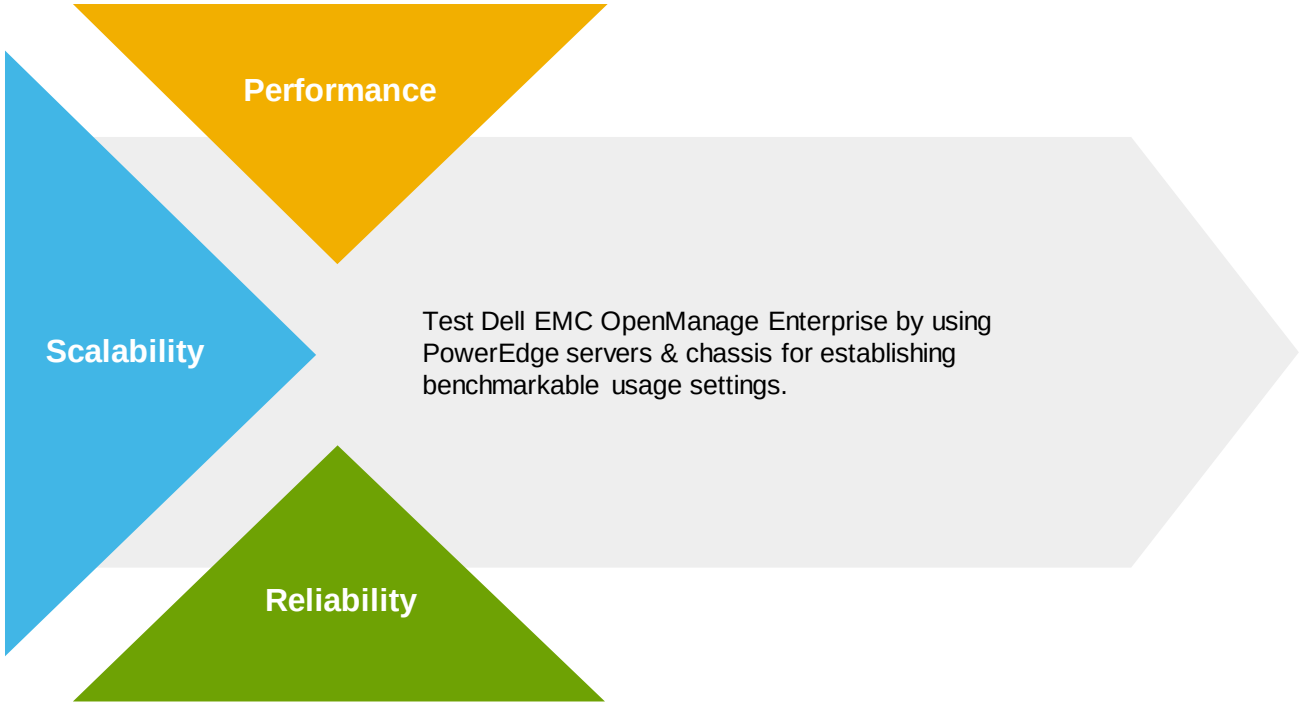
DELL Technologies

White Paper

# Benchmark the Performance, Reliability, and Scalability of Dell EMC OpenManage Enterprise 3.4 in your data center environment

This technical white paper provides information about best practices that you can use as the benchmark for using Dell EMC OpenManage Enterprise 3.4 to optimize the usage of servers and chassis.





## Abstract

This technical white paper provides information about the best practices you can adopt while using the following features of Dell EMC OpenManage Enterprise 3.4—discovery, inventory, health monitoring, firmware upgrade, and configuration and deployment. To minimize your efforts to read, where possible, information is provided in the form of infographics. Where available, direct links to the micro-video URLs are provided to demonstrate the tasks of using OpenManage Enterprise.



July 2020

14465

# Revisions

| Date | Description |
|---|---|
| February 2019 | Initial release |
| June 2019 | Revision 1 |
| July 2020 | Revision 2 |

# Acknowledgements

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# Executive summary

Dell EMC OpenManage Enterprise is a web-based hardware monitoring and management console that provides a comprehensive view of Dell EMC servers, chassis, network switches, other third-party devices, and components on the enterprise network. It is designed for the next generation IT professionals with a focus on simplicity, automation, and unification of data center management.

This technical white paper provides an overview of scalability, reliability, and performance of Dell EMC OpenManage Enterprise 3.4. It contains reports of test results that were used to assess the product quality, stability, and scalability of various features that include discovery, inventory, monitoring, firmware update, configuration, and deployment. This technical white paper also offers recommendations to achieve optimal performance as demonstrated by the test results.

-  You can also view the following videos to get more information about using the unmatched features of Dell EMC OpenManage Enterprise Graphical User Interface (GUI):
  - Creating a firmware baseline in Dell EMC OpenManage Enterprise (01:22 m)
  - Dell EMC OpenManage Enterprise Systems Management Console (02:02 m)
  - Dell EMC OpenManage Enterprise

**Note**: For more information about the field definitions involved in the tasks performed that are discussed in this technical white paper, see the Online Help documentation by clicking the ? symbol in the upper-right corner of that respective page. Else, you can also see the Dell EMC OpenManage Enterprise User's Guide available on the support site.

# Acronyms

| Acronym | Expansion |
|---|---|
| **AD** | Active Directory |
| **CLI** | Command Line Interface |
| **DNS** | Domain Name System |
| **DIMM** | Dual In-line Memory Module |
| **DRM** | Dell EMC Repository Manager |
| **DUP** | Dell Update Package |
| **FC** | Fibre Channel |
| **FCoE** | Fibre Channel over Ethernet |
| **FIPS** | Federal Information Processing Standards |
| **FQDD** | Fully Qualified Device Descriptor |
| **FTP** | File Transfer Protocol |
| **GUI** | Graphical User Interface |
| **HDD** | Hard Disk Drive |
| **iDRAC** | Dell EMC Integrated Dell Remote Access Controller |
| **IOM** | Input-Output Module |
| **iQN** | iSCSI Qualified Name |
| **iSM** | iDRAC Service Module |
| **LSB** | Large Scale Business |
| **MAC** | Media Access Control |
| **MCM** | Multi Chassis Management |
| **OMEM** | OpenManage Enterprise Modular |
| **PERC** | Dell PowerEdge RAID Controller |
| **SNMP** | Simple Network Management Protocol |
| **SSB** | Small Scale Business |
| **VLAN** | Virtual Area Network |
| **WAN** | Wide Area Network |
| **WWNN** | World Wide Node Name |
| **WWPN** | World Wide Port Name |

# 1. Impact of hardware on the performance of OpenManage Enterprise 3.4 in PowerEdge servers and MX7000 chassis

To optimize the setup and task schedule of your appliance, it is first necessary to understand how the hardware may affect performance. The appliance does most of the processing and stores all the data, so both the underlying hardware and the hardware allocated to the VM will be a limiting factor in the overall performance. Hardware must be prioritized by using the following guidelines:

- **Memory**—This will be a gating factor to the number and size (in devices) of tasks which can be run simultaneously. It is mandatory to increase the RAM from the default—up to 32 GB—when running a max scale configuration to allow more concurrent processes.
- **CPU**—The appliance has multiple services that are responsible for running distinctive tasks by using different threads concurrently. Also, OpenManage Enterprise database activities are CPU–intensive. Therefore, it is also recommended to add more cores for better performance.
- **Network**—Majority of functionality in OpenManage Enterprise is based on network interactions from the appliance to devices. This information is then transmitted from the appliance to a client which is accessing it over the network.
  - **Network speed**—The speed of a network defines the responsiveness of appliance and its performance. The time taken to execute a job depends on the available bandwidth and delay that exists in a network.
  - **Timeout**—There are many different cases where network communication to the device may fail. Depending on the nature of the failure, this may be noticeable in the task performance. Especially, if this happens for many devices in the task (for example, for a discovery task). For a slower network or device, it is recommended to increase the timeout and number of ‘retries’ for a discovery job. Possible scenarios are listed here:
    - **Sparsely populated IP range in a discovery job**— Define the discovery range more granularly to avoid this. If it is possible, define a single discovery task with a list of IPs or ranges.
    - **Discovery uses incorrect credentials**— If the devices on your network must use different credentials, it is required to split these into separate ranges with the appropriate credentials.
    - **Device malfunctions or the protocol is disabled**— The task execution history may provide some details about a failure. This may require actions on the device to resolve.
  - **Device actions**—The time taken running different tasks—such as firmware update and configuration inventory—depends on the server generation, hardware inventory, and selected components.
- **Hard drive**— The default drive space requirements are mentioned for specific tests covered for the purpose of this technical white paper.

Overall, smaller scale configurations will have better performance, because they manage less data and will generally have fewer scheduled tasks running at the same time. Multiple tasks running together have additional constraints, complexity, or dependencies which may not be immediately obvious but will impact performance numbers. The performance of OME for monitoring and managing FIPS–enabled iDRAC configuration (that have TLS 1.2 installed) is similar to the iDRACs that do not have FIPS enabled.

# 2. OpenManage Enterprise 3.4 features tested

Scalability, performance and longevity tests were performed on OME 3.4 for the following features:

- Discovery and Inventory
- Health Monitoring
- Firmware and driver Update
- Configuration and Deployment

The methodology used for various tests is defined below:

**Performance**: Performance testing is intended to determine the responsiveness, throughput and reliability of a system under a given load. Various load parameters used for OME are defined in section 2.2.

**Scalability**: Scalability tests were performed in OME to determine its capacity to scale up to the supported number of devices.

**Longevity**: Longevity testing is performed to observe OME behavior during prolonged usage. System parameters such as memory usage, CPU usage, and UI load time were recorded at regular intervals.

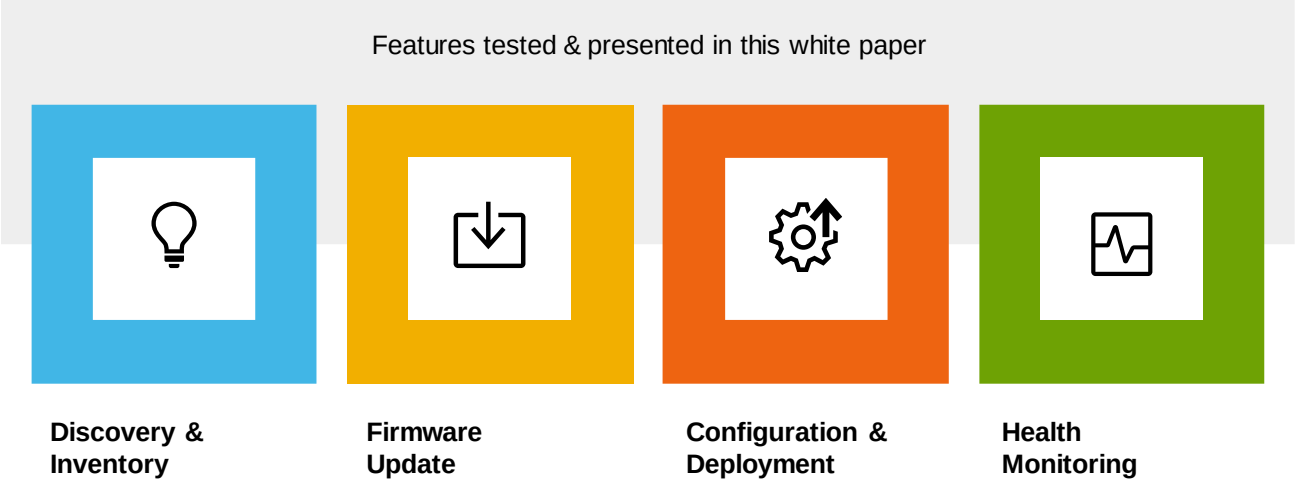



Figure 1 OpenManage Enterprise 3.4 features tested and discussed in this technical white paper

## 2.1 System Configurations used for Scalability and Performance evaluation of OpenManage Enterprise 3.4

Minimum system configuration required for OpenManage Enterprise in scale environment

| | Configuration 1 | Configuration 2 |
|---|---|---|
| Number of Managed Devices | 8000 | 3000 |
| RAM used (GB) | 32 | 32 |
| Hard Drive (GB) | 200GB | 100GB |
| Processor Cores | 8 | 8 |

**Note**: Anything below “minimum recommended system configuration” is not supported.

## 2.2 Load parameters used for performance evaluation

The load parameters used for the evaluation were to see how OpenManage Enterprise 3.4 performance varies when load parameters are changed.

| Generation Servers | Modular Infrastructure | Fully Loaded Appliance | Power Manager Plugin |
|---|---|---|---|
| • YX3X servers<br>• YX4X servers | • M1000e Chassis each populated with 7 sleds on average<br>• MX7000 Chassis (20 and 10 Chassis groups) | The database was loaded with data by using events, tasks, and jobs such as configuration inventory and firmware update. After that, tests were performed for specific features. | was installed on OpenManage Enterprise 3.4 and 6,000 Devices were added to the plugin working set and metric collection task was initiated. |

**Note**: To evaluate scalability support for various tasks, simulated managed devices were used to replicate the exact response of the respective managed nodes.

## 2.3 General recommendations for optimal performance and scalability of OpenManage Enterprise 3.4

Based on the analysis of various tests performed, it is recommended to have the following minimal configurations for optimal performance:

- **Minimum hardware configuration** shown in Table 2 must be used. Enhanced hardware specifications—such as increasing the processor core or RAM—will result in a better performance than described in this technical white paper.
- **A DNS must be configured** so that OpenManage Enterprise 3.4 is able to resolve the hostname of all the managed devices.
- Default Configuration Inventory task should be disabled for scalable environments.
- Increase in available network bandwidth will lead to higher performance.

## 2.4 Test results for deployment of OpenManage Enterprise 3.4

Objective of this test is to verify the time taken to deploy OpenManage Enterprise 3.4 virtual appliance on ESXi.

OpenManage Enterprise 3.4 virtual appliance file size (In MB):

- **OVF** Size: 1430
- **VHD** Size: 3281.2
- **KVM** Size: 2912.9

**ESXi setup details**:

- ESXi version–6.5.0 U1
- Server**–**PowerEdge R940
- Sockets–4
- Cores per socket–24

**Test results**:

Table 1 Time breakup during deployment of OpenManage Enterprise appliance on ESXI

| S.NO. | Parameters | Time Taken | Comments |
|---|---|---|---|
| 1. | Virtual appliance (OVF) deployment | 2m 5s | OVF upload from local HDD to ESXI data store (dependent on network speed) |
| 2. | Installation till TUI screen to appear | 4m 1s | OS Image load and OM Enterprise packages installation |
| 3. | Basic IPV4 DHCP configuration & save changes (restart of services) | 50s | Configure IP as DHCP/Static and Service restart time taken |
| 4. | Restart the Appliance till TUI screen appears | 1m 58s | NA |

## 2.5 Test results for console upgrade to OpenManage Enterprise 3.4 from various previous versions

Console upgrade to OpenManage Enterprise 3.4 was tested in a scalable environment in four different configurations.

