In-band or out-of-band: Advantages of iDRAC and iSM compared to OMSA

This paper showcases the advantages and features that out-of-band tools provide and compares them to the use of in-band agents for Dell EMC PowerEdge Systems Management.

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Acknowledgments

Authors: Aparna Giri, Doug Iler, Jeff Krebs

Contributors: John Abrams, Rama Bisa, Prakash Pawar, Manjunath M V, Sheshadri PR Rao

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Executive summary

The traditional approach to server systems management has been to install an agent in the server 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. In band agents were the de facto method for server management.

However, Dell EMC changed this paradigm in 2012 with the introduction of the first agent free architecture. No agents in the operating system or hypervisor to inventory as all management is done in band. In band, also called side band, is the iDRAC communicating directly to the components on the system board. The iDRAC9 is further reducing the need for in band agents as a result of many new "bare-metal" or out-of-band management capabilities.

As Dell EMC has added more improvements to iDRAC9 and the latest PowerEdge servers, the gap between in-band and out-of-band management capabilities has become narrow. There are 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 and integration with vendors for peripherals such as network cards. A detailed functionality chart helps identify supported management functions to help IT admins transition from in band to out of band solutions.

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1 Introduction

The Dell EMC OpenManage portfolio is a suite of tools to help IT admins manage PowerEdge servers. OpenManage tools help IT administrators deploy, update, monitor, and manage IT assets and allows them to quickly respond to issues. As a result, admins can manage Dell EMC PowerEdge servers efficiently in physical, virtual, local, and remote environments by using in-band and out-of-band technologies.

While the in-band method has been the de facto management means for many years, many companies are gradually adopting 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 iDRAC, which is embedded into each server, and requires no extra software. The Dell EMC iDRAC Service Module (iSM) is a small OS-resident module that can provide operating system-related information and capabilities to iDRAC. This additional functionality makes the combination of iDRAC and iSM a viable replacement for OMSA functionality for many customers. Also, iSM offers several features that OMSA cannot provide, and continues to provide added value and functionality.

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2   iDRAC9 — Server industry leading Embedded Management solution

The integrated Dell Remote Access Controller 9 (iDRAC9) 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. 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 infrastructure requirements grow. Customers can 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)

iDRAC Service Module (iSM) is a small module which installs on a wide variety of supported operating systems and hypervisor. The iSM makes OS-related information and capabilities available to the iDRAC. iSM also provides features like a watchdog timer for automatic server recovery, which are important in certain IT environments. While iSM does not have its own interface, it still assists iDRAC by providing data using various means. These methods include the iDRAC GUI interface, Dell Remote Access Controller Admin (RACADM), or Redfish API. A version of iSM also supports multiple generations of PowerEdge servers.

As a result of its 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. One such iDRAC9 feature is the option to completely drain the power from the server remotely. The result means no longer requiring a technician in the data center to physically pull the power cable from the back of the server. Many other value-added capabilities available in iDRAC using the iSM include:

- Send Lifecycle Controller logs to the operating system logs
- Accessing iDRAC using Host operating system and operating system credentials
- iDRAC SNMP alerts using in-band
- Automated dispatch of drives for certain predictive alerts (requires SupportAssist)
- Expanded list of supported operating systems

Because iSM can bridge the gap between the operating system and iDRAC, there are several additional solutions available. Also, having iSM installed greatly reduces the time that is spent on the phone with Tech Support. Valuable information such as operating system and application logs provide faster time to resolution and automated ticket creation with Dell Pro Support. Also, the bridge between iDRAC and iSM is secure with TLS Security and support for IPv6.

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 can provide this support by being installed in the operating system or hypervisor on a PowerEdge server.

While OMSA provides many of the same functions as iDRAC, it does have some limited functionality. OMSA supports only legacy OM CLI for scripting options and not newer automation paradigms like Redfish. OMSA does provide a few storage information (see chart below) that is still not available by using iSM or iDRAC. For certain customers, that is a reason to continue using OMSA. These features and options are fully described in the following matrix.

2.3 Limitations that are related to 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 operating system*. Both items are necessary to check and report on the overall health of network and storage devices. Some of other challenges in agent-based systems management are depicted below.

