Advantages of iDRAC & iSM (Out-of-band) and OMSA (in-band) tools in Systems Management functions for Dell EMC PowerEdge servers

This technical white paper discusses in brief the advantages and features provided by different versions of iDRAC in combination with iDRAC Service Module (iSM), and then compares against Dell OMSA. Enables you in selecting the right components for specific server management requirements that meet requirements for deploying, monitoring, and managing your data centers infrastructure.

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Executive summary

The traditional approach to server systems management has been to install an agent in the server's operating system, and proceed from there. These "in-band" agents were required to connect to various platform components to be able to discover, configure, update, and monitor the device. However, beginning with iDRAC7, and continued in iDRAC8 and the new iDRAC9, this requirement is drastically reduced because iDRAC's "bare-metal" or out-of-band management capabilities became quite extensive.

As Dell EMC has added more improvements to iDRAC9 and the 14th generation of PowerEdge servers, the gap between in-band and out-of-band management capabilities has become narrow. There are, however, still some functions that require the use of the in-band agent—either the lightweight iDRAC Service Module (iSM) or OpenManage Server Administrator (OMSA.) This paper discusses the unique iDRAC9 architecture & integration with vendors for peripherals such as network cards. This paper also includes a detailed functionality chart, making it easy to identify supported functions for each type of management to help IT admins transition from in band to out of band solutions.

1 Introduction

Dell OpenManage tools help IT administrators effectively deploy, update, monitor, and manage IT assets and to quickly respond to issues by helping them manage Dell EMC PowerEdge servers effectively and efficiently in physical, virtual, local, and remote environments by using in-band and out-of-band technologies.

Because the in-band method has been the De facto management means for many years, many companies have yet to adopt an out-of-band approach to systems management. The traditional, in-band approach of Dell EMC has been anchored with the OpenManage Server Administrator (OMSA) component. The out-of-band approach uses the integrated Dell Remote Access Controller (iDRAC), which is embedded into each server, thus requiring no extra software in order to start working. Dell EMC has just recently developed the iDRAC Service Module (iSM), a very small OS-resident process that is able to communicate OS-related information to iDRAC. This additional functionality makes the combination of iDRAC and iSM a possible replacement for OMSA's functionality for many customers.

Dell EMC continues to improve upon the iDRAC Service Module (iSM), a very small OS-resident process that is able to communicate OS-related information to iDRAC. This additional functionality makes the combination of iDRAC and iSM a very viable replacement for OMSA's functionality for many customers. Also, iSM offers several features that OMSA cannot provide, and will continue to provide added value and functionality.

2 iDRAC9 - The server industry's leading Embedded Management solution

The integrated Dell Remote Access Controller 9 (iDRAC9) with Lifecycle Controller delivers advanced, agent-free, local and remote server administration. Embedded in every PowerEdge server, iDRAC9 provides a secure means to automate a multitude of common management tasks. Because iDRAC is embedded in every PowerEdge server, there is no additional software to install; just plug in power and network cables, and iDRAC with Lifecycle Controller is ready to go. Even before installing an operating system or hypervisor, IT administrators have a complete set of server management features at their fingertips.

With iDRAC9 in place across the Dell EMC PowerEdge portfolio, the same IT administration techniques and tools can be applied throughout. This consistent management platform allows easy scaling of PowerEdge servers as an organization's infrastructure requirements grow. Customers will be able to use the iDRAC RESTful API for the latest in-scalable administration methods of PowerEdge servers. With this API, iDRAC enables support for the Redfish standard and enhances it with Dell EMC extensions to optimize at-scale management of PowerEdge servers. Regardless of size though, the entire OpenManage portfolio of systems management tools allows every customer to tailor an effective, affordable solution for their environment.

2.1 iDRAC Service Module (iSM)

iSM is a very small process which installs in a wide variety of supported operating systems. The iSM makes OS-related information available to the iDRAC, and provides features like a watchdog timer for automatic server recovery, which are important in certain IT environments. The iSM software process does not have its own interface but assists iDRAC by providing additional data that is accessible by using the iDRAC GUI interface, Dell Remote Access Controller Admin (RACADM), or the Web Services for Management (WS-Man) API.

As a result of the smaller footprint iSM is supported on more operating systems when compared to OMSA. There are also features offered by iSM that OMSA does not provide, such as the new for iDRAC9 feature to completely drain the power from the server remotely—no longer requiring a technician in the datacenter to physically pull the power cord from the back of the server.

Because iSM can bridge the gap between the OS and iDRAC, there are several additional solutions available. For example, it is possible to perform a full power cycle of the server via iSM on 14G servers, safely and remotely. No need to travel to the datacenter to pull a power cord. Also, having iSM installed greatly reduces the time spent on the phone with Tech Support. Valuable information such as OS logs can be accessed providing faster time to resolution, and can even provide automated ticket creation with Dell Pro Support.

2.2 OpenManage Server Administrator (OMSA)

OpenManage Server Administrator provides a comprehensive one-one systems management solution for both local and remote servers, their storage controllers, and Direct Attached Storage (DAS). OMSA is able to provide this support by being installed in the operating system or hypervisor on a PowerEdge server.

OMSA provides many of the same functions as iDRAC, but as iDRAC and iSM have continued to improve and evolve, the need for OMSA has been greatly reduced. OMSA does provide some storage information

(see chart below) that is still not available by using iSM or iDRAC. Therefore, for certain customers, that is a compelling reason to continue using OMSA. These features and options are fully described in the following matrix.

2.3 Agent-based systems management

While many customers use the agent-based “in-band” agent for managing their servers, there are some “understood” disadvantages associated with this process. The key implication is that the server has a functioning agent in a functional OS to check and report on the overall health of network and storage devices. Some of other challenges in agent-based systems management are depicted in this Infographics.

