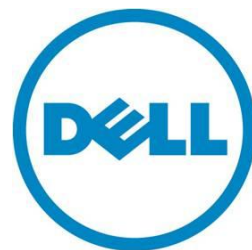

Agent-free Inventory and Monitoring for Storage and Network Devices in Dell PowerEdge 12th Generation Servers

This Dell Technical White Paper provides an overview on the agent-free monitoring feature provided in Dell's 12th generation servers.

Authors: Chitrak Gupta, Srilatha Narayana, Karthik V, and Sai Prasad Bale
Dell Group



Executive Summary

Agent-free monitoring is the state-of-the-art out-of-band manageability solution for Dell's 12G servers. The whitepaper aims to provide the salient features of the solution and how it helps in more efficient device management in the servers in datacenters. The solution is completely out-of-band with no dependence on any operating system agents.



Contents

- Introduction.....4
- About Agent-free Monitoring4
 - The Backbone: MCTP5
- Agent-free Inventory and Monitoring of Storage Devices5
 - Inventory of Storage Devices5
 - Monitoring Storage Devices 10
- Agent Free Monitoring for Network Devices 11
 - Inventory of Network Devices 12
 - Monitoring Network Devices 13



Agent Free Monitoring helps Out-of-band monitoring of devices with no dependency on operating system or in-band agents.

Introduction

Until the advent of 12G servers, the storage and network device inventory and monitoring was performed in-band that is using software agents installed on the system. Software agents include Dell OpenManage Server Administrator or vendor provided tools running on the operating system. They were used to effectively monitor any IPMI-capable device with the iDRAC device on the motherboard. In Dell PowerEdge 12th generation servers, you can inventory and monitor the storage and network devices using iDRAC7 without installing any agent on the managed system and management station. Agent-free monitoring is the systems management solution for Dell's 12th generation servers.

You can remotely inventory and monitor the storage and network devices connected to the server irrespective of the host operating system state.

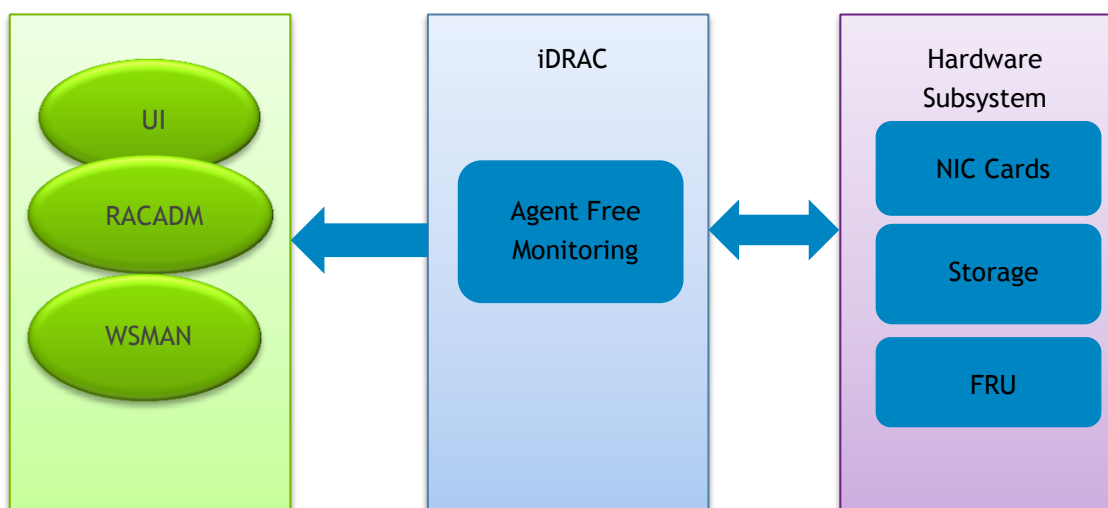
Agent-free monitoring helps to:

- Remove dependence on in-band agents and monitor devices without the presence of an operating system.
- Release CPU cycles for other computing tasks since there is zero impact on host performance.
- Provides the most relevant data through an intuitive user interface.
- Provides a centralized location from where the monitoring data of the storage devices and network cards can be accessed, thereby reducing the need for multiple agents to monitor.