Possible limitations and drawbacks of an in-band agent	
Consuming Resources	The agent running on the host is often heavy-weight and consumes important cycles like memory and CPU.
Host operating system stop responding	If the host operating system stops responding, information about storage, networking, and more is not available, along with the option to alert on any issues.
Agent crash	Should the agent crash, or even while during an update, devices such as storage, memory, and networking are not managed.
Multiple agents	While some agents are necessary, "the less the better" rule applies here.
Operating system-dependent settings	Various operating system-dependent settings like BIOS cannot be modified.

2.4 Advantages of out of band management

Aside from the various points listed above, there are also many other features that out of band management provides, as seen in the following table.

Feature	Benefit
Single source of information	No need for multiple agents, or open "vendor specific" consoles to check health status, perform configuration or update tasks.
Improve system performance.	With no agent running on the host, there is no performance impact on the server. This option allows the processors and memory to be dedicated solely to supporting the operating system and applications, and not the management of the server.
"Always on" management	Out of band provides full functionality for all aspects of server management independent of operating system presence or state. In other words, full management at the 'bare metal' stage or if the operating system or hypervisor is in a 'stopped responding' state. Also, IT admins have access to a system in failed state to recover and troubleshoot the host operating system.

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2.5   iDRAC Agent free management

Dell EMC provides the option to for complete real-time agent free management of server. This means that no agents must be installed in the operating system or hypervisor for complete monitoring and management of the components. iDRAC uses Management Component Transport Protocol (MCTP), 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 that the Distributed Management Task Force (DMTF) maintains. The iDRAC provides user an ability to deploy, update, configure, and monitor various devices and functions such as:

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

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3 iDRAC9 enhancements — Deep dive into storage and networking

The Dell EMC engineers continue to add and expand the various features and functionality for iDRAC9. Two key areas of focus are storage and network management. The end goal is full functionality 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

PowerEdge servers that are equipped with PERC10 and iDRAC9 allow users to configure the storage without any agent. Also, does not require reboot of server for storage configuration. The following storage configurations are added to make the storage configuration more comprehensive:

- Online Capacity Expansion: Online Capacity Expansion (OCE) allows the increase of storage capacity of selected RAID levels (all RAID levels except RAID 50 and RAID 60.) This expansion is possible either using available disk capacity or by adding a new disk.
- RAID Level Migration: RAID Level Migration (RLM) provides changing a virtual disk RAID level.
- Instant Erase Secured Physical Disk: This feature is the ability to securely erase the contents on the physical Self-Encrypting Drives.
- Rebuild Physical Device: This feature is the ability to reconstruct the contents of failed disk. This option is only available 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: User can 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. Background initialization must be complete. However, some processes such as creating a virtual disk cannot be run while the background initialization is in progress. This feature can cancel the background initialization manually. But if canceled, the background initialization automatically restarts within 0 to 5 minutes.
- Rename VD: 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 iDRAC9 collects the information about storage controllers, hard drives, virtual drives, Enclosures, Fans, EMMs, and batteries. For more information about the inventory details, see screenshots in Appendix.

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3.2   Enhancements for real-time network management

Along with new storage features, iDRAC also expanded and enhanced its network management. A new feature that is found in iDRAC9 is "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 that are 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.

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 so on

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

Attribute	Description
Link Status	iDRAC detects if the network port or partition link is up (if port is partition capable).
Operating system Driver State	iDRAC detects 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.

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4 Comparison Matrix – iDRAC, iDRAC with iSM, and OMSA

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

Category	Feature	iDRAC9	iDRAC9 with iSM	OMSA
Server Health	CPU (Processors)	✔	✔	✔
	CPU Throttling Warning	✔	✔	✔
	Predictive CPU failure	✔	✔	✔
	Fans	✔	✔	✔
	Temperatures	✔	✔	✔
	Memory	✔	✔	✔
	NVDIMM (memory only)	✔	✔	✔
	DIMM ranking	✔	✔	✔
	NICs	✔	✔	✔
	CNAs	✔	✔	✔
	Power Supplies	✔	✔	✔
	Power Consumption	✔	✔	✔
	Power Consumption History	✔	✔	
	Voltages	✔	✔	✔
	Batteries	✔	✔	✔
	Chassis Intrusion	✔	✔	✔
	Inlet Temperature history	✔	✔	
Storage	PERC storage controller	✔	✔	✔
	PERC battery	✔	✔	✔
	Physical Storage Devices	✔	✔	✔
	Virtual Drive	✔	✔	✔
	External Storage Enclosure	✔	✔	✔
	SSD monitoring	✔	✔	✔
	SSD write endurance	✔	✔	✔
	PCIe SSDs	✔	✔	✔
	FC HBAs	✔	✔	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 hot spare	✔	✔	✔
	Cryptographic Erase of Physical Disk	✔	✔	✔
	Manage Preserve Cache	✔	✔	✔