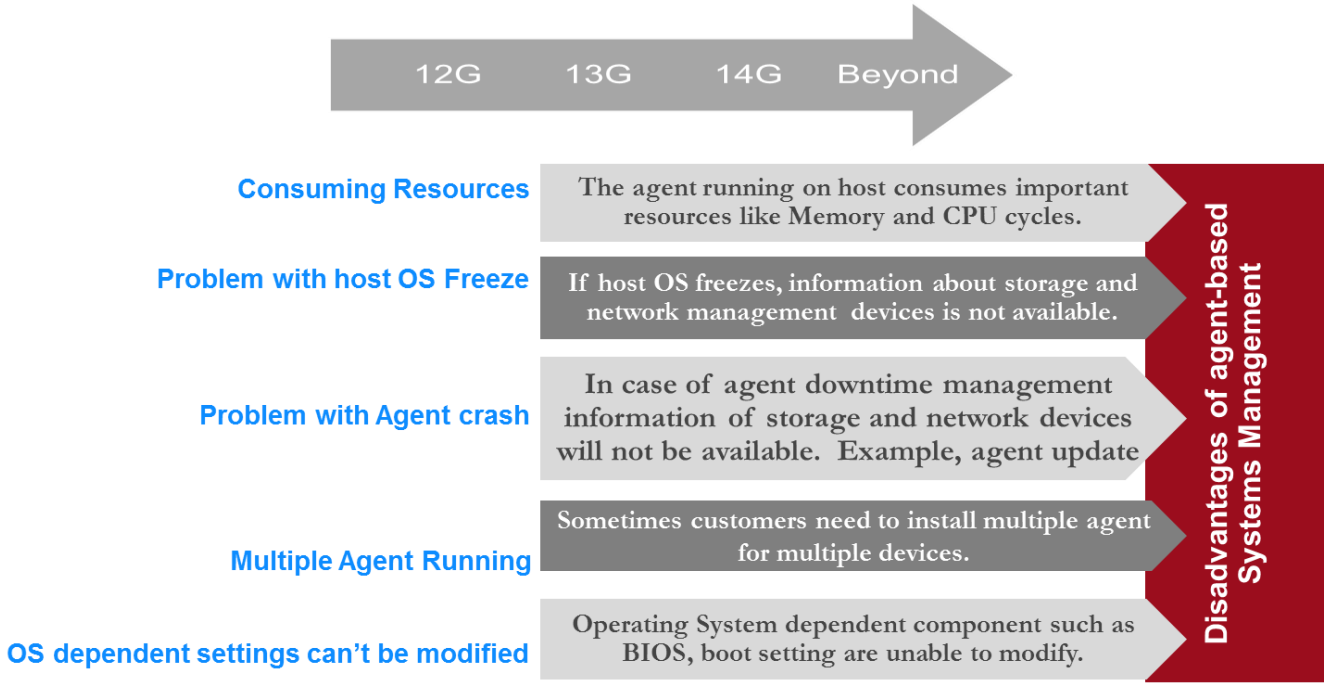

Figure 1 Challenges in agent-based Systems Management

2.4 iDRAC agent-free management

Starting from 12th Generation of PowerEdge Servers, iDRAC supports real-time agent free management of server – meaning no agents are installed or necessary in the OS or hypervisor for complete monitoring and management of the components. iDRAC uses MCTP (Management Component Transport Protocol), a low level protocol used to inventory, monitoring and configuration of hardware components like storage controllers and network cards. MCTP is an industry standard protocol maintained by DMTF (Distributed Management Task Force). iDRAC provides user an ability to deploy, update, configure and monitor various devices & functions such as

- Temperatures
- CPUs
- Memory
- Fans
- Power supplies and voltages
- System information
    - BIOS
    - OS
    - Name
    - Model
- RAID controllers and battery charges
- HBAs
- Network Controllers
- Hard Disks
    - SAS/SATA HDDs
    - SAS/SATA/PCIe SSDs
    - NVMe SSDs