About Agent-free Monitoring

In Dell PowerEdge 12th generation servers, agent-free monitoring uses Management Component Transport Protocol (MCTP) to effectively monitor the RAID controllers and network controllers present in the server. MCTP is an industry standard protocol defined and maintained by Distributed Management Task Force (DMTF).

Figure 1. Overall Architecture



The Backbone: MCTP

MCTP is a media independent transport protocol for communicating management information or traffic over different bus types within a system. MCTP is a compact protocol that is suitable for intra-system exchange of management data. This enables management data to be exchanged with very less overhead of the protocol while abstracting the details of the data that is exchanged between managed devices and the management controller from the application layers. MCTP enables agent-free monitoring with a standard method to add out-of-band management support for more devices (from different vendors) that use MCTP.

Out-of-band operation is implemented in Dell's 12th generation servers using a separate SMBus connection between iDRAC and supported endpoints.

Note: Out-of-band management is applicable only for supported devices. For more information about supported devices, see the Dell website.

All MCTP communication occurs over this SMBus interface. This separate interface has allowed:

- Agent free management or monitoring
- Host processing power not consumed for management or monitoring tasks

For more information on MCTP, see

<http://www.dmtf.org/sites/default/files/standards/documents/DSP2016.pdf>

Agent-free Inventory and Monitoring of Storage Devices

Until the 11th generation of Dell servers, the storage components were primarily monitored using in-band software agents such as OpenManage Storage Services (OMSS). Starting with 12th generation of servers and the new PERC 8 series of controllers, there is an additional mechanism to achieve this with agent-free monitoring. Agent-free monitoring or Out-of-band monitoring solution on iDRAC7 encompasses inventory and monitoring of the direct-attached storage subsystem that includes the RAID controller cards, batteries, physical disks, virtual disks and enclosures.

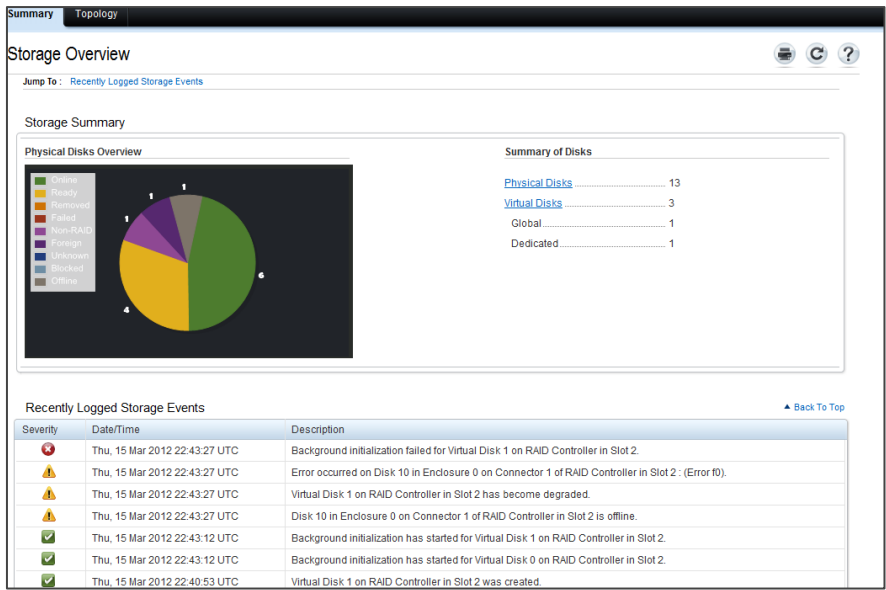
Inventory of Storage Devices

To view storage inventory using the iDRAC7 Web interface, launch the iDRAC7 Web interface and go to Overview-> Storage. The following sections provide more information on the various storage devices displayed in the iDRAC7 Web interface.

Storage Summary Page: Provides a summary of the devices in the storage sub-system (Figure 2). The pie chart represents the physical disks connected to the PERC8 controllers. Alongside the pie chart, cumulative statistics about the physical disks, virtual disks, and hot spares are displayed. Click on the physical disks or virtual disks links, to view the respective pages that provide more information. The recent storage related events monitored by iDRAC7 are also listed.

