DriveScale - Seagate
Joint Reference Architecture

Deploying Seagate® Exos® AP 5U84
with DriveScale Composable Platform

DriveScale

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DriveScale - Seagate

1. Executive Summary

This document is a high-level design reference architecture guide for implementing the DriveScale Composable platform with industry standard servers, the Seagate® Exos® AP 5U84, and DriveScale Adapter Software.

This reference architecture introduces all the high-level components, hardware, and software included in the stack. Each high-level component is described individually. The reference architecture does not define any applications.

DriveScale Technology Overview

Scale-out clusters common for the deployment of advanced analytics, NoSQL/NewSQL databases and AI/machine learning have traditionally used servers with local storage inside. As clusters grow in size and number across the organization, the challenges to this design become more apparent including CAPEX budget spent but underutilized due to trapped resources that sit idle, the inability to easily move resources between clusters, and the high cost of upgrading compute and storage simultaneously when only one or the other is required.

With cloud-native application design, Kubernetes container orchestration, and bare-metal cloud infrastructure picking up steam, it's time to align data center fixed hardware deployments to these modern applications with cloud-like elastic infrastructure.

The DriveScale Composable Platform turns any data center into an elastic bare-metal cloud with on-demand instances of compute, GPU and storage – including native NVMe over Fabrics – to deliver the exact resources a workload needs and to expand, reduce or replace resources on the fly. With DriveScale, compute and drives (both HDD and SSD) are disaggregated from the traditional server that has local storage in the box and connected to a standard Ethernet network. DriveScale provides fully automated fabric configuration so that users can quickly and easily compose resources into high scale, adaptable clusters for high-performance applications including machine learning, advanced analytics and cloud-native.

Seagate® Exos® AP 5U84 Technology Overview

The Exos AP 5U84 platform from Seagate is a high-density, high-capacity storage building block. Leveraging an Intel ® Xeon ® E5 v4 Family CPU in each controller, the Exos AP 5U84 supports a variety of deployments due to its multiple modular, interchangeable compute structures. Dual controller redundancy, inter-controller communication and multi-controller drive access safeguards your data with powerful processing capabilities. Additionally, the chassis can also be split into two nodes to yield powerful multi-node architecture and exceptional throughput in a single chassis. In addition, the storage capacity of up to 84 3.5" high capacity drives in a standard 1m rack paired with the dual server controllers and 80 PLUS platinum power efficiency yields stellar performance-to-storage density at a minimum TCO.

2. Audience and Scope

This reference architecture guide is for IT architects who are responsible for the design and deployment of high performance and low latency applications on premises, as well as for administrators and architects and data center architects/ engineers who collaborate with specialists in that space.

3. Glossary of Terms

Term	Description
DriveScale Adapter Software	The software on the Adapters enables drives from the EBODs to be mapped to the servers. These drives will appear architecturally identical to locally attached drives
DriveScale Cloud Central (DSC)	DriveScale Cloud Central is a cloud-based support platform for account management.
DriveScale Composer	The DriveScale Composer is software that creates composable infrastructure from a set of diskless servers and disk drives.
Application Platform	EBOD (Ethernet attached Bunch of Disks). A collection of hard disks or NVMe solid state drives and a pair of redundant controllers that makes the HDDs and SSDs accessible as Ethernet endpoints.
HDD	Hard Disk Drive
NIC	Network Interface Card
PDU	Power Distribution Unit
SSD	Solid State Drive
ToR Switch	Top-of-rack switch

4. DriveScale - Seagate Solution Overview

Together, DriveScale and Seagate turn industry-standard compute nodes, GPU nodes, and storage systems into elastic resource instances that can be deployed, adapted or replaced on the fly from user-created templates or the RESTful API. Users can deploy IT resources on demand, expand compute capacity or storage as the workload requires, redeploy compute nodes or storage when a workload completes, and replace failed components instantly via software.

DriveScale NVMe Adapter software is easily installed on the Seagate Exos AP 5U84 Application Platform EBOD (Ethernet-attached Box of Drives) using a USB. This brings the composability benefits to the high availability storage server. The DriveScale SAS Adapter Software enables users to connect HDDs from Seagate Exos AP 5U84 Application Platform EBOD to any x86 server over an Ethernet network.