2.5 Advantages of out-of-band management

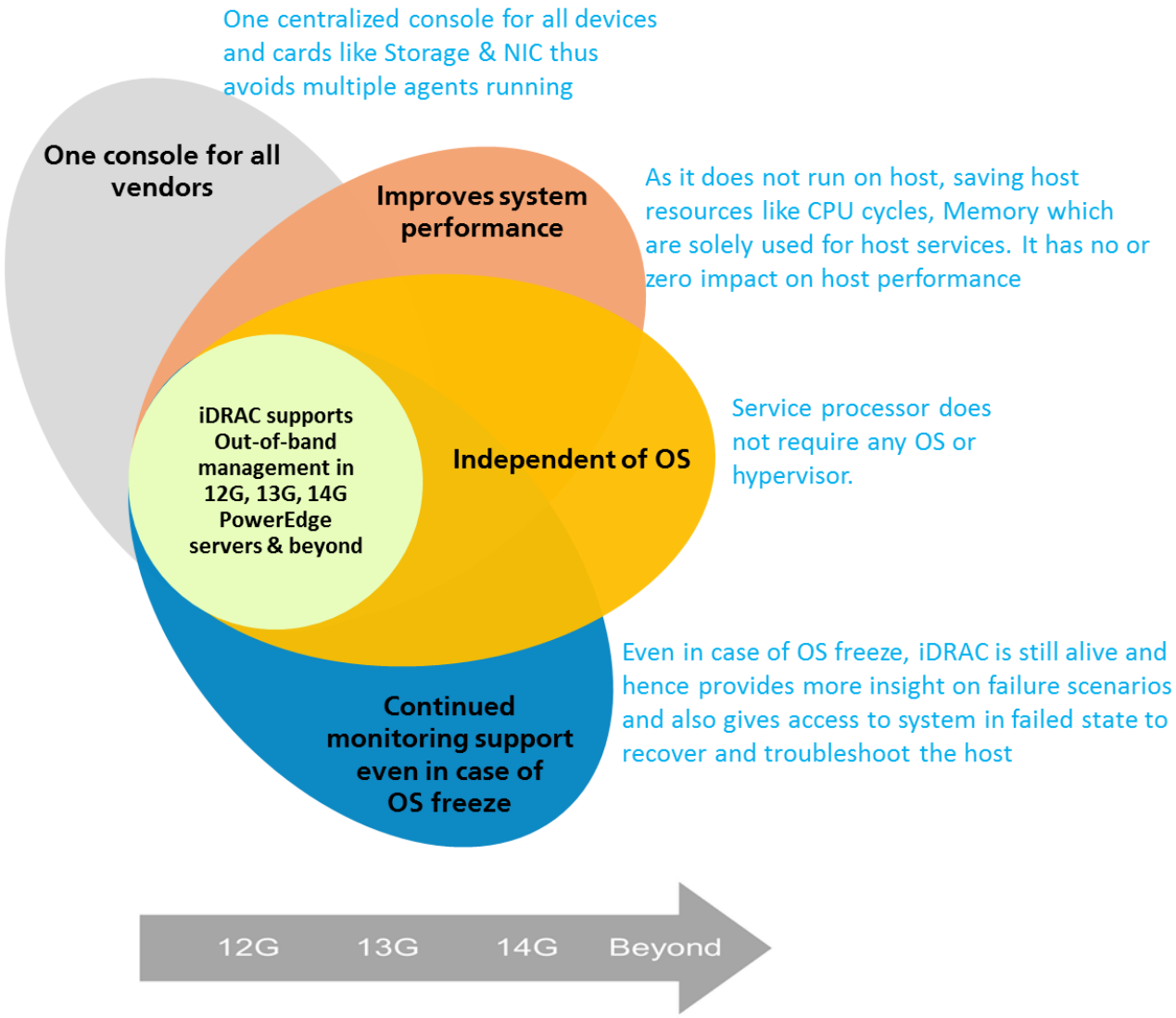

Figure 2 Out-of-band management advantages in Dell EMC iDRAC

2.6 iDRAC agent-free architecture

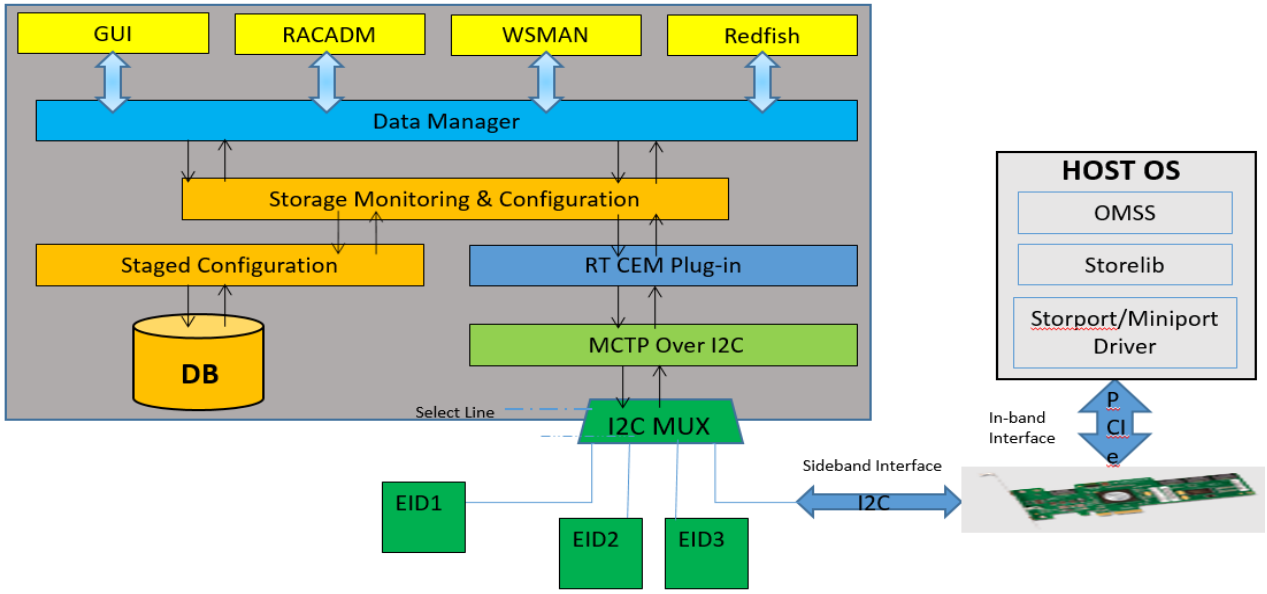

Figure 3 iDRAC agent-free architecture

Communication between iDRAC and storage cards are using SMBus/I2C. For other system components like network card uses RMII. MCTP is transport layer protocol used. For storage and network monitoring iDRAC sends vendor specific commands in MCTP payload over I2C. For some network cards like LOMs, NCSI commands in MCTP payload over RMII. Using staged configuration offline storage configuration is done which requires host to reboot. With RTCEM storage configuration are done in real-time without a host reboot. All inventory & monitored data is stored in data manager. All these data are made available through interfaces like GUI, RACADM, WSMAN and Redfish.

Many vendors work with Dell to support the above back end communications, such as Broadcom, Emulex, Intel, Mellanox, Qlogic, and Samsung.

3 iDRAC9 enhancements—Deep-dive into storage and networking

iDRAC engineers continue to add and expand the various features and functionality for both storage and network management without the use of an agent in the operating system or hypervisor. This section explores in detail these two topics.

3.1 Enhancements for real-time storage management

The 14th generation of PowerEdge server comes with support for PERC10 and iDRAC9 which allows users to configure the storage without any agent. Also, does not require reboot of server for storage configuration. The following storage configuration are added to make the storage configuration more comprehensive:

- **Online Capacity Expansion**: Online Capacity Expansion (OCE) allows to increase the storage capacity of selected RAID levels (currently all RAID levels except RAID 50 and RAID 60) either using available disk capacity or by adding new disk.
- **Raid Level Migration**: RAID Level Migration (RLM) refers to changing a virtual disk´s RAID level. So this feature provides ability to change the RAID level of virtual disk.
- **Instant Erase Secured Physical Disk**: This feature is the ability to securely erase the contents on the physical Self Encrypting Drives.
- **Rebuild Physical disk**: This feature is the ability to reconstruct the contents of failed disk. This is true only when auto rebuild option is set to false.
- **Manage preserved cache**: The Manage Preserved Cache feature provides user the option to discard the controller cache data.
- **Cancel Initialization**: Using this feature, user is allowed to cancel background initialization of virtual disk. On PERC controllers, the background initialization of redundant virtual disk begins automatically after a virtual disk is created. The background initialization of redundant virtual disk prepares the virtual disk for parity information and improves write performance. It is important that the background initialization is allowed to be complete. However some processes such as creating a virtual disk cannot be run while the background initialization is in progress. This feature provides the ability to cancel the background initialization manually. But if cancelled, the background initialization automatically restarts within 0 to 5 minutes.
- **Rename VD**: Using this feature, the administrator can rename any virtual disk.
- **Set Enclosure Asset Tag**: This feature is the ability to configure Asset Tag of storage enclosure. The user can change the Asset Tag property of the enclosure to help them identify enclosures.
- **Set Enclosure Asset name**: This feature is the ability to configure Asset Name of storage enclosure. The user can change the Asset Name property of the enclosure to help them identify enclosures.

As part of storage inventory iDRAC collects the information about storage controllers, physical drives, virtual drives, Enclosures, Fans, EMMs & batteries. For more information about the inventory details refer to screenshots in Appendix.

3.2 Enhancements for real-time network management

Along with new storage features, iDRAC also expanded and enhanced its network management. A new feature found in Dell EMC 14th generation PowerEdge servers is the iDRAC9 “Connection View.” This feature provides details of the physical mapping of switch ports to server ports and iDRAC dedicated port connections. Many of the Dell supported cards used for LOM, NDC, Mezz cards, PCIe add-in cards and Standard PCIe cards can report this feature. The switch connection and switch port connection information are provided per network port and not per network partition.

Aside from Connection View, iDRAC still provided in depth inventory on networking cards. As part of inventory, iDRAC collects following information from network devices.

Table 1 Details of Inventory of Network Devices

Inventory Details
Vendor name
Number of ports
Device Type, whether the device is Integrated, Embedded, Slot (NIC) or Mezzanine.
Slot number where the device is located
Port supports partitioning or not
Port is partitioned or not
Different partitions of a port
Partition protocols used such as NIC, iSCSI, or FCoE
MAC addresses of port and partitions
Media type of the port such as BASE-T, KR, KX, SFP, SFP+, and so on.
Family firmware version
Family driver version (in case the operating server driver is installed)
Controller capabilities such as virtual addressing, boot protocol capabilities, eSwitch, DCB and etc.

iDRAC monitors real-time information of network ports of network devices also. The following are the attributes of ports being monitored by iDRAC.

Table 2 Real-time Network controller Port information

Attribute	Description
Link Status	If the network port or partition link is up (if port is partition capable).
OS Driver State	If the network operating system driver is installed and is up.
Receive Statistics	Receive statistics such as Total Bytes, Total Unicast, Multicast, Broadcast packets, Runt packets, Jaber packets, and so on.
Transmit Statistics	Transmit statistics such as Total Bytes, Total Unicast, Multicast, broadcast packets, and so on.

4 iDRAC with Lifecycle Controller, iDRAC with iSM, or OMSA—Comparison matrix

The following matrix helps break down and identity features supported by these different OpenManage components. As seen below, iDRAC9 provides an extensive amount of features without the need for agents. However, added functionality can be gained by adding either iSM or OMSA.

Category	Feature	iDRAC7/8 2.10.10.10 or higher	iDRAC7/8 2.10.10.10 or higher, with iSM	iDRAC9 14G	iDRAC9 with iSM	OMSA (In Band) All generations
Server Health	CPU (Processors)	✓	✓	✓	✓	✓
	CPU Throttling Warning	✓	✓	✓	✓	✓
	Predictive CPU failure	✓	✓	✓	✓	✓
	Fans	✓	✓	✓	✓	✓
	Temperatures	✓	✓	✓	✓	✓
	Memory	✓	✓	✓	✓	✓
	NVDIMM (memory only)			✓	✓	✓
	DIMM ranking	✓	✓	✓	✓	✓
	NIC's	✓	✓	✓	✓	✓
	CNA's	✓	✓	✓	✓	✓
	Power Supplies	✓	✓	✓	✓	✓
	Power Consumption	✓	✓	✓	✓	✓
	Power Consumption History	✓	✓	✓	✓	
	Voltages	✓	✓	✓	✓	✓
	Batteries	✓	✓	✓	✓	✓
	Chassis Intrusion	✓	✓	✓	✓	✓
	Inlet Temperature history	✓	✓	✓	✓	
Storage	PERC storage controller	✓	✓	✓	✓	✓
	PERC battery	✓	✓	✓	✓	✓
	Physical Hard Drives	✓	✓	✓	✓	✓
	Virtual Drive	✓	✓	✓	✓	✓
	External Storage Enclosure	✓	✓	✓	✓	✓
	SSD monitoring	✓	✓	✓	✓	✓
	SSD write endurance	✓	✓	✓	✓	✓
	PCIe SSD's	✓	✓	✓	✓	✓