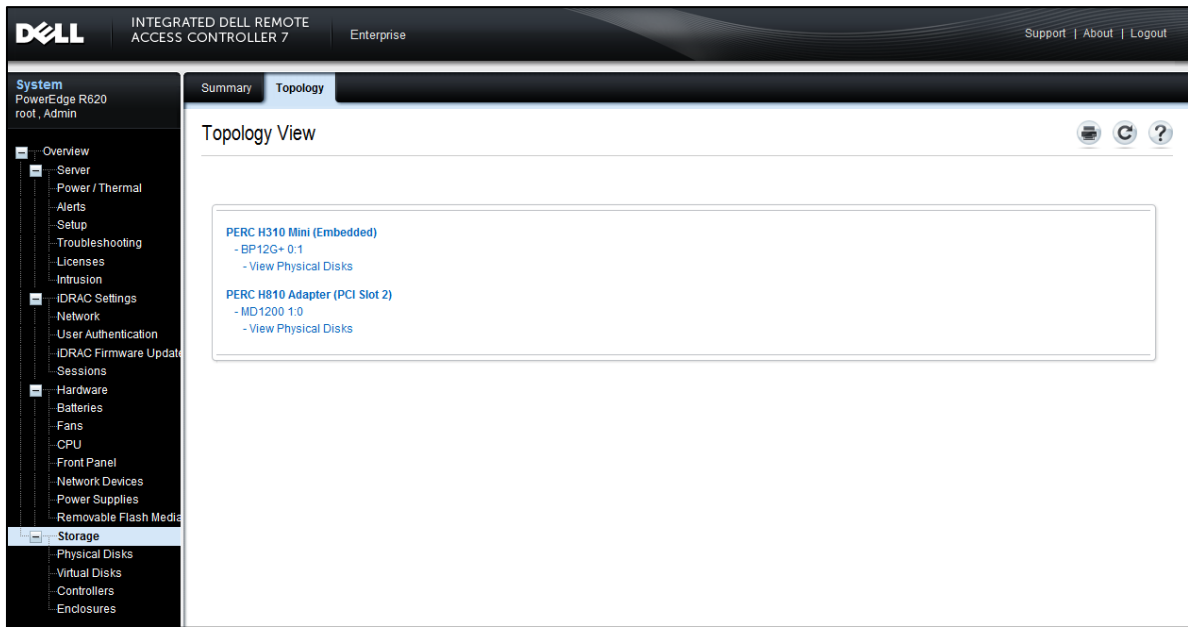


Figure 2. Storage Summary Page



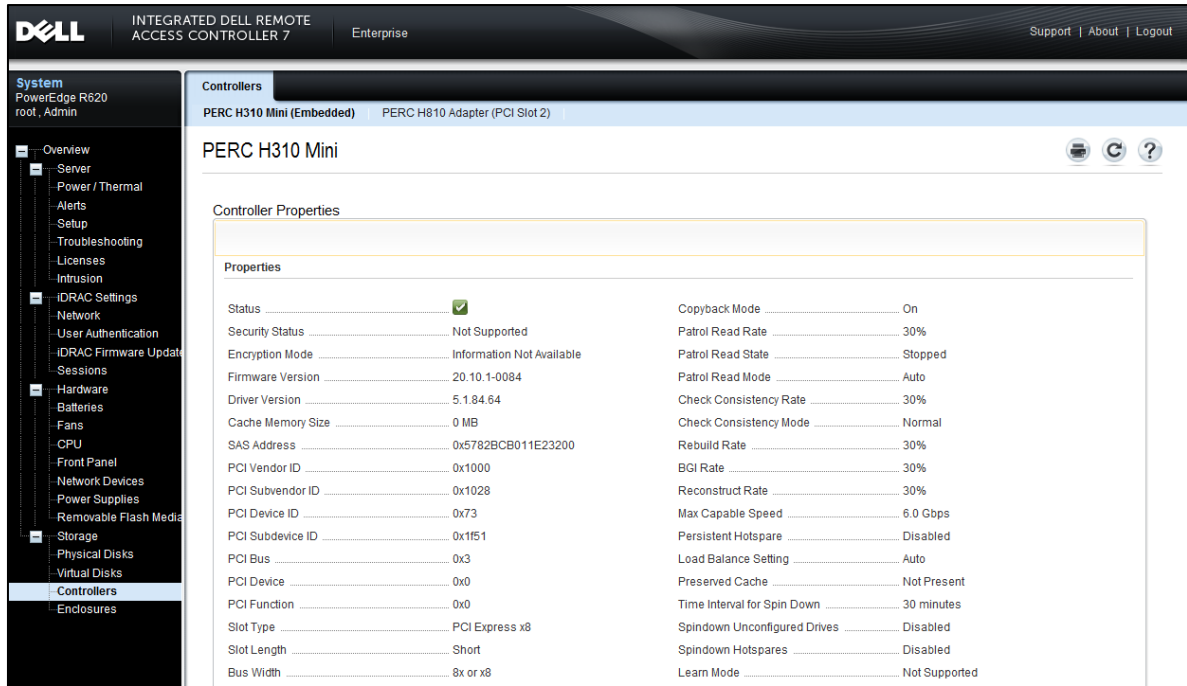
Topology View: Provides a hierarchical view of the physical containment of the storage devices attached to the server (Figure 3). Click on the links to view more information about the specific devices.