- Local Http share was used for the upgrade.
- All the OME Configs had below configuration:
    - RAM – 16GB
    - Virtual Processors – 8
- Overall appliance upgrade time taken displayed in the table below is from OME 3.3.1 to 3.4.

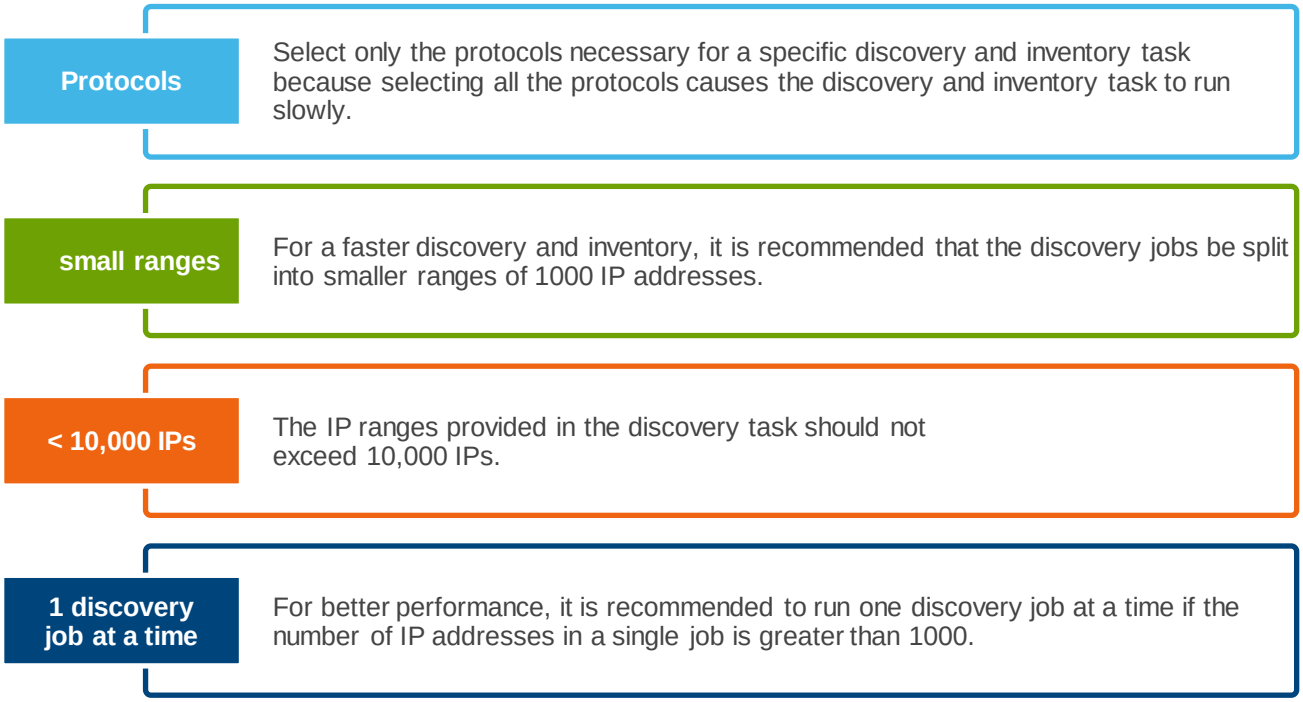
Table 2 Time taken for download of bundle packages and overall console upgrade to 3.4 across multiple configurations

| Config No. | Upgrade path | Bundle download time taken | Overall Appliance Upgrade Time Taken | Populated Data |
|---|---|---|---|---|
| 1 | OME 3.3.1(with power manager plugin configured) >> 3.4 | 7m 42s | 3h 20m | Discovered Servers – 8141<br>Total Groups (Static+ Query) - 500<br>PMP devices monitored- 3000<br>Alerts – 50000<br>Jobs – 609<br>Deployment Template – 8000 |
| 2 | OME1.0 >> 3.1 >> 3.3 >> 3.3.1 >>3.4<br>**The upgrade time considers the upgrade from 3.3.1>>3.4 | 21m 33s | 42m | Discovered Servers – 8499<br>Total Groups (Static+ Query) - 10<br>Alerts – 45000<br>Jobs – 612<br>Deployment Template – 107 |
| 3 | OME3.2 >> 3.2.1 >>3.4<br>**The upgrade time considers the upgrade from 3.2.1>>3.4 | NA | 24m | Discovered Servers – 3009<br>Alerts – 45010<br>Jobs – 13<br>Deployment Template – 8 |
| 4 | 3.3.1 >>3.4 | 1m 38s | 3h 56m | Discovered Servers – 8181<br>Total Groups (Static+ Query) - 278<br>Alerts – 45049<br>Jobs – 610<br><br>Deployment Template – 8000 |

# 3. Scalability and performance test results of OpenManage Enterprise 3.4 (tested on multiple PowerEdge servers)

## 3.1 Test setup and results of the Discovery and Inventory feature in OpenManage Enterprise 3.4

### 3.1.1 Recommendations for setting an environment to test the Discovery and Inventory feature in OpenManage Enterprise 3.4




### 3.1.2 Test environment and results of the Discovery and Inventory feature in OpenManage Enterprise 3.4

Table 3 System configuration of devices used as Load for testing Discovery and Inventory feature
*Below system configurations were simulated and used for Discovery

| Load Parameter | YX4X Server | YX3X Server |
|---|---|---|
| Model | PowerEdge R940 | PowerEdge M630 |
| Processor | 4 | 2 |
| iDRAC version | 4.10.10.10 | 2.63.60.61 |
| Physical Drives No | 24 | 2 |

| | | |
|---|---|---|
| **NICs** | 2 | 2 |
| **DiMMs** | 40 | 2 |

Table 4 Discovery and inventory of 8,000 servers by using server category (Config I)
*Simulated nodes were used as Test Setup

| **Protocol used for discovery** | WSMAN | |
|---|---|---|
| **Load Parameters** | **Without Power Manger Plugin** | |
| **Server Generation** | **YX4X** | **YX3X** |
| **Number of Servers Discovered** | **8000** | **8000** |
| **Time taken for the first discovery, inventory and onboarding** | 4h 29 m | 6h 54m |
| **Time taken for rediscovery and onboarding** | 4h 34m | 7h 28s |
| **Time taken for re-inventory** | 4h 4m | 6h 30m |
| **Time taken for status-poll** | 6m | 25m |

Table 5 Discovery and inventory of 8,000 servers by using server category Config I)
*Simulated nodes were used as Test Setup

| **Protocol used for discovery** | WSMAN |
|---|---|
| **Load Parameters** | **With Power Manager Plugin** |
| **Server Generation** | **YX4X** |
| **Number of Servers Discovered** | **8000** |
| **Time taken for the first discovery, inventory and onboarding** | 4h 43m |
| **Time taken for rediscovery and onboarding** | 4h 44m |
| **Time taken for re-inventory** | 4h 13m |
| **Time taken for status-poll** | 9m 35s |

Table 6 Discovery and inventory of M1000e Chassis each mapped with on average 7 sleds
*Simulated nodes were used as Test Setup

| **Protocol used for discovery** | WSMAN |
|---|---|
| **Number of chassis discovered** | 250 |

| | |
|---|---|
| **Time taken for first discovery, inventory, and onboarding** | 29m 57s |
| **Time taken for re-discovery** | 26m10 |
| **Time taken for re-inventory** | 9m 38s |
| **Time taken for status-poll** | 29s |
| **Time Taken for Complete Chassis Sub-Discovery (1918 sleds)** | 1h 47m |

## 3.2 Test setup and results of the Firmware and Driver Upgrade feature in OpenManage Enterprise 3.4

### 3.2.1 Recommendations for setting an environment to test the Firmware and Driver Upgrade feature in OpenManage Enterprise 3.4

- **Catalog download**: Catalog can be downloaded from online/Dell Repository Manager. However, DRM is recommended as it takes less time to download the DUPs.
- **Creating baselines**: A baseline is a set of devices or group of devices that are associated with that catalog. A baseline is created for compliance evaluation of the firmware and drivers for the devices in that baseline, against the versions specified in the catalog.
- It is recommended to create a firmware baseline sequentially after completion of previous baseline and compliance report updates.
- For 8,000 devices, it is recommended to create 8 baselines with 1,000 devices each.