Category	Feature	iDRAC7/8 2.10.10.10 or higher	iDRAC7/8 2.10.10.10 or higher, with iSM	iDRAC9 14G	iDRAC9 with iSM	OMSA (In Band) All generations
	FC HBA's	✓	✓	✓	✓	card/slot info
	Online Capacity Expansion (OCE)			✓	✓	✓
	RAID Level Management (RLM)			✓	✓	✓
	Rename Virtual Disk			✓	✓	✓
	Cancel Initialization			✓	✓	✓
	Rebuild / Cancel rebuild Physical Disks			✓	✓	✓
	Set Enclosure Asset tag and Asset name			✓	✓	✓
	Enabling revertible hotspare			✓	✓	✓
	Cryptographic Erase of Physical Disk			✓	✓	✓
	Manage Preserve cache			✓	✓	✓
	Create Virtual Disk	✓	✓	✓	✓	✓
	Delete Virtual Disk	✓	✓	✓	✓	✓
	Reset Controller Configuration	✓	✓	✓	✓	✓
	Clear Foreign Configuration	✓	✓	✓	✓	✓
	Import Foreign Configuration	✓	✓	✓	✓	✓
	Initialze Virtual Disk (Fast and Full)	✓	✓	✓	✓	✓
	Consistency Check for Virtual Disk	✓	✓	✓	✓	✓
	Start/Stop Patrol Read	✓	✓	✓	✓	✓
	Assign/Unassign Global and Dedicate Hotspares	✓	✓	✓	✓	✓
	Blink/Unblink Physical Disk/Virtual Disk	✓	✓	✓	✓	✓
	Local Key Management (Create/Change/Delete Security Key)	✓	✓	✓	✓	✓
	Controller Attributes	✓	✓	✓	✓	✓
	Virtual Disk Attributes	✓	✓	✓	✓	✓

Category	Feature	iDRAC7/8 2.10.10.10 or higher	iDRAC7/8 2.10.10.10 or higher, with iSM	iDRAC9 14G	iDRAC9 with iSM	OMSA (In Band) All generations
	Convert drive to RAID	✓	✓	✓	✓	✓
	Convert drive to NonRAID	✓	✓	✓	✓	✓
	Staged RAID configuration	✓	✓	✓	✓	real time
	Preparing To Remove A PCIe SSD (NVMe)				✓	✓
	BOSS (Boot Optimized Storage Solution)					Monitor
	Chipset/software RAID					✓
Networking	Internet standard MIB-II	✓	✓	✓	✓	✓
	Network device MIB	✓	✓	✓	✓	✓
	Link Up/Down traps	✓	✓	✓	✓	✓
	Teaming Information					✓
	VLAN Information					✓
	Statistics	✓	✓	✓	✓	✓
	Host OS IP Address and host name				✓	✓
	MAC Address	✓	✓	✓	✓	✓
	Device Configuration	✓	✓	✓	✓	
Configuration and Settings	BIOS settings	✓	✓	✓	✓	✓
	iDRAC settings	✓	✓	✓	✓	✓
	Import/export system configuration	✓	✓	✓	✓	
	Power Cap	✓	✓	✓	✓	
	Power State Control	✓	✓	✓	✓	✓
	LCD	✓	✓	✓	✓	✓
	Remote full power cycle				✓	
	Remote iDRAC reset		✓		✓	
Inventory and Monitoring	OS Information (OS name, version)				✓	✓
	iDRAC Information	✓	✓	✓	✓	✓
	Firmware inventory	✓	✓	✓	✓	✓
	Logging to OS logs				✓	✓
	Event notification via Email	✓	✓	✓	✓	✓

Category	Feature	iDRAC7/8 2.10.10.10 or higher	iDRAC7/8 2.10.10.10 or higher, with iSM	iDRAC9 14G	iDRAC9 with iSM	OMSA (In Band) All generations
	Prescriptive Alert Messages	✓	✓	✓	✓	
	SNMP Traps (v1, v2, v3)	✓	✓	✓	✓	v1 v2 only
	SNMPv3 Gets	✓	✓	✓	✓	✓
	WS-MAN	✓	✓	✓	✓	
	Redfish support	✓	✓	✓	✓	
	Redfish IPv6 policy & vLAN information				✓	
	Hardware Inventory	✓	✓	✓	✓	✓
	iDRAC License management	✓	✓	✓	✓	view only
	View Lifecycle Controller Log	✓	✓	✓	✓	
	Crash Screen Capture				✓	✓
	Crash Video Capture (Enterprise)				✓	✓
	Automatic System Recovery (Watchdog timer)				✓	✓
	CLI tools	✓	✓	✓	✓	✓
Updates	iDRAC/LC update	✓	✓	✓	✓	
	System component update	✓	✓	✓	✓	
	Hard Drive updates (SAS/SATA)	✓	✓	✓	✓	✓

Conclusion

As seen in the above chart, the functionality of iDRAC continues to increase, especially in regards to agent-free storage management. Add on the additional benefits from having iSM installed, and the need for OMSA continues to decrease. iDRAC with iSM provides nearly the full range of monitoring and management functionality. However, there are a few corner case scenarios which would require the use of the in-band OMSA agent. In keeping with OpenManage design philosophy, it is the goal of Dell EMC to provide a full set of tools that allow each customer the right components for their IT environments.

Based on customer feedback, we will continue to add more features to the out-of-band iDRAC and iSM solution to provide greater functionality and reduce the need for in-band software agents.

Technical support and resources

- Dell.com/support is focused on meeting customer needs with proven services and support.
- Dell TechCenter is an online technical community where IT professionals have access to numerous resources for Dell EMC software, hardware and services.
- DellTechCenter/iDRAC provides up to date links to firmware downloads, manuals, and white papers for iDRAC.