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Category	Feature	iDRAC9	iDRAC9 with iSM	OMSA
	Create Virtual Disk	✔	✔	✔
	Delete Virtual Disk	✔	✔	✔
	Reset Controller Configuration	✔	✔	✔
	Clear Foreign Configuration	✔	✔	✔
	Import Foreign Configuration	✔	✔	✔
	Initialize Virtual Disk (Fast and Full)	✔	✔	✔
	Consistency Check for Virtual Disk	✔	✔	✔
	Start/Stop Patrol Read	✔	✔	✔
	Assign/Unassign Global and Dedicate Hot spares	✔	✔	✔
	Blink/Unblink Physical Disk/Virtual Disk	✔	✔	✔
	Local Key Management (Create/Change/Delete Security Key)	✔	✔	✔
	Controller Attributes	✔	✔	✔
	Virtual Disk Attributes	✔	✔	✔
	Convert drive to RAID	✔	✔	✔
	Convert drive to Non-RAID	✔	✔	✔
	Staged RAID configuration	✔	✔	real time
	Preparing to Remove A PCIe SSD (NVMe)		✔	✔
	Boot Optimized Storage Solution (BOSS)	✔	✔	Monitor
	Correlation of Software alerts in Storage(S2D) environment to Hardware logs		✔	
	Automated dispatch of Drives for select predictive failure alerts		✔	
	Software RAID			✔
	Smart Alerts Monitoring from SW RAID Devices		✔	✔
	Smart Alerts Monitoring in AHCI Mode		✔	✔
	Internet standard MIB-II	✔	✔	✔
	Network device MIB	✔	✔	✔
	Link Up/Down traps	✔	✔	✔
	Teaming Information			✔
	VLAN Information			✔
	Statistics	✔	✔	✔
Networking	Host operating system IP Address and hostname		✔	✔
	MAC Address	✔	✔	✔
	Support for IPv6 and toggle between IPv4 and IPv6	✔	✔	
	Non-SDL Card Support		✔	
	Device Configuration	✔	✔	
	BIOS settings	✔	✔	✔

Category	Feature	iDRAC9	iDRAC9 with iSM	OMSA
Configuration and Settings	iDRAC settings	✔	✔	✔
	Import/export system configuration	✔	✔	
	Power Cap	✔	✔	
	Power State Control	✔	✔	✔
	LCD	✔	✔	✔
	Remote full power cycle		✔	
	Launch iDRAC GUI from Host Operating System		✔	
	Single Sign-On (SSO) with operating system Credentials into console		✔	✔
	Remote iDRAC reset		✔	
Inventory and Monitoring	Operating system Information (operating system name, version)		✔	✔
	iDRAC Information	✔	✔	✔
	Firmware inventory	✔	✔	✔
	Telemetry Streaming data for analytics	✔	✔	
	Logging to operating system logs		✔	✔
	Event notification using Email	✔	✔	✔
	Prescriptive Alert Messages	✔	✔	
	SNMP Traps (v1, v2, v3)	✔	✔	v1 v2 only
	SNMPv3 Gets	✔	✔	✔
	Redfish support	✔	✔	
	Redfish IPv6 policy and 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 FW update	✔	✔	
	System component update	✔	✔	
	Hard Drive updates (SAS/SATA)	✔	✔	✔
Serviceability	SupportAssist Anonymous Collection Report		✔	
	Automated SupportAssist Log Collection with operating system and App. Info		✔	
	SupportAssist collection with selective Personally Identifiable Information (PII)		✔	

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5 Conclusion

As seen in the above chart, the functionality of iDRAC continues to increase, especially regarding agent-free storage management. Add on the additional benefits from having iSM installed, and the need for OMSA significantly decreases. 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.

The goal of Dell EMC OpenManage is to provide industry-leading tools that allow customers to efficiently manage their IT environments.

Dell EMC continues to add more features to the out-of-band iDRAC, and iSM solution based on customer feedback. This feedback helps provide greater functionality and reduce the need for in-band software agents.

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A   Technical support and resources

The iDRAC support home page provides access to product documents, technical white papers, how-to videos, and more.
www.dell.com/support/idrac

iDRAC User Guides and other manuals
www.dell.com/idracmanuals

Dell Technical Support
www.Dell.com/support

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