### 3.2.2 Test environment and results of the Firmware Upgrade feature in OpenManage Enterprise 3.4

**Test setup:** Below tests were performed by creating baselines using the Dell online catalog:

- Creation of single baseline with 8,000 simulated devices: Each device had at least ‘11’ updatable components such as iDRAC, BIOS, NICs, HDD, OS Collector, iSM and so on.
- Creation of 8 baselines with 1,000 simulated devices each. Each device had at least ‘11’ updatable components such as iDRAC, BIOS, NICs, HDD, OS Collector, iSM, and so on.
- Single baseline with ‘200’ physical servers was created and each device had at least ‘5’ updatable component. Performed Firmware Update on 200 devices.

**Test results:**

- Time taken to create and display a firmware compliance report having 8,000 devices in a single baseline is 5 mins.
- Time taken to create 1 baseline with 1,000 simulated devices associated to each baseline takes 30 secs.
- Time taken to create 8 baselines and display firmware compliance report for total 8,000 devices is 3 minutes.

Table 7 Time taken to create and display Firmware compliance report each having 1000 devices

| Baseline No. | Time Taken |
|---|---|
| Baseline 1 | 30s |
| Baseline 2 | 30s |
| Baseline 3 | 30s |
| Baseline 4 | 30s |
| Baseline 5 | 30s |
| Baseline 6 | 30s |

| | |
|---|---|
| Baseline 7 | 30s |
| Baseline 8 | 30s |

- The firmware update was qualified with 200 servers in a single job. Devices more than 200 in a single firmware update job is not supported.
- To test the scalability of the firmware update task, updates were pushed on 1,000 simulated devices and the job failed gracefully without any unexpected error.
- In case of online catalog, the time taken for firmware update depends primarily on the download of DUPs. Therefore, it is always recommended to have a high bandwidth network.

Table 8 Test results of Firmware update of 200 Physical YX3X (13G) and YX4X (14G) servers with online catalog

| Test Environment | Test result |
|---|---|
| **Number of servers updated** | 200 |
| **Time taken for firmware update** | 2h 45m |
| **Number of Dups downloaded** | 55 |
| **Time taken to Download Dups** | 22m |
| **Size of Dups downloaded** | 1.4GB |

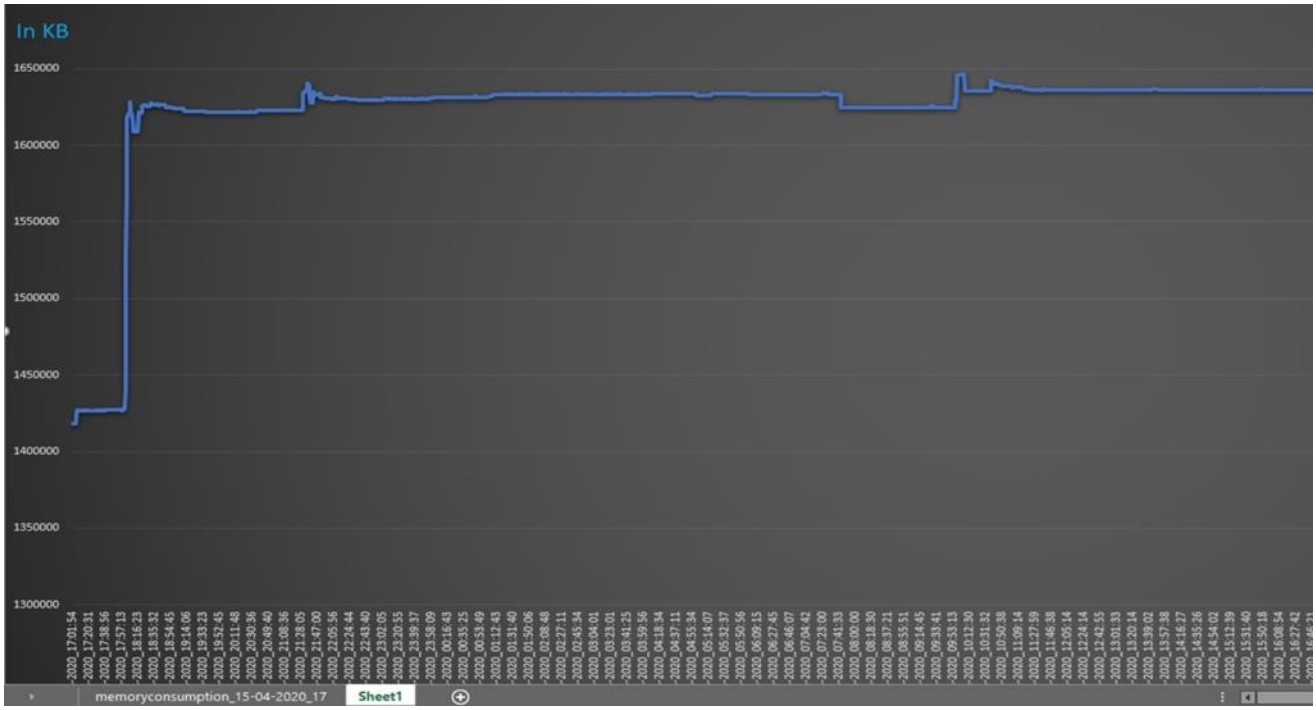
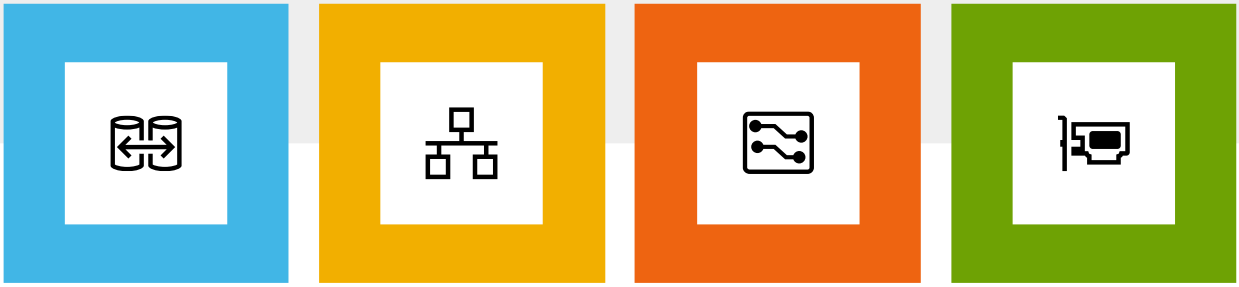



Figure 2 Task Execution Service Memory utilization (in KB )while testing the firmware upgrade feature for 200 servers of Dell EMCOpenManage Enterprise 3.4 on PowerEdge servers