5 Appendix

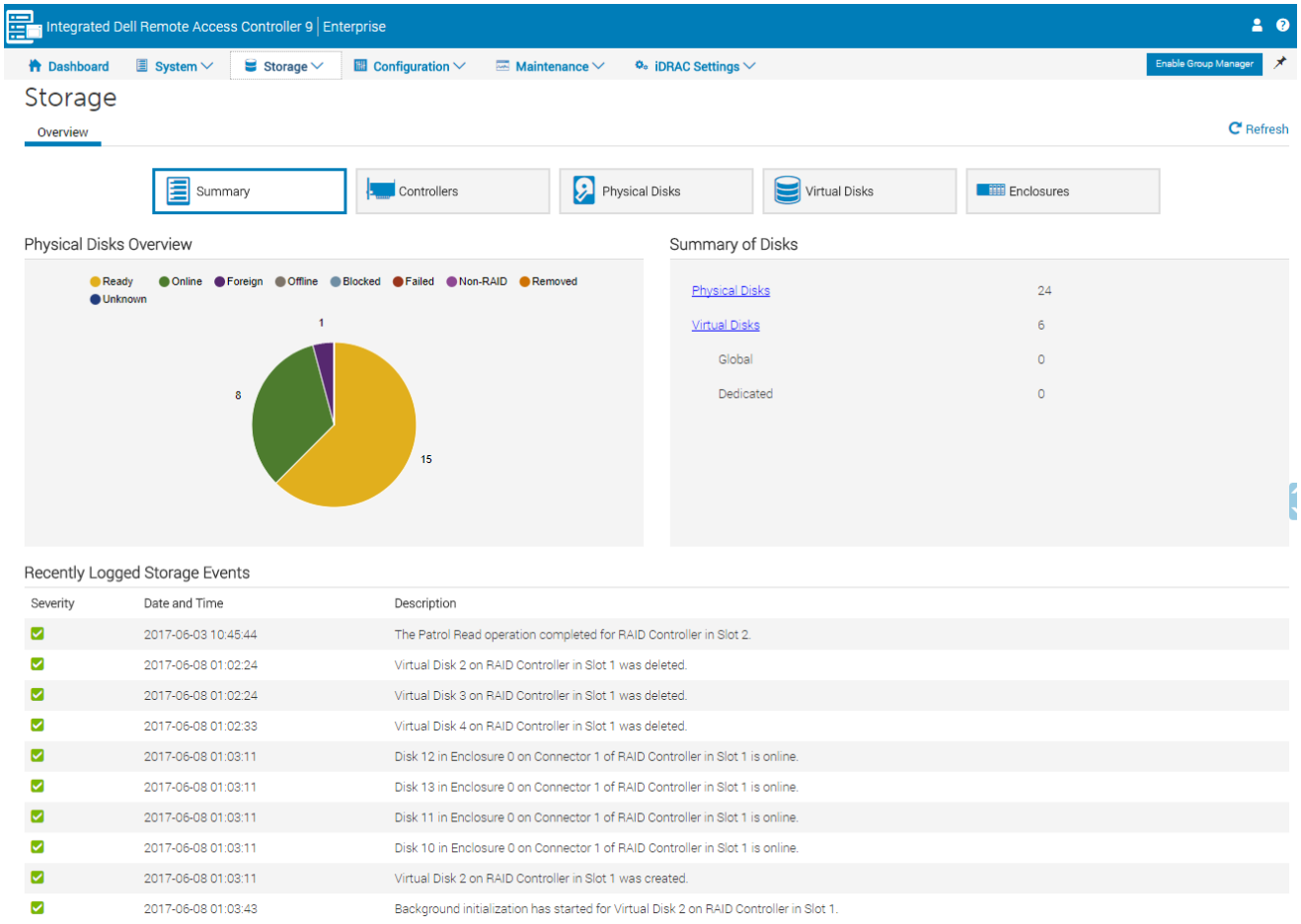

Figure 4 Storage Summary displayed on the iDRAC9 GUI

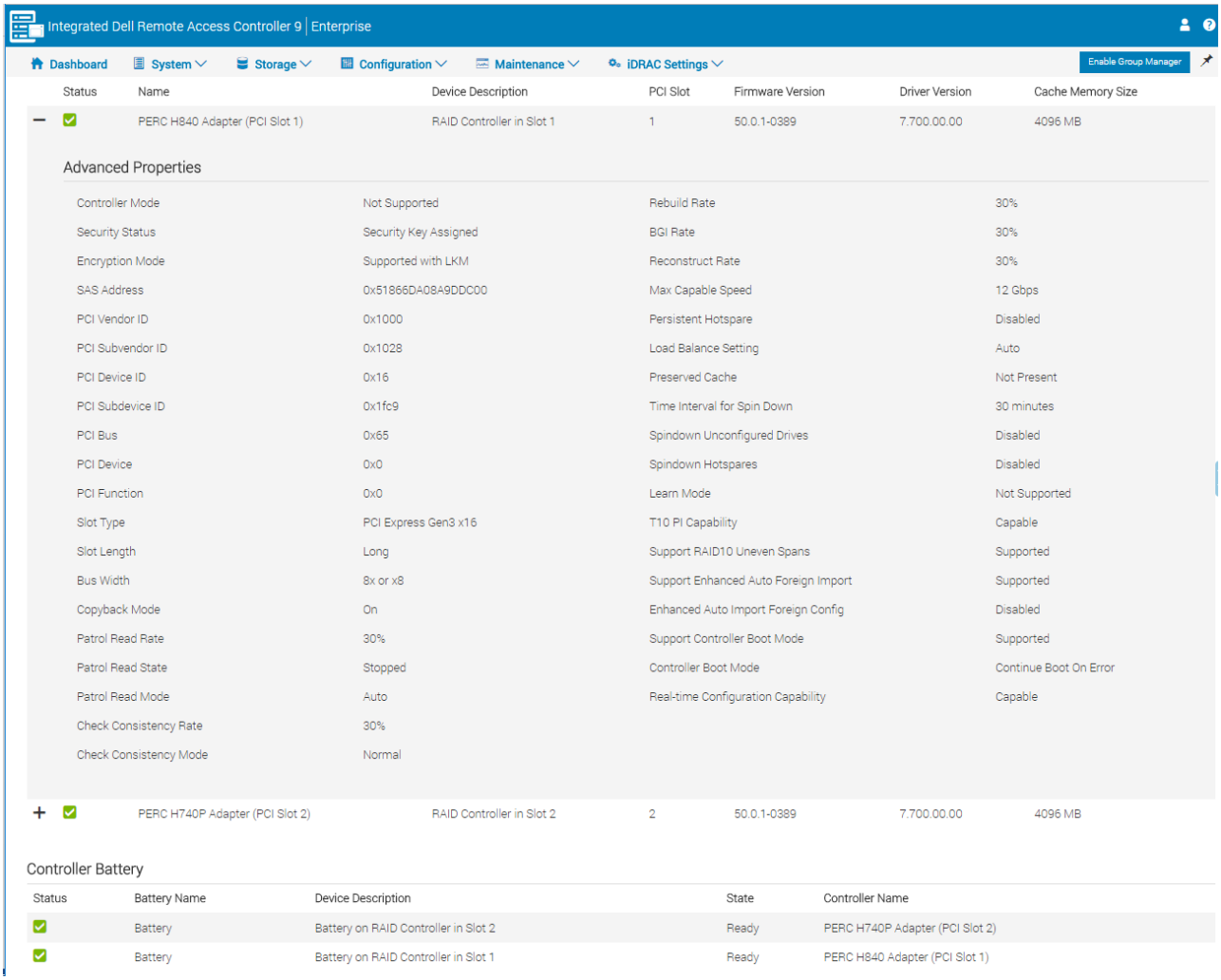

Figure 5 Controller Inventory Details displayed on the iDRAC9 GUI

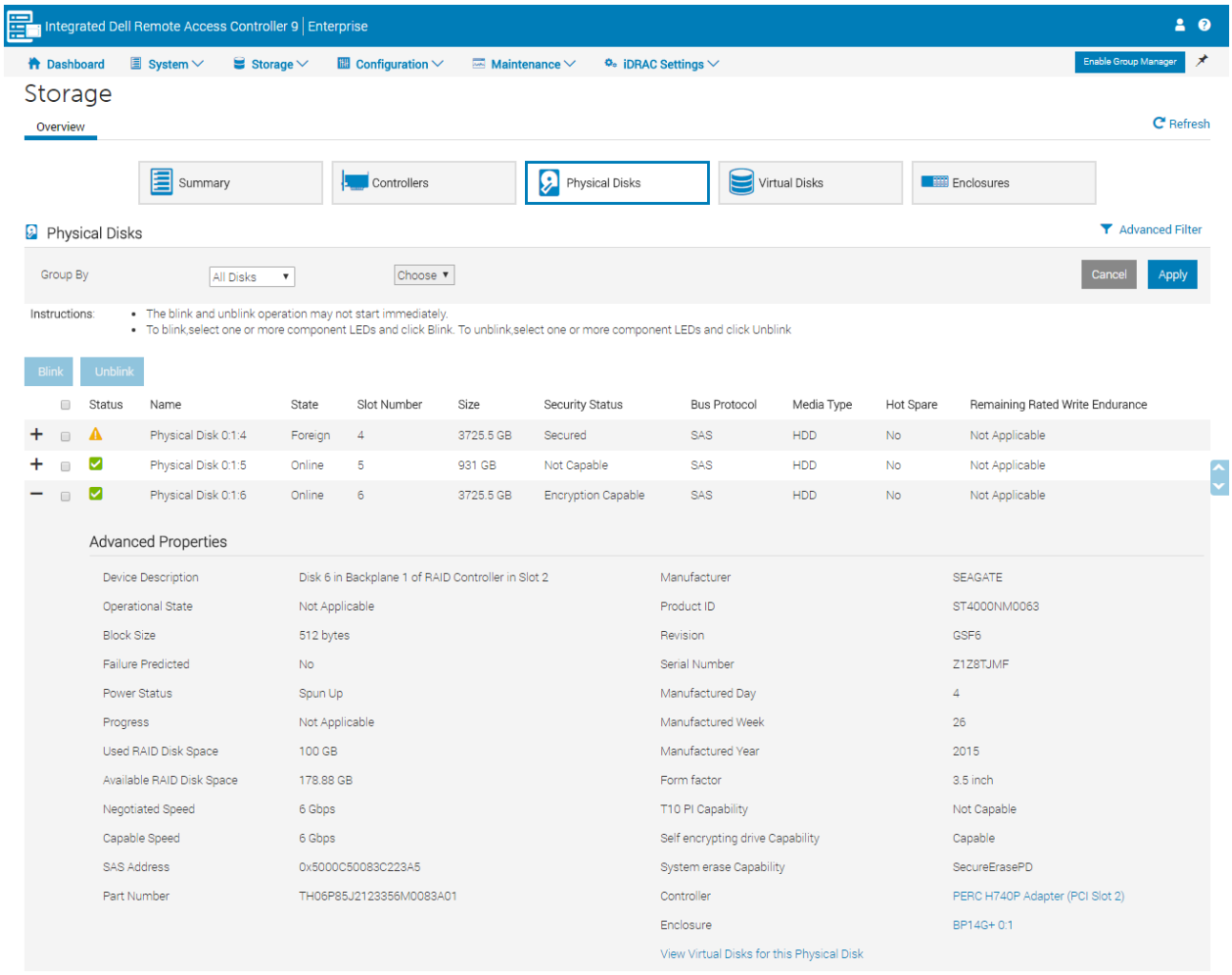