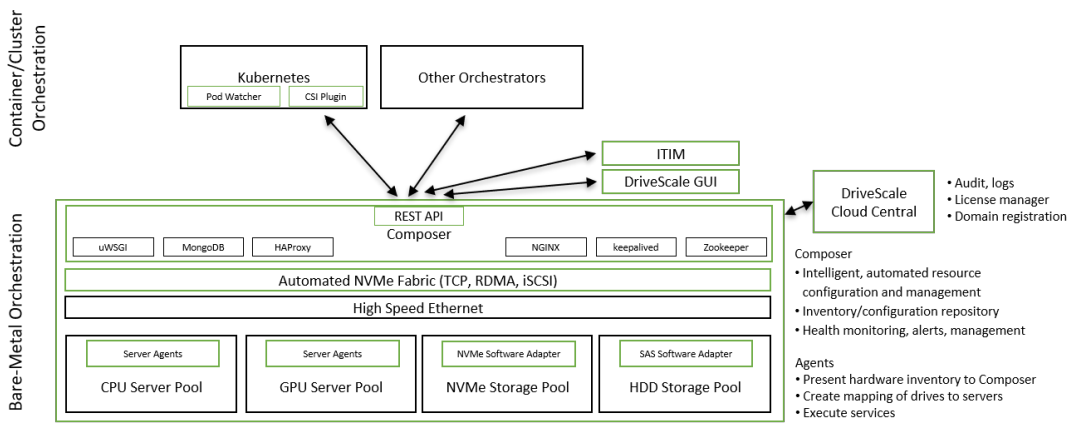
It uses performance optimized iSCSI with patented load balancing. This end-to-end solution is specifically designed to accelerate large-scale production while delivering the compute and storage performance needed.

5. DriveScale and Seagate Components Overview

The solution is composed of one hardware component and four software components:

5.1 Conceptual diagram of DriveScale and Seagate solution

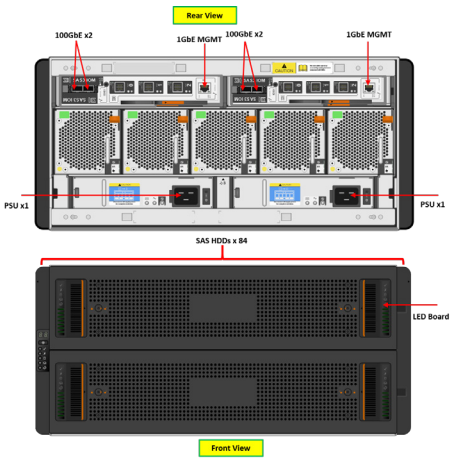
Figure 1: DriveScale Cluster components overview



5.2 Hardware: Seagate Exos AP 5U84 Application Platform

Storage system with dual Application Controllers that connects Hard Disk Drives (HDD) to an Ethernet network. The Seagate Exos AP 5U84 Application Platform has a highly available, high performance, low-latency, and secure architecture.

Figure 2: Seagate Exos AP 5U84 Application Platform



5.3 Software

There are four principal components of the DriveScale software:

a.) DriveScale Composer Server (Composer)

- The server running the Composer software bundle is called the Composer node.
- A typical deployment consists of three Composers in a clustered configuration for high availability (HA).
- The software manages and configures resources and contains the inventory/configuration information repository and database:
  1. Inventory: Composers, Adapters, switches, JBOD chassis, disks, server nodes
  2. Configuration: node templates, cluster templates, configured clusters
  3. Composer Database: used as a message bus to communicate with the end points

b.) DriveScale Server and Storage Adapter Agent

- DriveScale Server Agent discovery action provides inventory for hardware and servers and creates mappings between server nodes and the HDD or NVMe SSDs they consume.

c.) DriveScale Cloud Central (DSC)

- Cloud-based support management portal that acts as the:
  1. Software distribution repositories for subscribers
  2. DriveScale keys repository
  3. Centralized log file repository
  4. User documentation repository
  5. License manager

d.) DriveScale Adapter Firmware

- The firmware on the processor enables the EBODs/JBODs to be mapped to the servers and used as local drives.

6. DriveScale and Seagate Solution Benefits

- **Eliminate over-provisioning, adapt cluster resources on demand**

  With disaggregated IT resources, users can change the number of drives and server data nodes in real-time to utilize only what the workload requires. Compute or storage capacity can be expanded or reduced on demand eliminating the need to predict what a workload will need and then being

stuck with the pre-configured server chosen. Resources are no longer trapped in a cluster and can be released from one cluster and used in another as needed. Failed components are replaced through software instantly.