### 3.2.3 Test environment and results of the Driver Upgrade feature in OpenManage Enterprise 3.4

For testing of Driver Update feature below components were selected per server:



**RAID** **Network** **Chipset** **Video**

Table 9 Test results of Driver update of 60 Physical YX3X (13G) and YX4X (14G) servers with online catalog

| Test Environment | Test result |
|---|---|
| Number of servers updated | 60 |
| Time taken for firmware update | 1h 32m |
| Number of Dups downloaded | 11 |
| Time taken to Download Dups | 3m |
| Size of Dups downloaded | 387 MB |
| Operating System | Windows server 2019 DC |

## 3.3 Test setup and results of the Configuration Compliance feature in OpenManage Enterprise 3.4

### 3.3.1 Recommendations for setting an environment to test the Configuration Compliance feature in OpenManage Enterprise 3.4

- Maximum number of devices used in compliance should not exceed 6,000. If 6,000 devices are used, then they should be divided into 4 baselines with 1500 unique devices each. Each baseline should use a unique template (Original template can be cloned as desired).
- 1500 devices can be in a static/query group and each baseline can associate to one group.
- It is recommended that the baselines are created one after the other. Wait until the first baseline is completed and displays the compliance results in the pie chart, then create the next baseline.
- In cases of devices less than 6,000, it is always recommended to manage them using multiple baselines. It is also recommended to use separate templates for each baseline (Clone the same template and reuse if desired).
- Before editing the baseline template, ensure it is not associated with more than 100 devices.
- It is recommended to keep the default Configuration Inventory task in a disabled state in the scale environment.
- Users who frequently edit compliance template are advised not to use more than 100 devices in a single baseline. Each baseline should use a different template.
- Ensure that there are no other Configuration Inventory or Compliance Operations running at the same time.

### 3.3.2 Test environment and results of the Configuration Compliance feature in OpenManage Enterprise 3.4

**Test setup**:

Below steps are followed for testing configuration compliance feature:

- Create 4 baselines one after the other, using 4 different templates. Each baseline is associated to 1500 devices.

Note: Create Baseline1 using template1 and wait for the configuration inventory job to complete.
This should be followed for all remaining baselines. Completion of the previous configuration inventory job is a critical factor before creating a new one.

- Baselines are successfully created one after the other. Each baseline gets created after the configuration inventory task status changes from running to completed.

**Test results:**

Time taken to create subsequent baseline and compliance report to generate

| Deployment of Appliance | Fresh | Upgrade |
|---|---|---|
| Baseline (Each having 1500 devices associated to it ) | Time taken to complete Configuration Inventory and Compliance report generated | Time taken to complete Configuration Inventory and Compliance report generated |
| Baseline 1 | 2h 24 m | 2h 33m |
| Baseline 2 | 5h 5 m | 5h 6m |
| Baseline 3 | 8h 10m | 8h 5m |
| Baseline 4 | 15h 23m | 15h 29 |
| 6000 Devices | 9h 54 m | 11h 22m |
| Baseline1<br><br>(After changing Configuration Inventory of 500 devices) | 15h 56m | 14h 34m |
| 6000 devices<br><br>(After changing Configuration Inventory of 6,000 devices) | 49h 31m | 48h 53m |

- Once the baselines are created, the configuration inventory for all the 6,000 devices can be run from the Inventory portal. The configuration inventory should be run at a higher frequency for optimal performance (For example, once in 2 weeks).
- Configuration Inventory time will increase with each run if the inventory on the targets change.

# 3.4 Test setup and results of the Alert and Task Management feature in OpenManage Enterprise 3.4

## 3.4.1 Recommendations for setting an environment to test Alert and Task Management feature in OpenManage Enterprise 3.4

- Reception of alerts is supported with 5,000 alerts per minute for 60 minutes without any drop with no alert actions configured. This implies appliance will receive 85 alerts per second continuously for 1hr without any alert drop.
- With 1 alert action (email/Trap forwarding) configured and mapped with 8,000 discovered devices, reception of alerts is supported up to 85 alerts per second for a duration of 60 minutes with a possibility of 20% alert drop. Restarting services will help receive more number of alerts if such a situation happens.
- With all the alerts actions configured, reception of alerts is supported till 9 alerts per second with a possibility of 25% alert drop, if continued for long duration. Restarting services will help receive more number of alerts if such a situation happens.
- Key factors determining alert reception in case of alert actions configured:
  - No. of devices selected.
  - Time interval between alert reception.
  - Number of Alert actions configured

## 3.4.2 Test environment and results of the Alert and Task Management feature in OpenManage Enterprise 3.4

**Environment used:**

- CPU and memory data for alerts with a single alert action configured (such a Email) was captured for a reception of 50,000 alerts, at 85 alerts per second, for 5 cycles, with an interval of 2 hours between each cycle.
- The alert burst data was captured by generating 50,000 alerts together in the network and received by OpenManage Enterprise. Alert actions were not configured.

**Test results**:

Table 10 Memory and CPU utilization for alerts reception in OpenManage Enterprise 3.4

| Test Config | Config I | |
|---|---|---|
| **Alert Frequency** | **85 alerts per second without alert actions** | **85 alerts per second reception rate with single alert action** |
| **Total CPU usage** | 30% | 38.5% |
| **Event Processing Service Memory Consumption** | 894MB | 957MB |

- In case of an alert burst when all the alert actions are configured (For example Alert forwarding, Syslog, Email, Remote script, and so on), the alerts will drop at a much higher rate. During our testing

when 85 alerts/sec were sent to OME for one hour where 5 alert actions were configured, only 60,000 alerts were received.

- Note: On demand health poll was enabled.
- Once the alert frequency slows down and all the alert policy execution is complete, the alert reception will return to normal.
- When 50,000 events are generated together in a single instance in the environment (all discovered servers generate multiple events simultaneously), then all the events are received without any alert drop if no alert actions are configured.
- The time taken to receive 50,000 events at 85 alerts per second is approximately 15 minutes when no alert actions are configured. This time is the overall reception of all the events without any loss.