Figure 6 Physical Disk Inventory Details displayed on the iDRAC9 GUI

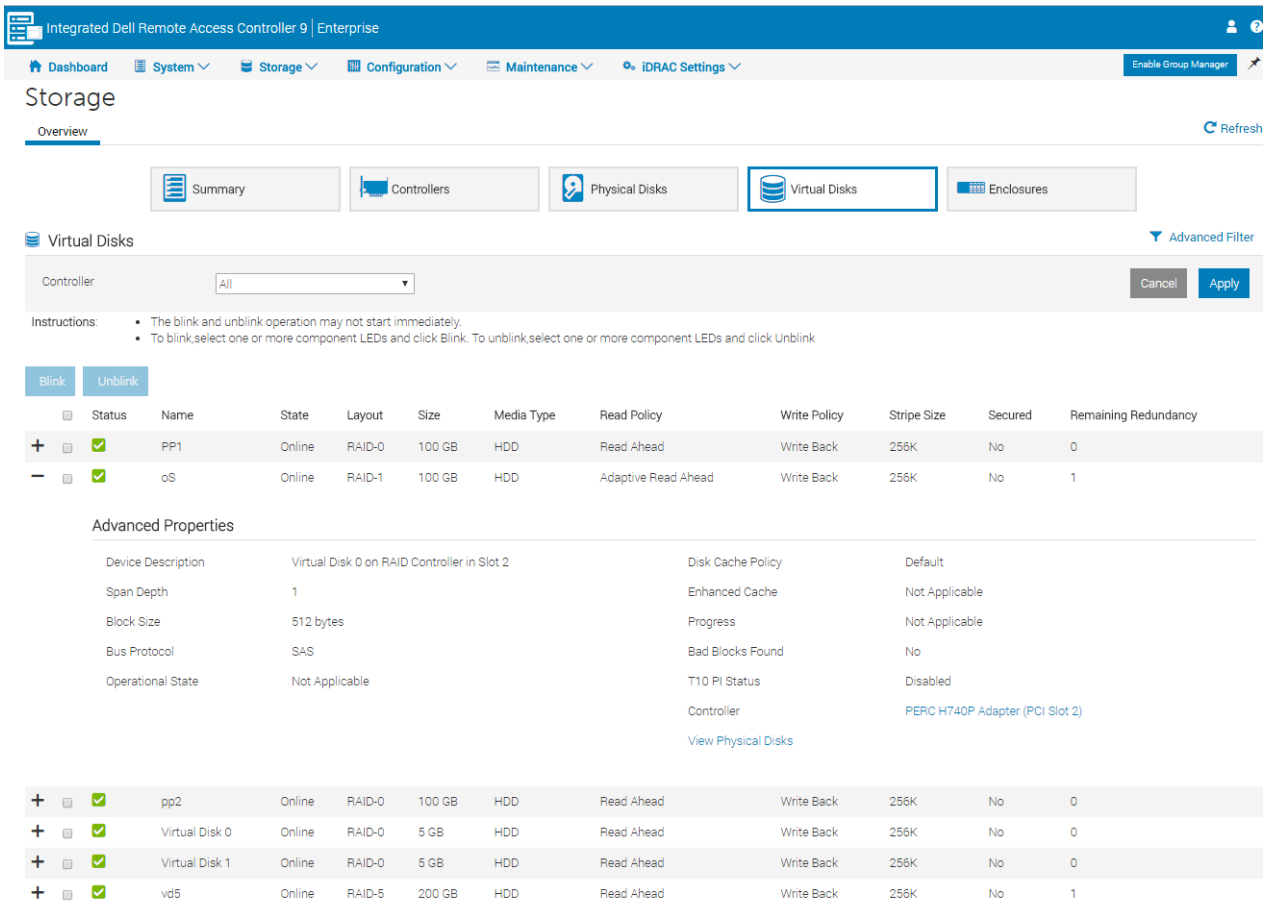

Figure 7 Virtual drive inventory details displayed on the iDRAC9 GUI

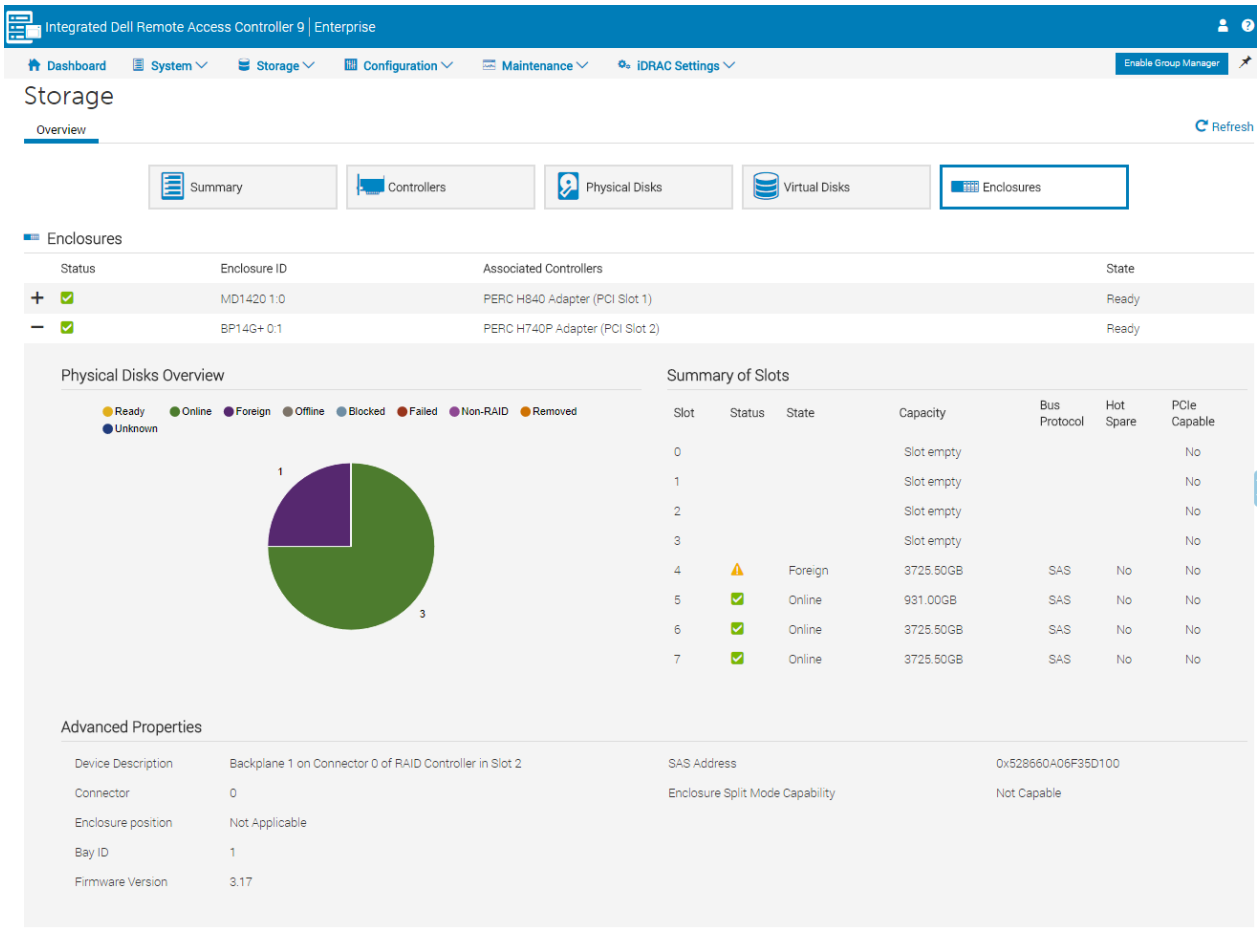