Figure 3. Topology View



Controller View: Provides details of the PERC 8 controllers connected to the server (Figure 4). Some of the attributes that can be viewed are - PCI slot, health status, firmware version, host driver version and cache memory size.

Figure 4. Controller View



Physical Disk View: Provides details of the physical disks attached to PERC 8 controllers (Figure 5). Some of the attributes that can be viewed are - slot number, health status, size, security status, bus protocol, media type and hot spare. Expand the entry to view more attributes. The disks connected to a specific backplane or enclosure or part of specific virtual disk can also be grouped and viewed (under the 'Basic Physical Disk filter' section). Additionally, physical disks with specific values can be filtered and viewed (under the 'Advanced Physical Disk filter' section).



Figure 5. Physical Disk View

The screenshot displays the Dell iDRAC 'Physical Disks' view. On the left is a navigation menu with categories like System, Overview, Server, Alerts, Setup, Troubleshooting, Licenses, Intrusion, iDRAC Settings, Network, User Authentication, iDRAC Firmware Updates, Sessions, Hardware, Batteries, Fans, CPU, Front Panel, Network Devices, Power Supplies, Removable Flash Media, Storage, Physical Disks, Virtual Disks, Controllers, and Enclosures. The main area shows a table of physical disks and an expanded 'Advanced Properties' section for a selected disk.

	Health	Model	State	Slot	Size	Capacity	Interface	Cache	Format
0:1:0	Online	U	136.13 GB	Not Capable	SAS	HDD	No		
Physical Disk 0:1:1	Online	1	136.13 GB	Not Capable	SAS	HDD	No		
Physical Disk 0:1:2	Non-RAID	2	136.13 GB	Not Capable	SAS	HDD	No		
Physical Disk 0:1:3	Ready	3	136.13 GB	Not Capable	SAS	HDD	Global		
Physical Disk 0:1:5	Ready	5	136.13 GB	Not Capable	SAS	HDD	Dedicated		

Advanced Properties

Status	Online	Negotiated Speed	3 Gbps
Name	Solid State Disk 1:0:2	Capable Speed	3 Gbps
State	Online	SAS Address	0x5001E82000012CD6
Operational State	Not Applicable	Part Number	US0X1MCH756410310CT4A00
Slot Number	2	Manufacturer	Pliant
Size	138.25 GB	Product ID	LB150S
Security Status	Not Capable	Revision	D011
Bus Protocol	SAS	Serial Number	00077012
Media Type	SSD	Manufactured Day	5
Hot Spare	No	Manufactured Week	11
Power Status	Spun Up	Manufactured Year	2010
Failure Predicted	No	Form factor	2.5 inch
Progress	Not Applicable	Controller	PERC H810 Adapter (PCI Slot 2)
Used RAID Disk Space	138.25 GB	Enclosure	MD1200 1:0
Available RAID Disk Space	0.00 GB		View Virtual Disks for this Physical Disk

Virtual Disk View: Provides details of the virtual disks created on PERC 8 controllers (Figure 6). Some of the attributes that can be viewed are - RAID layout, health status, size and read or write policy. Expand the entry to view more attributes. The virtual disks connected to a specific controller can be grouped and viewed (under the 'Basic Virtual Disk filter' section). Additionally, virtual disks with specific values can be filtered and viewed (under the 'Advanced Virtual Disk filter' section).