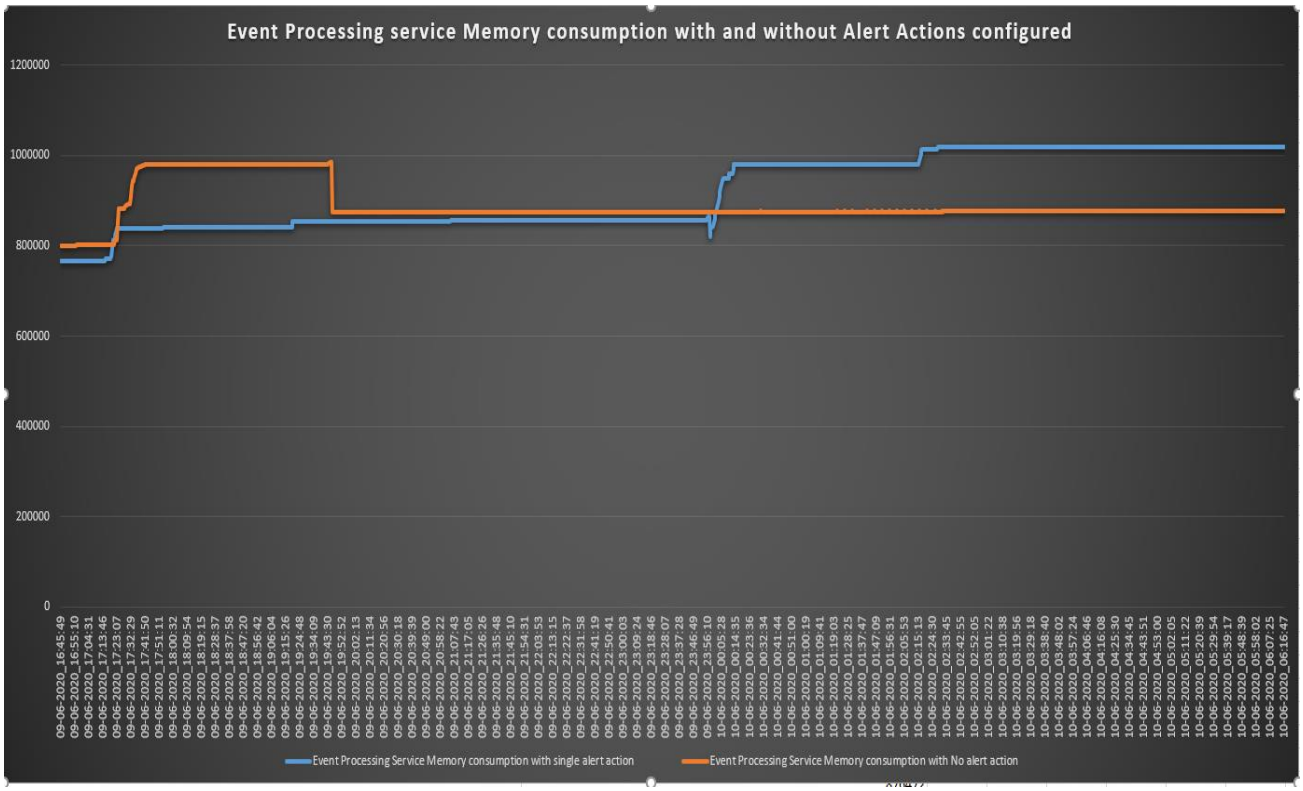
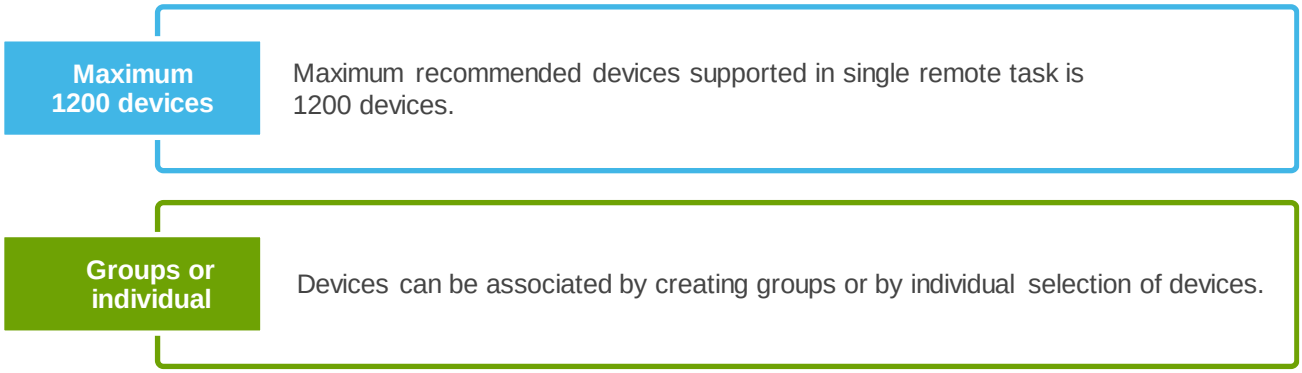



Figure 3 Comparison graph displaying Memory utilization of Event Processing service with and without alert actions configured when alerts are received at 85 alerts per second.

## 3.5 Test setup and results of the Power Control, Remote CLI, Blink LED Task feature in OpenManage Enterprise 3.4

### 3.5.1 Recommendations for setting an environment to test Power Control, CLI, Blink LED Task feature in OpenManage Enterprise 3.4




### 3.5.2 Test environment and results of the Power Control, CLI, Blink LED Task feature in OpenManage Enterprise 3.4

- Time taken to complete the Power Control task for 150 physical devices and 1000 simulated devices is 5 mins 20 secs.
  - Simulated devices failed as expected. Test was performed to check for any unexpected errors during task execution.
- Time taken to complete the Blink LED task for 150 physical servers is 1min 45 secs.
- Time taken to complete the RACADM CLI task for 150 physical servers is 40 secs.
  - RACADM CLI commands such as `racreset` and `getsysinfo` were used.

## 3.6 Test setup and results of the Profile creation and assignment feature in OpenManage Enterprise 3.4

### 3.6.1 Recommendations for setting an environment to test Profile creation and assignment feature in OpenManage Enterprise 3.4

- Maximum number of Profile supported by OpenManage Enterprise 3.4 is 2,000. One profile is associated with one device.
- If the template used for profile creation is associated with an identity pool, it is recommended to use one template for a maximum of 500 devices. For creation of 2,000 profiles, 4 templates should be used, and they should be associated to unique identity pools.

### 3.6.2 Test environment and results of the Profile creation and assignment feature in OpenManage Enterprise 3.4

**Test setup**:

- Template was captured from a server having following hardware:
  - CNA card
  - FC card
- The following virtual identities were deployed on each server using OME
  - CNA card
    - 1 iSCSI vMAC
    - 2 vMAC
    - 2 iSCSI IP (initiator)
    - 1 iQN
    - 2 FCoE identity (1WWPN) (1WWN)
  - FC card
    - 2 WWPN
    - 2 WWNN
- Total identities per server: 12.
- IO Pool with below values:
  - vMAC: 5000
  - iSCI vMAC: 2500
  - IPv4: /20
  - WWPN/WWN: 5000
- Profile creation using REST APIs in the OME as follows:

  a. Create 100 profiles at a time using a single template and wait 2 mins for profiles to be created. Repeat this until 500 profiles are created.
  b. Use the above steps to create the remaining 1500 profiles (3 more templates are needed as one template should be used for 500 profiles. The original template can be cloned and associated to unique IO pools).

- Profile assignments using REST APIs in the OME as follows:

  a. The API assigns one profile to each device. The API script uses the assignment until the assignment completes for 250 devices. Each assignment has 10 seconds gap. The script waits for the deployment to complete for the 250 devices.
  b. The same step should be used till the assignment completes for 2,000 profiles.

- These assignments were performed on simulated devices which failed as they did not have write operation capabilities. This test was conducted to check for any unexpected errors.

**Test results:**

Table 11 Time taken to create and assign 2,000 profiles

| Environment | Profile creation and assignment without identities | Profile Creation and assignment with identities (1 profile mapped to 12 identities). |
|---|---|---|
| **Time taken to create 2,000 Profiles** | 5 m | 10 m |
| **Time Taken to assign 2,000 profiles** | 60 m | 3.5 h |

## 3.7 Test setup and results of the Deployment feature in OpenManage Enterprise 3.4

### 3.7.1 Recommendations for setting an environment to test Deployment feature in OpenManage Enterprise 3.4

For deploying a template on multiple servers in a single task, follow the recommendations below to have a higher success percentage:

- Server should have iDRAC Enterprise and OpenManage Enterprise Advanced License in the server.
- Server having BIOS ErrPrompt setting as enabled can require manual interaction during POST.
- The iDRAC ServerBoot.1#FirstBootDevice being set to BIOS will boot the system to the BIOS F2 menu. This would require manual interaction.
- Review any error listed in POST and take appropriate action mentioned on the screen during deployment job.