Figure 8 Enclosures Inventory Details displayed on the iDRAC9 GUI

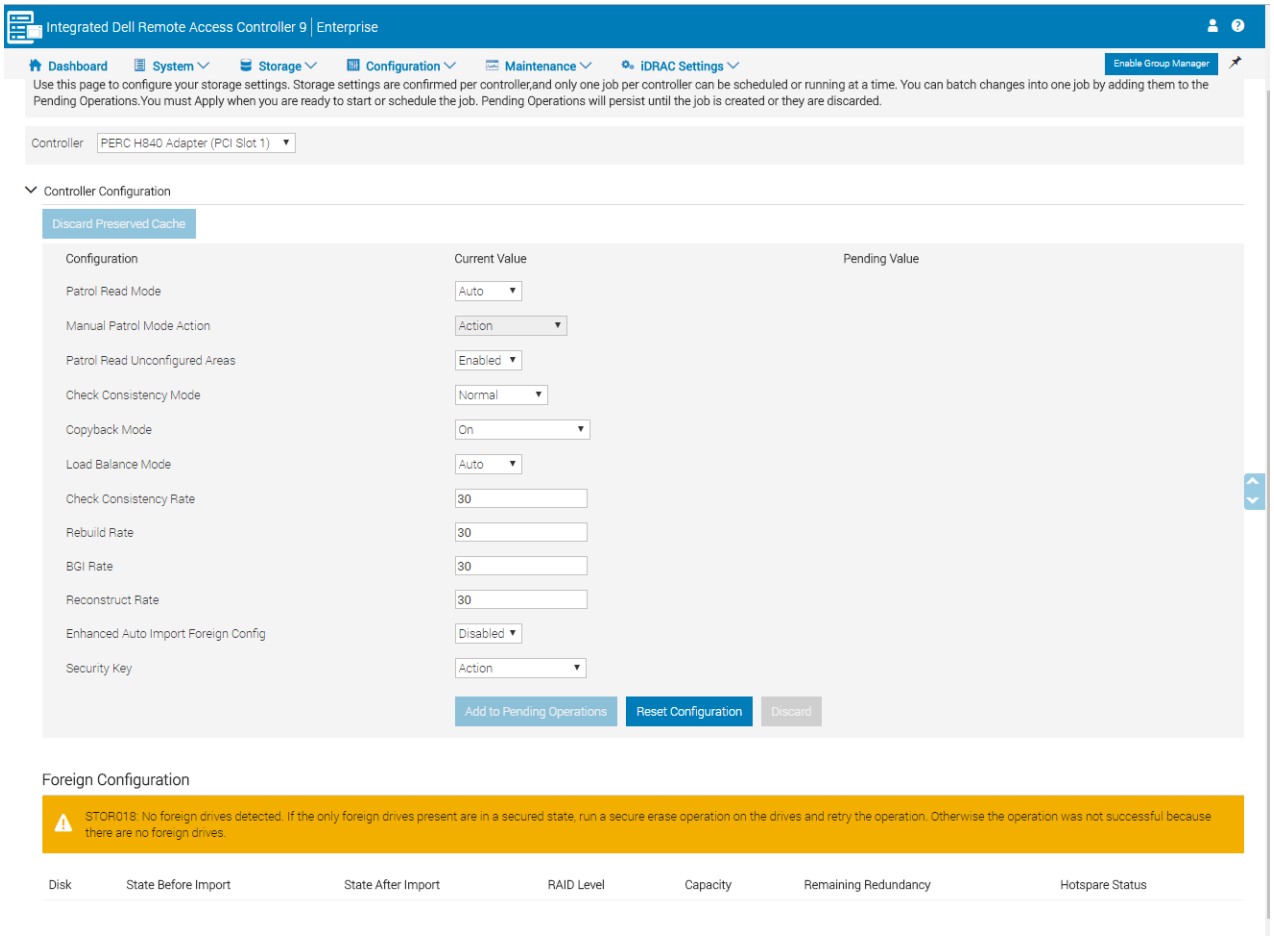

Figure 9 Controller Configuration displayed on the iDRAC9 GUI

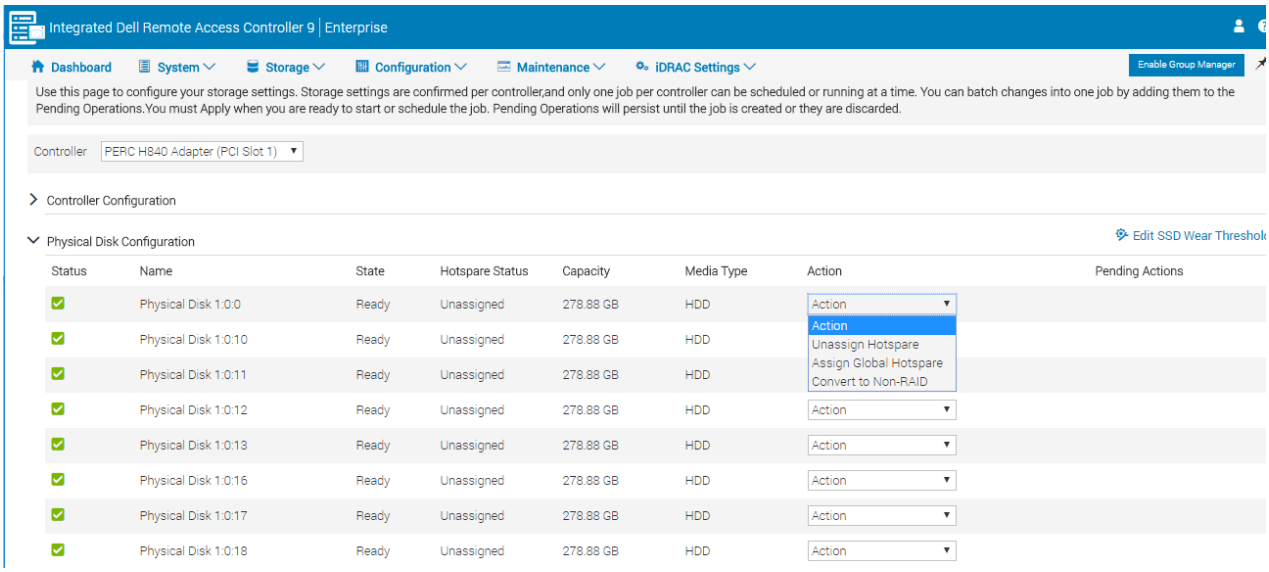

Figure 10 Physical Disk Configuration displayed on the iDRAC9 GUI