Figure 6. Virtual Disk View

DELL INTEGRATED DELL REMOTE ACCESS CONTROLLER 7 Enterprise Support | About | Log Out

System
PowerEdge R620
root, Admin

- Overview
 - Server
 - Power / Thermal
 - Alerts
 - Setup
 - Troubleshooting
 - Licenses
 - Intrusion
 - iDRAC Settings
 - Network
 - User Authentication
 - iDRAC Firmware Update
 - Sessions
 - Hardware
 - Batteries
 - Fans
 - CPU
 - Front Panel
 - Network Devices
 - Power Supplies
 - Removable Flash Media
 - Storage
 - Physical Disks
 - Virtual Disks**
 - Controllers
 - Enclosures

Virtual Disks

Basic Virtual Disk Filter

Options: [Advanced Filter](#)

Controller:

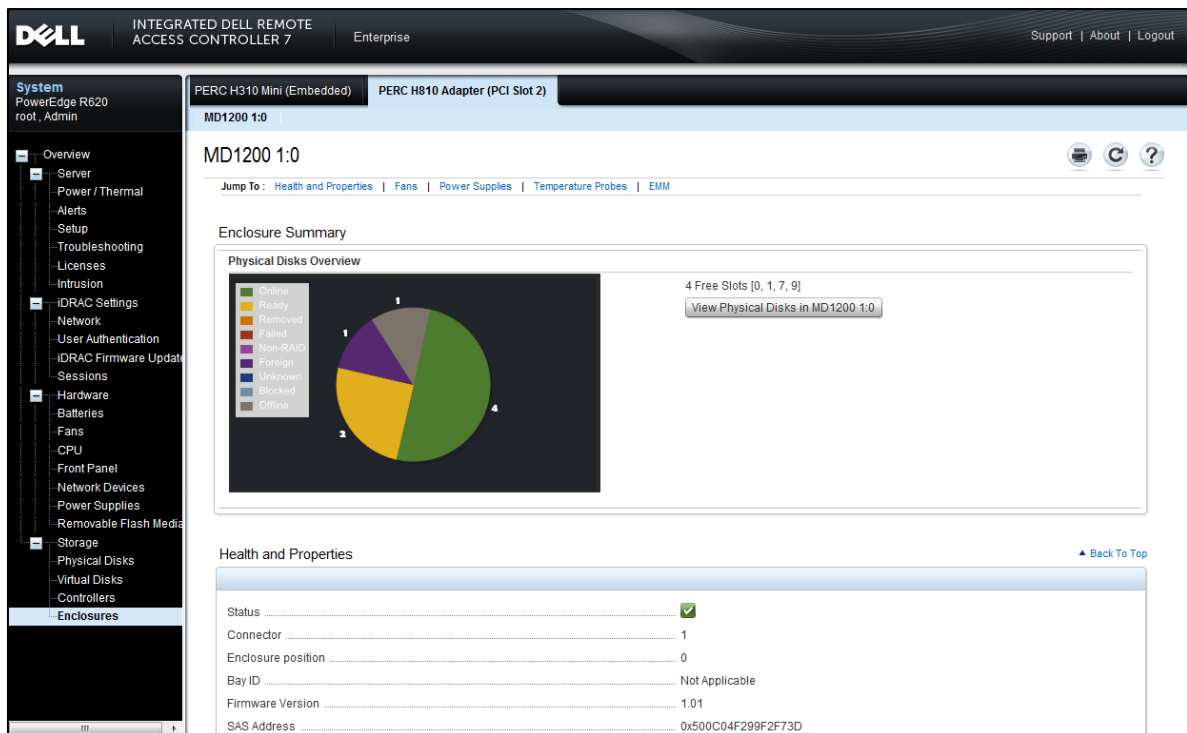
Virtual Disks Page 1 of 1

Status	Name	State	Layout	Size	Media Type	Read Policy	Write Policy	Stripe Size	Secured	Remaining Redundancy
☒	Virtual Disk 0	Online	RAID-1	136.13 GB	HDD	No Read Ahead	Write Through	64K	No	1
Advanced Properties										
Status ☒										
Name Virtual Disk 0										
State Online										
Layout RAID-5										
Size 276.50 GB										
Bus Protocol SAS										
Media Type SSD										
Operational State Background Initialization										
Read Policy Adaptive Read Ahead										
Write Policy Write Back										
Stripe Size 64K										
Disk Cache Policy Default										
Enhanced Cache Not Applicable										
Progress 44%										
Bad Blocks Found No										
Secured No										
Remaining Redundancy 1										
Controller PERC H810 Adapter (PCI Slot 2)										
View Physical Disks										
☐	Virtual Disk 1	Degraded	RAID-1	67.75 GB	HDD	Adaptive Read Ahead	Write Back	64K	No	0