- **Reduce upgrade costs and time**

  With the DriveScale and Seagate solution, a data center can upgrade servers and drives separately, thereby maximizing the lifetime of the hardware infrastructure. Users can expand storage or compute capacity by simply adding more drives or nodes on the fly depending on the requirements of the applications.

- **Gain direct-attached equivalent performance**

  With load-balancing and fine-tuned performance, the DriveScale and Seagate solution provides equivalent performance to local drives.

- **Fully automated end-to-end NVMe over fabrics**

  DriveScale instantly discovers server configuration and determines fabric options available and chooses the highest performance fabric then automatically sets it up providing the industry's simplest NVMe over fabrics.

7. Reference Architecture Details

7.1 Physical Cluster Components and Configuration List

The following table lists the physical components for the cluster

Component	Configuration	Description	Quantity
Seagate Exos AP 5U84 Application Platform EBOD	DHCP, Jumbo frame enabled	5U appliance with dual adapters that connect to servers via Ethernet	Min 1
Composer Server	Composer running on a VM or bare metal	Manages and configures the nodes and DriveScale cluster and stores the inventory/configuration repository of every hardware in the cluster.	Min1, recommended 3 for HA
Servers[1]	x86 server with CPU and memory as per the application requirements	Commodity x86 servers that house all the master, infrastructure, and compute instances with DriveScale agents.	Depends on the workload requirement

1 Customers with higher (or lower) compute needs can acquire bigger (or smaller) data nodes configured with CPU and memory that fits the specific requirements of their applications

HDD for Servers	OS installed on internal boot drive(s).	The internal drives are used for OS install.	2 for each server
NICs	Dual port 25 Gbps Ethernet NICs. The connector type	Provides the data network	Min 1 for each server
Seagate HDD for Application Platform for EBOD[2]	Default configuration	Drives to house the data for the cluster.	Depending on the cluster requirements
ToR 100/25 G switch	LLDP, Jumbo Frame 9K configured	Provides data network connectivity.	2 for each rack
ToR 1G switch	Default configuration	Provides management network connectivity.	1 for each rack

7.2 Logical Cluster Topology

The following table lists the physical components for the cluster

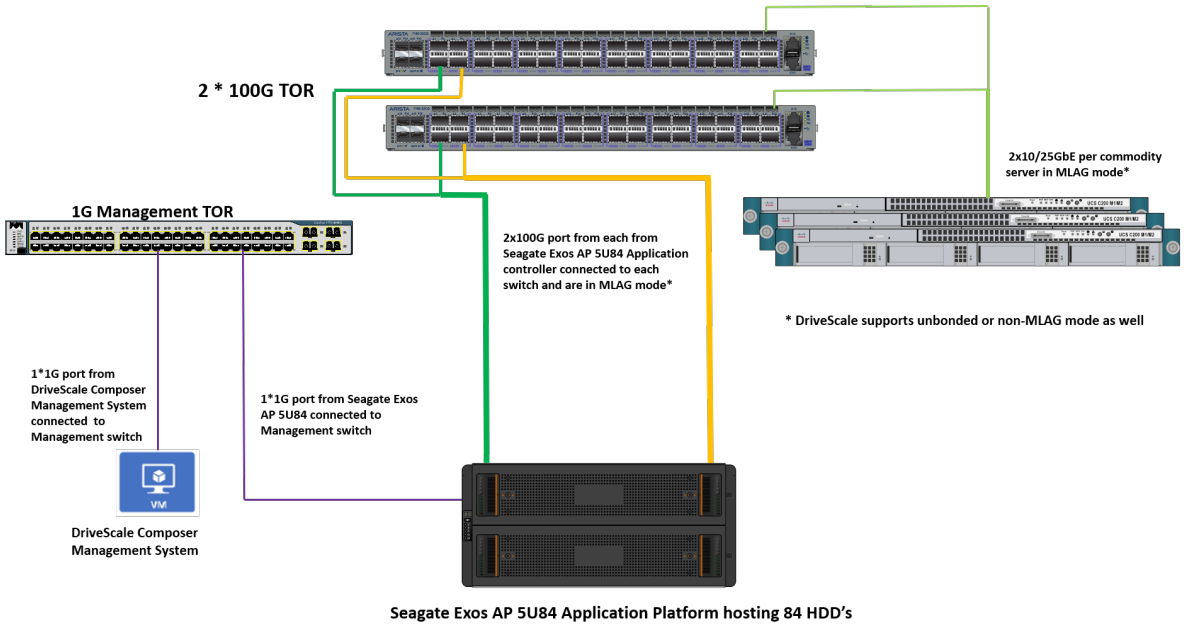
- 2-3 Compute Nodes
- 1 Seagate Exos AP 5U84 Application Platform
- DriveScale Adapter Software
- 1 Composer Server
- 2 100G Switches
- 1 1G Switch
- 20-30 Seagate SAS Drives for the Application Platform

This reference architecture is built with 3 compute nodes and 1 Seagate Exos AP 5U84 Application Platform EBOD 84 drives. However, it is not required to populate the Application Platform EBOD with 84 drives. Customers can start with a small number of HDD's and add more capacity whenever required.