### 3.7.2 Test environment and result of the Deployment feature in OpenManage Enterprise 3.4

Deployment Template contained 28 attributes from below 2 components:


Table 12 Test Setup for testing deployment feature:

| Server Model | No. of Servers |
|---|---|
| M630 | 37 |
| R630 | 16 |
| R530 | 6 |
| C6420 | 3 |
| R330 | 2 |
| R430 | 1 |
| R440 | 2 |

Table 13 Configuration Deployment of 67 servers with 28 attributes

| Test Environment | Test results |
|---|---|
| **Server generation** | YX3X, YX4X |

| | |
|---|---|
| **Time taken for configuration deployment** | 2m 30s |

# 4. Scalability and performance test results of OpenManage Enterprise 3.4 (tested on 20 MX7000 chassis MCM setup)

## 4.1 Performance results for managing a 20 chassis MCM setup from OpenManage Enterprise 3.4

- **Test setup**: MCM setup with 1 Lead and 1 backup Lead.
  - MX7000 chassis: 20
  - PowerEdge MX740c: 124
  - PowerEdge MX840c: 11
  - Dell EMC MX7116n Fabric Expander: 2
  - Dell EMC MX9116n Fabric Engine: 1
  - MX7116n Fabric Expander Module: 57
  - Dell EMC MX9116n Fabric Engine: 5
  - To discover the chassis, selected the Chassis option from the discovery wizard while creating the discovery task.
  - WSMAN protocol is automatically used for the sub-discovery task of sleds present in a Chassis.
  - Time taken for discovery and inventory of 20 chassis MCM, includes the sub-discovery of sleds.
  - To run the Status Poll, users can select all MX7000 chassis from All devices page after discovery and click on the refresh status option.
  - Time taken for rediscovery of the 20 MX7000 chassis is less than the first-time discovery.

Table 14 Discovery and inventory of MX7000 chassis

| **Protocol used for discovery** | **Redfish for chassis**<br>**WSMAN for servers** |
|---|---|
| **Number of chassis discovered** | 20 |
| **Time taken for first discovery, inventory, of 20 chassis MCM with lead IP and onboarding of chassis** | 30m |
| **Time taken for scheduled rediscovery** | 24m |
| **Time taken for Status Poll of 20 MX7000 chassis** | 10s |

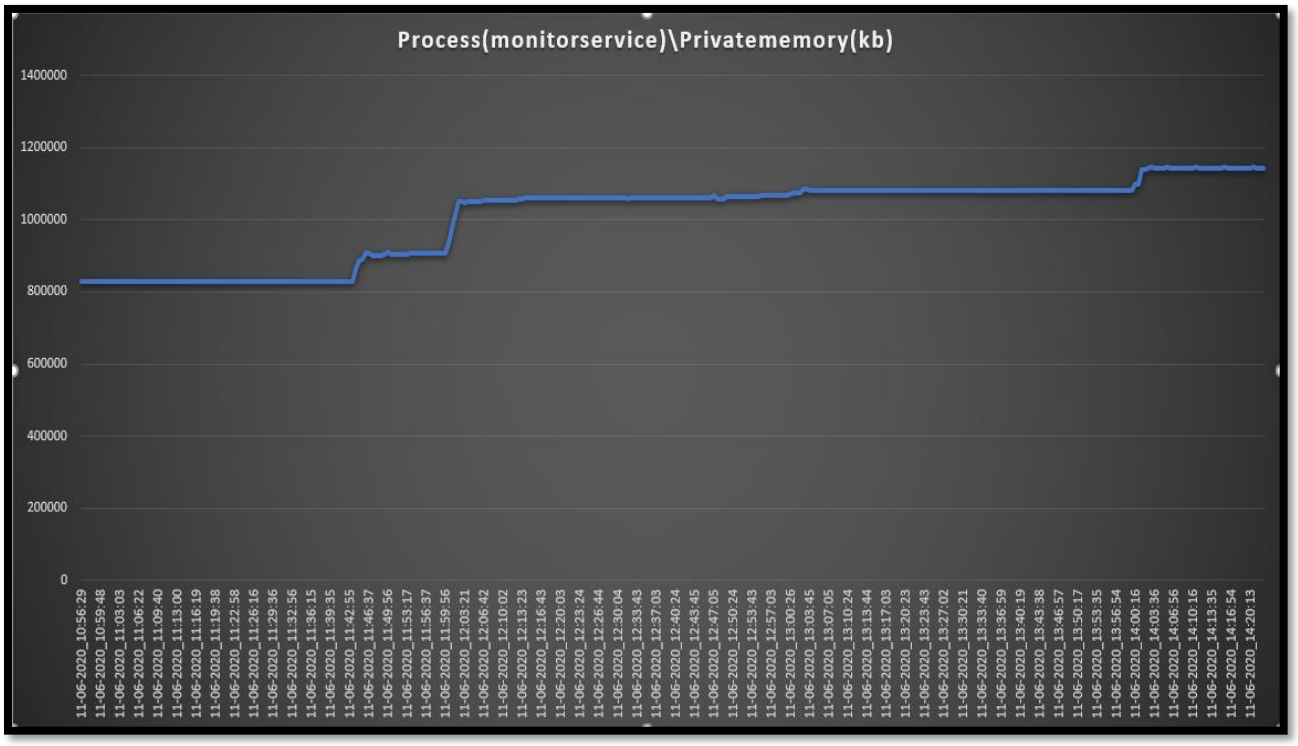



Figure 4 Memory mapping for Discovery,Inventory and Statusing of 20 MX7000 chassis MCM setup

## 4.2 Test setup and results of the Firmware Upgrade feature in OpenManage Enterprise 3.4 (tested on 10 MX7000 chassis)

Note:
OME supports monitoring of 20 Chassis MCM but the firmware update is only supported for 10 Chassis MCM when the number of SLEDs does not exceed 43.
Also, **OME** 3.4 does not support firmware upgrade on IOMs.

Note:
Maximum 9 member MX7000 chassis can be updated in a single firmware update task. It is mandatory to update the member chassis first. This is applicable only if you are upgrading from 1.10.20 or lower.
Once all the member chassis are updated**,** the lead chassis can be updated.

Table 15 Test Setup configuration details used for Firmware update of 10 chassis MCM setup

| Device used for Firmware Update in 10 Chassis MCM step | Number of Devices populated |
|---|---|
| MX7000 chassis | 10 (1 Lead Chassis, 9 Member chassis) |
| PowerEdge MX740c Sled | 31 |
| PowerEdge MX840c sled | 12 |

- Chassis and SLEDs should not be updated together.

- "Reset iDRAC" is not supported when updating SLEDs in an MCM setup (Only clear job queue is supported).
- Online catalog was used for firmware update of Chassis and Sleds.

Table 16 Time taken for firmware update of MX7000 chassis and multiple sleds

| Target | Time taken | Comments |
|---|---|---|
| **9 member chassis** | 1h 21 m | Firmware version- 1.10 to 1.20 |
| **43 sleds** | 1h 44m | Each sled had 8 DUPs to update.<br><br>Components: iDRAC, BIOS, iSM, NIC, SEP, OS collector, OS driver pack, BackPane |

## 4.3 Test setup and results of the Configuration Deployment feature in OpenManage Enterprise 3.4 (tested on a single MX7000 sled)

**Test setup**:

- Test configuration:
  - Dell EMC MX7000 chassis
  - 2 Dell EMC MX840C sleds with 4 network cards and 2 FC card
  - 4 MX5108n IOMs
- Identity migration was performed from one Dell EMC PowerEdge MX840c server to another similar Dell EMC PowerEdge MX840c server. The identities selected for deployment include virtual MAC address, virtual iSCSI MAC address, virtual FIP MAC address, virtual WWPN, virtual WWNN for FC and FCoE, and iQN. Few other attributes from BIOS, iDRAC, Lifecycle Controller, NIC, and FC were also deployed and verified for migration.

