support multi-tenancy in virtualized or containerized environments, providing full separation amongst thousands of users and tenants in a single cluster.

**Security:** The Fungible Storage Cluster, powered by the Fungible DPU, was architected to provide a no-compromise security offering. The FSC maintains robust, security partitions amongst the different users. User data is secured by means of encryption at rest and in motion. Under no circumstance can one user gain access to the data of a different user.

The Fungible DPU has a set of built-in capabilities for security, including a secure boot processor, root of trust and a secure enclave. The FSC will deploy a per-volume/customer crypto key (provided via the customer's KMS system) and will encrypt the data at rest as well as on the network (using a Fungible DPU enabled host card – for data in motion). Even if SSDs are taken out of the cluster, the customer volumes cannot be decrypted.

**Quality of Service:** When customer data is sent across the network, the storage provider must make sure that SLAs are met in terms of min/max IOPS and throughput as well as latencies. The Fungible FSC deploys advanced QoS shaping and policing algorithms inside the Fungible DPU to eliminate effects of noisy neighbors, thus guaranteeing QoS. In addition, the Fungible True Fabric is the only network protocol available in the market that provides a reliable, end-to-end QoS with very low latencies including tail latencies. This makes the FSC an ideal solution to provide customers DAS-like performance with the flexibility and economics of disaggregation.

## SUMMARY OF BENEFITS

- Effective blend of performance, scale and economics addresses stringent requirements of modern applications
- Data durability schemes protect against drive, processor, system, and rack failures and eliminates any single point of failure
- Network EC provides improved reliability and media efficiency compared to replication
- Line-rate data reduction techniques applied to hot and warm data offer more than 5X media, achieved without performance impact
- Line-rate security features offer no-compromise security
- Shared high performance storage pools enable live migration of VMs, obviating need to move data, thus increasing up-time
- No requirement to install custom software or agents on application servers makes deployment simple (native support for NVMe/TCP)
- Standard IPoE network compliance (NVMe/TCP) obviates need for expensive InfiniBand or complex RDMA that does not scale
- Disaggregation of compute and storage nodes enable improved infrastructure agility through independent scaling of servers
- Per-volume level granularity of features for data durability, reduction, security makes the FSC ideal for multi-tenant environments

## THE STORAGE THAT KEEPS ON GIVING

The Fungible Storage Cluster unlocks the true value of storage hyperdisaggregation for IT leaders managing data centers in CSPs and enterprises. The FSC not only provides a high performance, low latency disaggregated scale-out storage that meets the needs for modern applications, it also solves operational dilemmas for IT leaders by enabling on-demand provisioning of storage, higher media utilization, higher security and varying levels of durability. CSPs will no longer need to delay revenue or overprovision resources in anticipation of future customer requirements while Enterprises can count on lean and streamlined provisioning. Modern applications have moved beyond traditional infrastructures, now you can move your business to the next level with the Fungible Storage Cluster!

## NEXT STEPS

For additional information and demo, contact [sales@fungible.com](mailto:sales@fungible.com).