2 Depending on the application data requirements, customers can add or remove disk drives to match the specific needs of their applications

7.3 Physical Cluster Topology

Figure 3: DriveScale Reference Architecture with 1xSeagate Exos AP 5U84 Application Platform EBOD, client nodes



7.4 Cluster Management

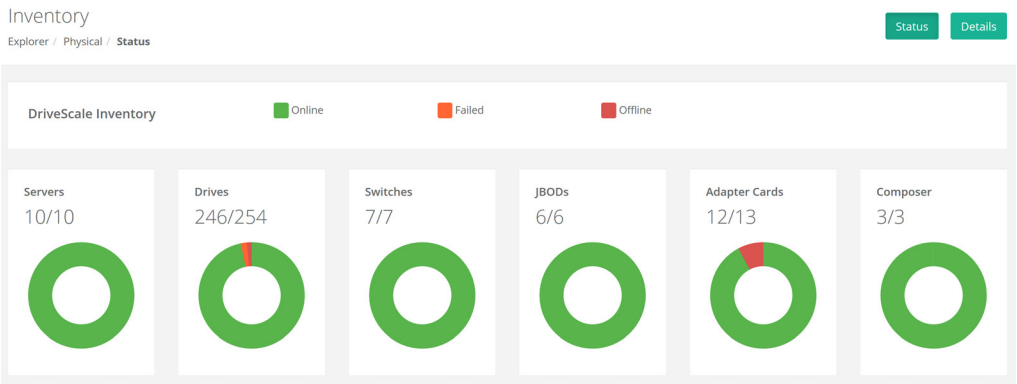
This section details the steps for setting up a DriveScale enabled Seagate platform.

7.4.1 Setting up DriveScale Composer and Server Agents

Before installing or using an existing install of any application, you must complete the following tasks for setting up the DriveScale and Seagate solution:

1. Rack and install the servers using the documentation provided by the vendor.
2. Create the required configuration for the internal HDD on the server and install the OS on all the other servers.
3. Install and configure Composer Server either as a VM or on a bare metal server. For test deployments, one Composer node may be sufficient. For production deployment, the DriveScale Composer must be deployed in an HA configuration on three nodes.
4. Set up the Adapter configuration from the Composer.
5. Install and configure DriveScale agents on all the nodes.
6. Ensure the Composer UI has the servers are listed in the inventory list.

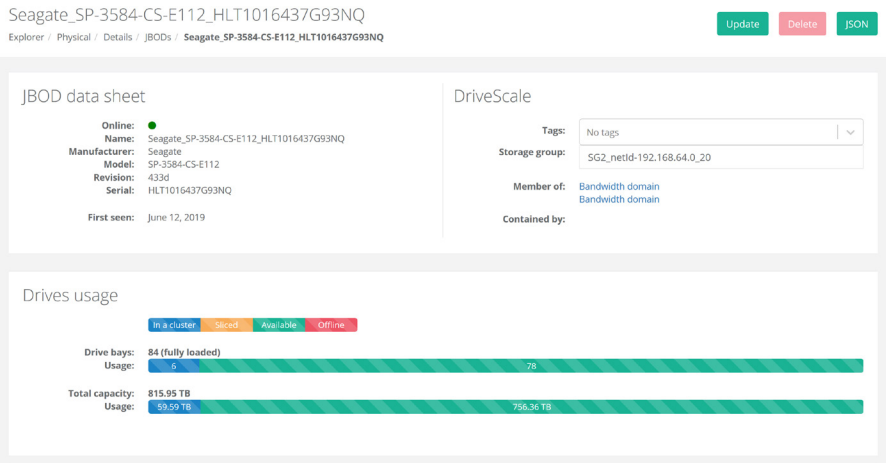
Figure 4: Physical components overview from Composer UI



7.4.2 Setting up the the Seagate Exos AP 5U84

1. Download the DriveScale Adapter Software from DriveScale Central and follow the steps to create a bootable USB with that image.
2. Follow the steps in the installation guide provided by DriveScale to install the software on both the controllers.
3. Follow the steps to copy the config file and finish the adapter IP configuration if required using the DSA utility.
4. Reboot the controllers and ensure they are up and seen in the Composer UI.