Enclosure View: All the enclosures and backplanes connected to PERC 8 controllers are reported here (Figure 7). The pie chart provides the physical disks connected to the enclosure or backplane. Some of the attributes that can be viewed are connector, position, firmware version, and service tag. The enclosure elements such as fans, power supplies and so on are also displayed here.



Figure 7. Enclosure View



Monitoring Storage Devices

You can monitor the health of the storage devices using iDRAC7. The iDRAC7 periodically polls the PERC controllers to get the run-time state changes and inventory or configuration changes. For example, virtual disk creation or deletion, physical disk failures, enclosures hot plugs and so on. All these events are recorded in the Lifecycle logs (LC Logs) and/or trigger SNMP traps that are sent to 1: N consoles.

In the iDRAC7 web interface, you can view storage related events in: Overview-> Server -> Logs -> Lifecycle Log. In the 'Log Filter' section, select the 'log type' as 'storage' and click 'Apply'. All the storage related events are displayed (Figure 8).

You can configure the SNMP trap destinations to send the events generated in iDRAC7 to 1: N management consoles. For more information, see the *iDRAC7 User's Guide* available at support.dell.com/manuals.

Each event has a unique message ID. For example, message ID 'BAT1000', where 'BAT' indicates the controller battery object and '1000' is the event ID. The other prefixes relevant to storage events are - BAT: Controller Battery; VDR: Virtual Disk; PDR: Physical Disk ENC: Enclosure or Backplane; FAN: Enclosure Fan; TMP: Enclosure Temperature Probe; PSU: Enclosure Power Supply. For further details about the event, such as detailed description, recommended response action and so on, look up message ID in the Event Messages Guide available at support.dell.com/manuals.



Figure 8. Storage Events View

The screenshot displays the Dell iDRAC7 interface for viewing storage events. The left sidebar contains a navigation tree with categories like System, Server, Alerts, Setup, Troubleshooting, Licenses, Intrusion, iDRAC Settings, Network, User Authentication, iDRAC Firmware Update, Sessions, Hardware, Batteries, Fans, CPU, Front Panel, Network Devices, Power Supplies, Removable Flash Media, Storage, Physical Disks, Virtual Disks, Controllers, and Enclosures. The main content area is titled 'Logs' and features a 'Log Filter' section with dropdowns for Log Type (Storage), Status Level (Choose Type), Keyword Search, and Date (From/To). Below the filter is a 'Log Results' table with columns for Status, Date and Time, Message ID, Summary, and Comment. The table shows several events related to RAID controller initialization and disk status.

Status	Date and Time	Message ID	Summary	Comment
+	2012-03-15T22:43:27Z	VDR34	Background initialization failed for Virtual Disk 1 on RAID Controller in Slot 2.	
+	2012-03-15T22:43:27Z	PDR60	Error occurred on Disk 10 in Enclosure 0 on Connector 1 of RAID Controller in Slot 2 : (Error 10).	
+	2012-03-15T22:43:27Z	VDR8	Virtual Disk 1 on RAID Controller in Slot 2 has become degraded.	
+	2012-03-15T22:43:27Z	PDR6	Disk 10 in Enclosure 0 on Connector 1 of RAID Controller in Slot 2 is offline.	
+	2012-03-15T22:43:12Z	VDR32	Background initialization has started for Virtual Disk 1 on RAID Controller in Slot 2.	
+	2012-03-15T22:43:12Z	VDR32	Background initialization has started for Virtual Disk 0 on RAID Controller in Slot 2.	
+	2012-03-15T22:40:53Z	VDR4	Virtual Disk 1 on RAID Controller in Slot 2 was created.	
+	2012-03-15T22:40:53Z	PDR26	Disk 8 in Enclosure 0 on Connector 1 of RAID Controller in Slot 2 is online.	