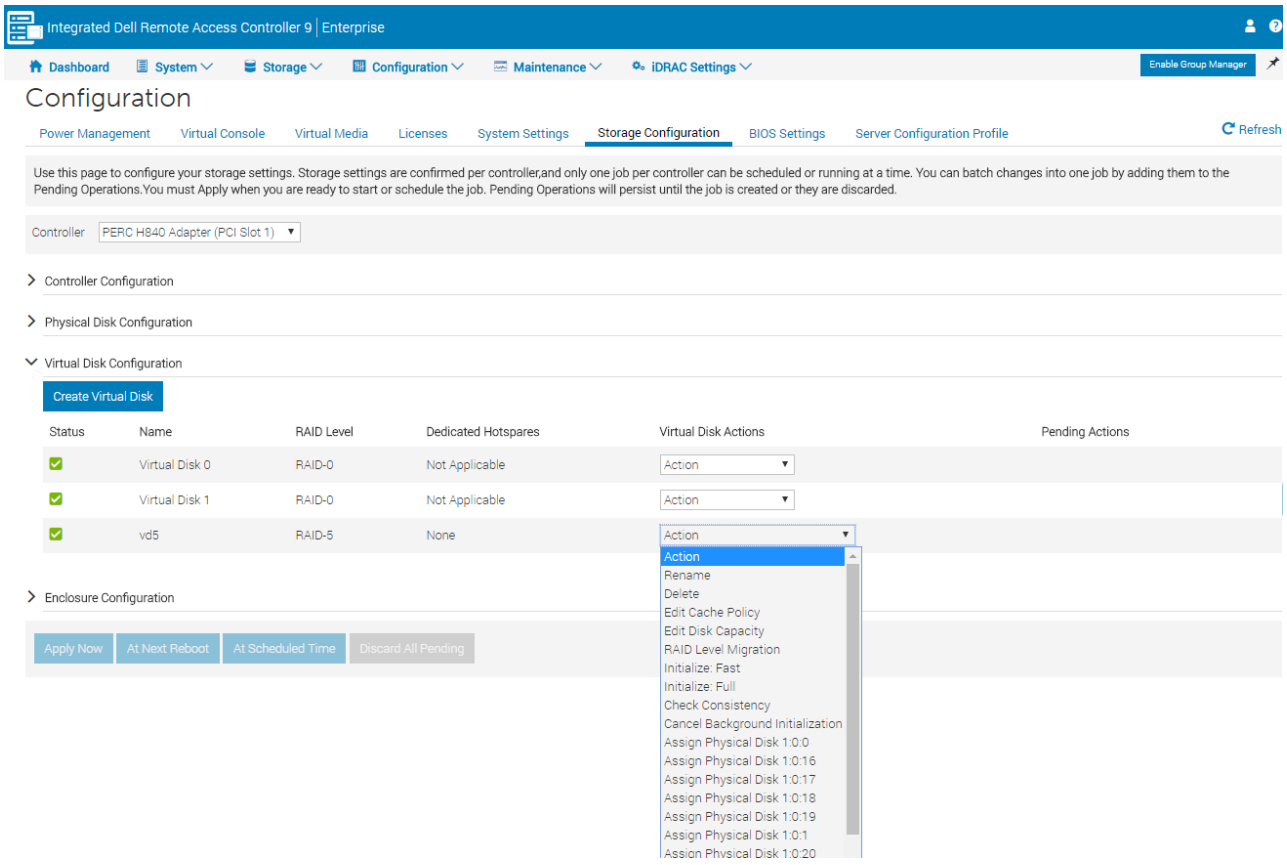

Figure 11 Virtual Disk Configuration displayed on the iDRAC9 GUI

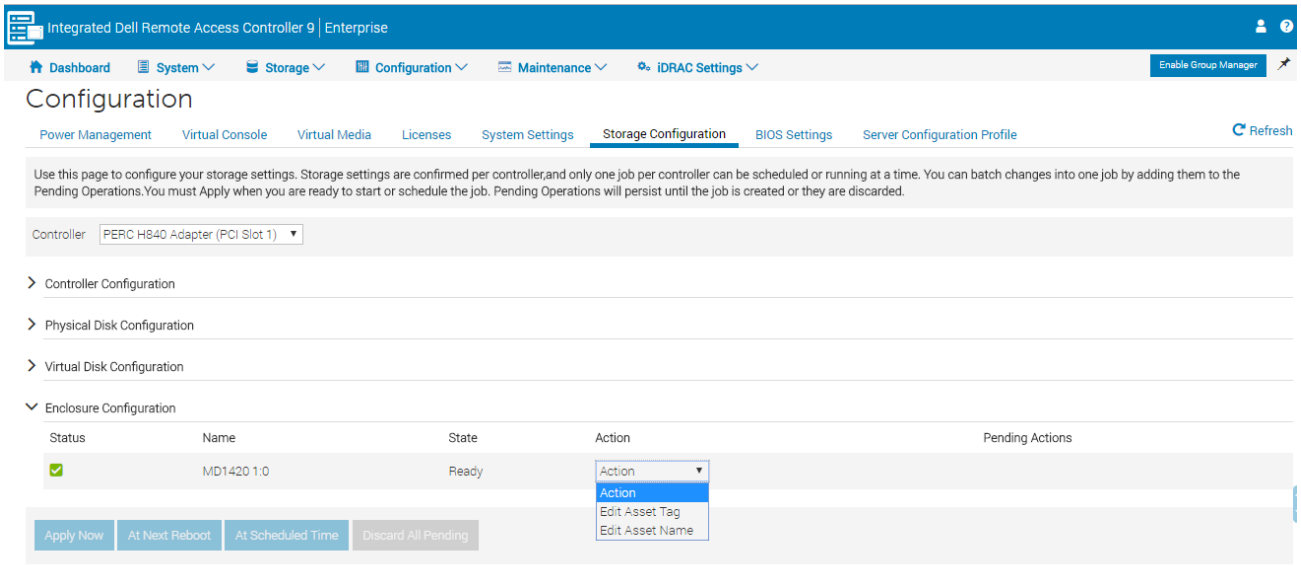

Figure 12 Enclosure Configuration displayed on the iDRAC9 GUI