Figure 5: Application Platform detail from the Composer UI



5. To test the installation, configure a cluster with the required compute and storage for the application under test. Refer to the DriveScale Administration guide for details on creating clusters.

Figure 6: Node templates details

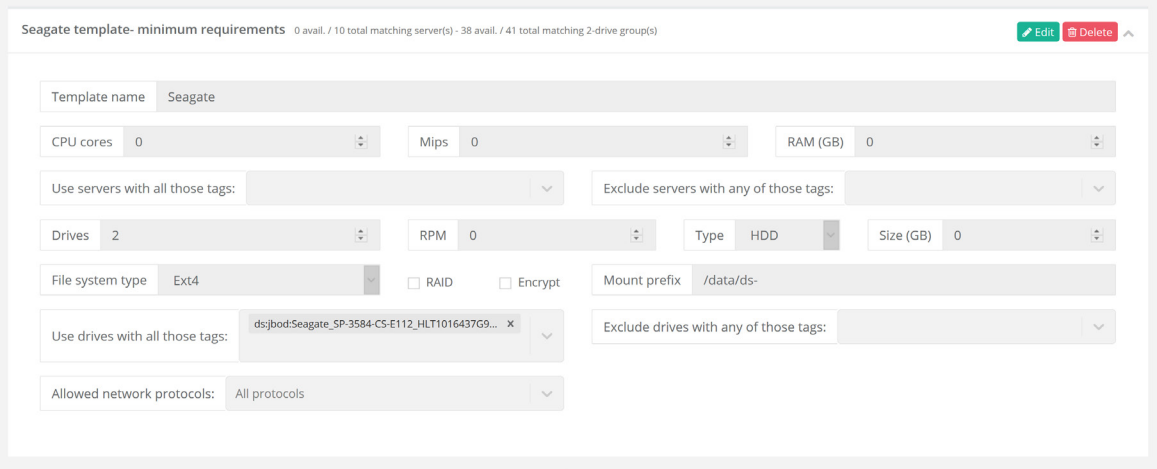


Figure 7: Cluster template

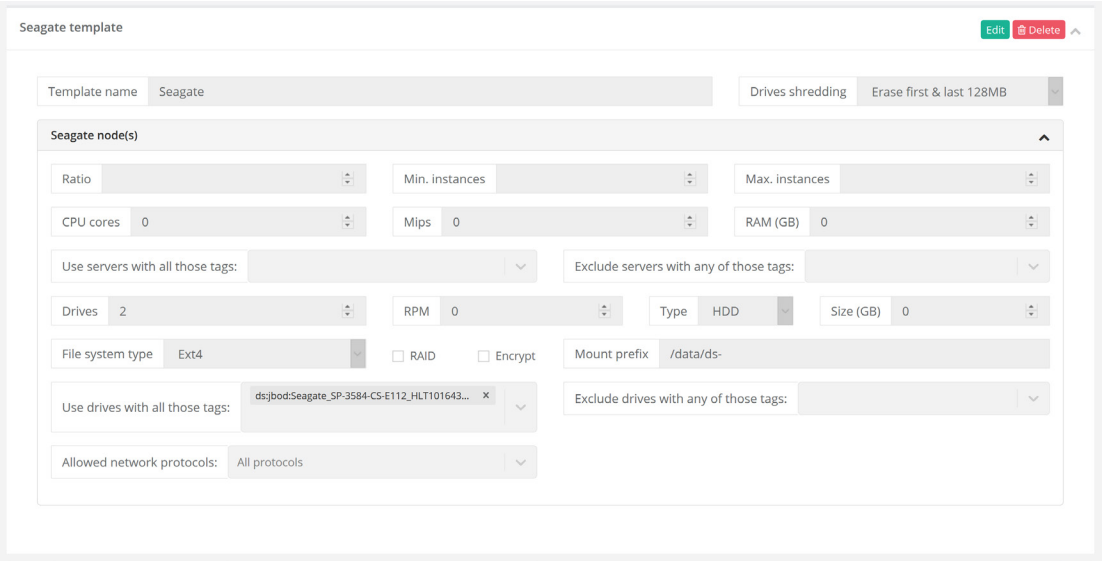
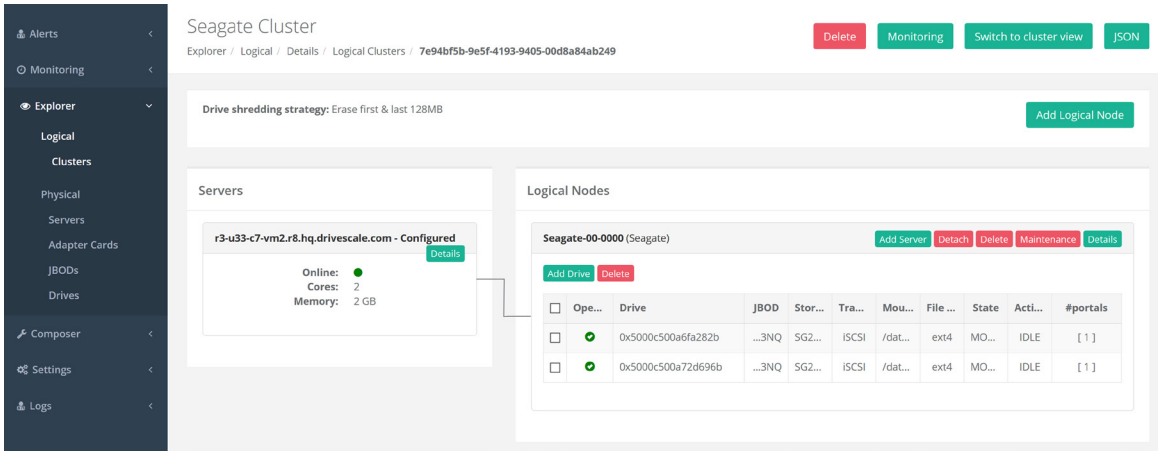