Similarly, storage inventory and monitoring information can also be viewed using other iDRAC7 interfaces such as RACADM or WinRM remote service commands (WS-MAN). For more information, see the *iDRAC7 User's Guide* available at support.dell.com/manuals.

Agent Free Monitoring for Network Devices

You can inventory and monitor all the LOMs (with NC-SI support) and PCIe Add-in Adapters (with MCTP over NC-SI support) using iDRAC7. The network devices are broadly classified as:

- LOMs - Include network controllers embedded on the motherboard and NDCs.
- PCIe Add-in Adapters - Include NICs, mezzanine cards, and CNAs.

Agent-free monitoring also supports partition capable network card. Agent-free monitoring dynamically inventories and monitors each partition protocol such as NIC, iSCSI, or FCoE of a network controller.

Currently, only three network device vendors support agent-free monitoring – Broadcom, Intel and Qlogic. In future, support is planned for other network device vendors also.



Inventory of Network Devices

All the agent-free monitoring supported Network devices are inventories and reports in all the consoles of iDRAC such as GUI, RACADM, and WS-MAN. The inventory of a network card provides details such as:

- 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 so on.

Figure 9 and Figure 10 provide examples of inventory for different network controllers.

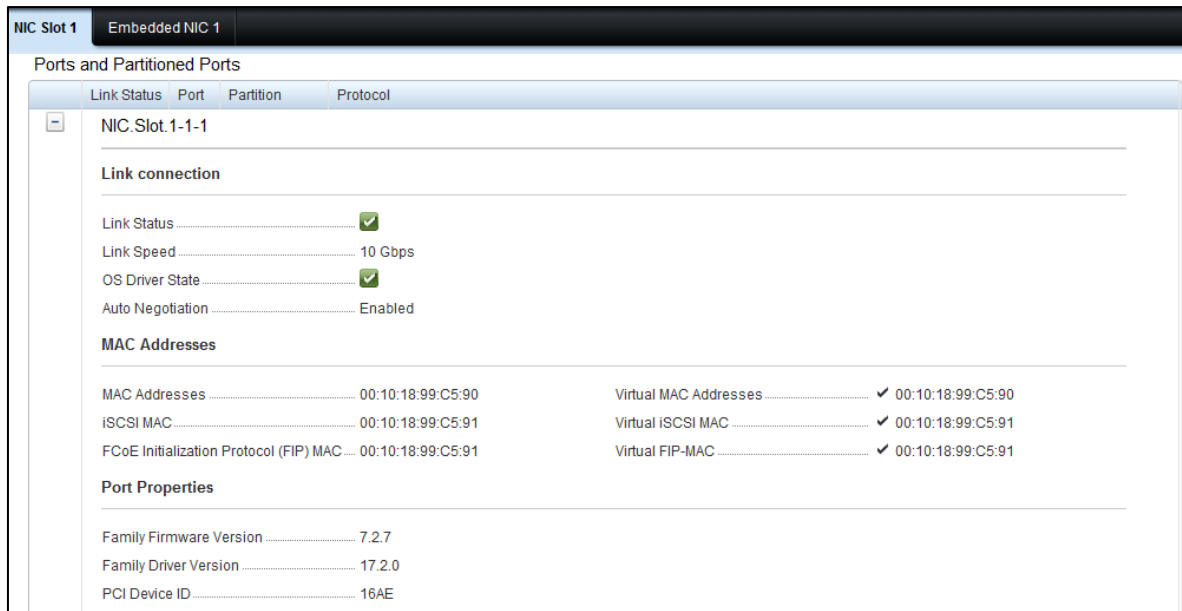
Figure 9. NIC Inventory

The screenshot shows the Dell iDRAC GUI for a PowerEdge R820 server. The left sidebar contains a navigation menu with categories like System, Overview, iDRAC Settings, Hardware, Network Devices, Power Supplies, Storage, and Controllers. The 'Network Devices' section is expanded, showing 'NIC Slot 3', 'NIC Slot 4', and 'Integrated NIC 1'. The main content area displays the configuration for 'NIC Slot 3: Broadcom Gigabit Ethernet BCM5719 - 00:10:18:B2:68:B8'. Under 'Port Properties', the 'Vendor Name' is 'Broadcom Corp' and the 'Number of Ports' is '4'. Below this, the 'Ports and Partitioned Ports' table lists four ports, all with a status of 'Not Supported' and protocol of 'NIC'.