Figure 8: Logical Cluster Details



7.4.2 Setting up the Seagate Exos AP 5U84

	Composer	Server Nodes
CentOS/RHEL 7.x	X	X
Ubuntu 14.04	X	X
Ubuntu 16.04	X	X
Ubuntu 18.04	X	X
Ubuntu 19.04	X	X

8. References

1. Seagate Exos AP 5U84 Datasheet https://www.seagate.com/files/www-content/datasheets/pdfs/exos-ap-5u84-DS2013-1-1905US-en_US.pdf
2. Seagate Exos series https://www.seagate.com/enterprise-storage/systems/exos/
3. DriveScale documentation for racking and installation which are provided by DriveScale solution architect or can be downloaded from DriveScale Cloud Central.

9. Bill of Materials

Component	Configuration
Server	CPU: Dual socket Intel Xeon Silver 4114, 10 Core, 2.2GHz
	RAM: 128GB DDR4-2400
	NIC: Dual 25GbE, Mellanox ConnectX®-4
Seagate Exos AP 5U84	CPU: Single Intel® Xeon® E5 v4 Family processor
	RAM: 128GB DDR4-2400
	NIC: Dual 100GbE, Mellanox® ConnectX®-5
SAS HDD	84 * Seagate Compatible HDD
Switch	2 * Arista 7160-32CQ switch
	1 * D-Link DGs-1518-28 1GbE switch
Software	CentOS: 7.5
	DriveScale Adapter Software: 3.5.0-1.25
	Mellanox Firmware: 14.24.1000
	Arista software: 4.19.8M
	Arista hardware: 11.01

10. Conclusion

The DriveScale-Seagate Enterprise solution reference architecture guide is designed to provide an overview of the combined solutions and the critical components employed. The reference architecture also outlines the advantages of compute and storage disaggregation with DriveScale-Seagate solution.

About DriveScale

DriveScale instantly turns any data center into an elastic bare-metal cloud with on-demand instances of compute, GPU and storage, including NVMe over Fabrics, to deliver the exact resources a workload needs, and to expand, reduce or replace resources on the fly. With DriveScale, high-performance, Kubernetes clusters deploy in seconds for machine learning, advanced analytics and cloud-native applications at a fraction of the cost of the public cloud. Visit www.drivescale.com or follow us on Twitter at @DriveScale_Inc.

About Seagate

Seagate crafts the datasphere, helping to maximize humanity's potential by innovating world-class, precision-engineered data management solutions with a focus on sustainable partnerships. Learn more at **www.seagate.com/enterprise-storage/systems/exos/.**

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