Link Status	Port	Partition	Protocol
+	1	Not Supported	NIC
+	2	Not Supported	NIC
+	3	Not Supported	NIC
+	4	Not Supported	NIC



Figure 10.NIC Properties



Monitoring Network Devices

All the 12G supported network devices (that also support agent-free monitoring) are monitored real-time and the information is available in iDRAC7. Events are recorded in the Lifecycle Log or SNMP traps (if configured) are generated if the link is lost on a specific network controller port.

Agent-free monitoring provides the following basic details for a specific network controller port:

- 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.

Figure 11 shows port monitoring details.



Figure 11.NIC Monitoring

NIC Slot 1

Embedded NIC 1

Settings and Capabilities

Maximum Bandwidth	100	Supported Boot Protocol	iSCSI, FCoE, PXE
Minimum Bandwidth	0	Data Center Bridging (DCB)	Capable
Wake On LAN	Capable		
SR-IOV	Capable		
Partitioning	Capable		
iSCSI Offload	Capable		
FCoE	Capable		

Statistics: Ethernet

Receive Statistics		Transmit Statistics	
Total Bytes	5380554	Total Bytes	8969398
Total Unicast Packets	0	Total Unicast Packets	12951
Total Multicast Packets	1027	Total Multicast Packets	78695
Total Broadcast Packets	4357	Total Broadcast Packets	15614
False Carrier Detection	0	Single Collision Frames	0
FCS Errors	0	Multiple Collision Frames	0
Alignment Errors	0	Late Collision Frames	0
Runt Errors	0	Excessive Collision	0
Jabber Errors	0		

If the network port of a controller is partition capable, in addition to the basic details, agent-free monitoring provides the partition level details such as:

- Partition Link Status
- Partition Driver State
- FCoE Statistics such as FCoE Packets Receive, FCoE Packets Transmitted, and so on.

Figure 12 shows the partition monitoring details on a Qlogic CNA.

Figure 12.NIC Partitioning Information

**INTEGRATED DELL REMOTE
ACCESS CONTROLLER 7**

[Express](#)

[Support](#) | [About](#) | [Log out](#)

System
PowerEdge R620
root, Admin

- Overview
- Server
 - Power / Thermal
 - Alerts
 - Setup
 - Troubleshooting
 - Licenses
 - Intrusion
- iDRAC Settings
 - Network
 - User Authentication
 - iDRAC Firmware Update
 - Sessions
- Hardware
 - Batteries
 - Fans
 - CPU
 - Front Panel
 - Network Devices
 - Power Supplies
 - Removable Flash Memory
 - Storage
 - Physical Disks
 - Virtual Disks
 - Virtual Media

NIC Slot 1
NIC Slot 2
Integrated NIC 1

Settings and Capabilities

Maximum Bandwidth	100	eSwitch Mode	Not Capable
Minimum Bandwidth	0	Supported Boot Protocol	FCoE, PXE
Wake On LAN	Capable	Data Center Bridging (DCB)	Capable
Partitioning	Capable		
iSCSI Offload	Capable		
FCoE	Capable		
Management Pass Through	Capable		

Statistics: FCoE

FCoE Packets Transmitted	4277
FCoE Packets Dropped	0
Virtual Link Failures	0
FC CRC Error Count	0

+	☒	2	1	NIC
+	☒	2	2	NIC
+	☒	2	3	iSCSI
+	☒	2	4	FCoE



Conclusion or Summary

Agent Free Monitoring provides a monitoring solution that is independent of operating systems, to collect performance parameters for the on board devices in real-time and present it in a standard format from the service processor user interface. The Agent Free monitoring solution thus provides information about network and storage devices in real-time and enables management without the need to install any software agents on the server.

Learn more

Visit www.dell.com/idrac7 for more information on Dell's enterprise-class servers.

© 2012 Dell Inc. All rights reserved. Dell and its affiliates cannot be responsible for errors or omissions in typography or photography. Dell and the Dell logo are trademarks of Dell Inc. Microsoft, Windows, and the Windows logo are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries. Intel and Xeon are registered trademarks of Intel Corporation in the U.S. and other countries. Other trademarks and trade names may be used in this document to refer to either the entities claiming the marks and names or their products. Dell disclaims proprietary interest in the marks and names of others.

March 2012 | Rev 1.0