**Test results:**

- The time taken to perform identity and VLAN deployment took 28 mins. The time taken is based on the identity attributes that were selected for deployment along with the four attributes per FQDD.
- The time taken to perform deployment increases when more number of attributes are selected for performing a configuration operation.
- The time taken to perform migrations is almost double the time taken to perform deployments.

Table 17 Server configuration, identity, and VLAN deployment

| Operation performed | Server configuration, identity, and VLAN deployment |
|---|---|
| **Time taken to perform identity and VLAN deployment** | 28m |
| **Time taken to perform identity + VLAN migration to another server in same chassis** | 56m |

# 5. Longevity Test results for OpenManage Enterprise 3.4

## 5.1 Longevity test configuration for OpenManage Enterprise 3.4

**For Longevity testing the appliance was loaded with below Data on Day 1:**

- 8,000 devices were discovered and inventoried. Devices discovered were a mix of chassis and rack servers (5,000 rack and remaining chassis and sleds.)
- At least 200 device groups were created with at least 100 devices in each (Groups created were a mix of static and query groups).
- At least 40,000 alerts were sent to the console, with 35,000 of these events mapped to the discovered systems.
- Firmware baseline was created using an online catalog and mapped to 6,000 devices.
- A few physical rack servers were discovered with OME advanced licenses.
- Created templates. Cloned the created templates so that there are at least 200 templates.
- Some of the templates were deployed on simulated servers.
- One template was deployed on at least 50 servers.
- Few alert policies were created that would send emails based on the alerts received.
- At least 5,000 jobs were created by running CLI commands on targets.
- The config inventory job was scheduled to run on at least 2,000 targets every 24 hours.
- A template was used to create a baseline and associated at least 2,000 servers to it.
- Open Manage Power Manager Plugin 1.2 was installed, and metric collection was enabled for 5,000 devices.
- Created a policy that will send the notifications to OMM mobile app.

**Following steps were executed periodically from Day 2 onwards till 14th day:**

- Executed a REST API script to get all the alerts in the appliance every hour.
- Executed a REST API script to get all the devices in the appliance every hour.
- Executed a REST API script to trigger compliance re-checks for the baseline.
- Generated 500 alerts every 2 hours. These alerts were part of an alert policy which triggered an email action.
- Refresh inventory of 8,000 devices was scheduled to run every 12 hours.
- Performed one template deployment per day using the GUI on physical server.

## 5.2 Longevity test results for OpenManage Enterprise 3.4

- The time taken for performing scheduled discovery, inventory, and status poll remained approximately constant for a period of 15 days for the supported number of devices.

Table 18 Time taken for various Tasks for Day 1 and 14

| Task | Day 1 | Day 14 |
|---|---|---|
| Discovery and Inventory Task | 4hr 56m | 5hr 1m |
| Default Inventory | 3hr 59m | 4hr 6 m |
| Default Global health | 24m | 29m |
| Alert reception (500 alerts at 30 alerts/second) | 20s | 22s |

- An uninterrupted service was observed while performing the Longevity test.
- The time taken to receive alerts, process alert actions, and run tasks remained constant for the duration of the test.
- The figure below describes memory consumption (in KBs) of various services of OpenManage Enterprise during Longevity testing in OpenManage Enterprise 3.4.

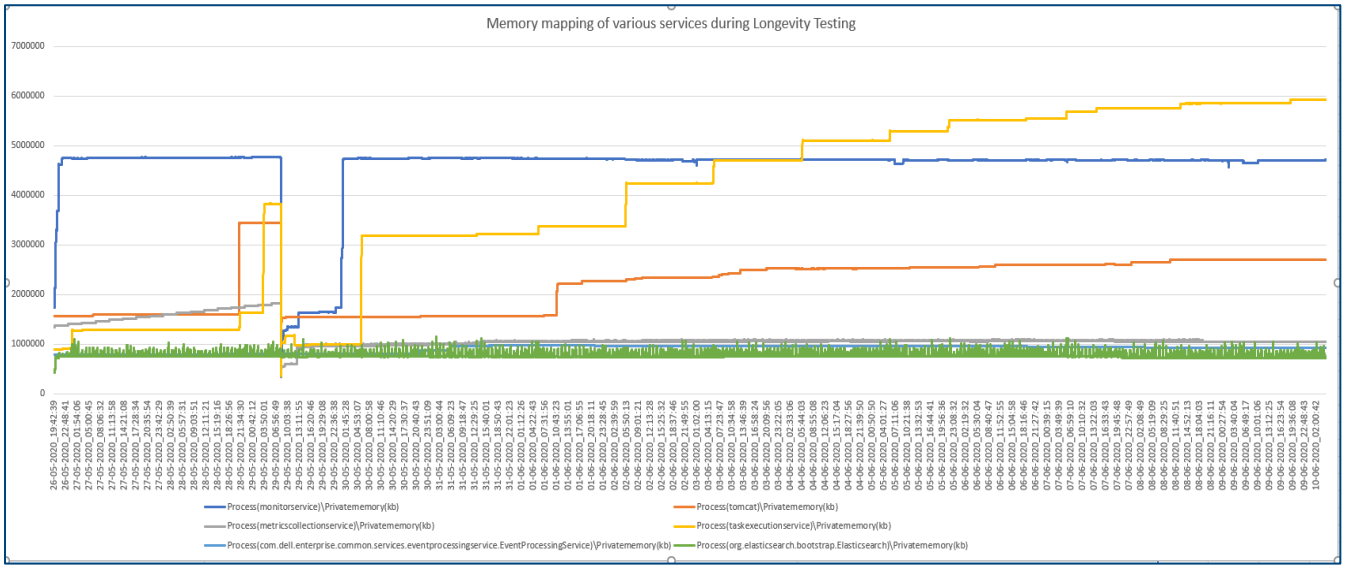



Figure 5 Memory consumption (in KBs) of appliance services throughout Longevity testing in OpenManage Enterprise 3.4

- The time taken to open the GUI and access different pages increases slowly but becomes stable after a few days. No drastic increase in Page Load time was observed. The test data below was captured after each day. To reduce the time taken to open the GUI, users can restart services after a few months if needed.

Table 19 Test results of the Page load time of various Pages per day in Longevity testing in OpenManage Enterprise 3.4

| | Page Load Time(sec) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Dashboard** | **All Devices** | **Alert log** | **Jobs** | **Audit logs** | **Warranty** | **Reports** | **View compliance** |
| **Day-1** | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| **Day-2** | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| **Day-3** | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| **Day-4** | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| **Day-5** | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| **Day-6** | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| **Day-7** | 3 | 4 | 3 | 2 | 2 | 2 | 2 | 2 |
| **Day-15** | 3 | 4 | 3 | 2 | 2 | 2 | 2 | 2 |

## 5.3 Test results of REST API in a Longevity setup in OpenManage Enterprise 3.4

**Test setup**:

- 8,000 Devices were discovered in Open Manage Enterprise 3.4.
- 50,000 Alerts were present in the Database.
- OpenManage Power Manager plugin was installed with 6,000 devices added to working set. There is no major difference in results with Power Management plugin installed.

**Test results:**

Table 20 Average response time for various REST APIs after Day30:

| URLName | RestURL | Average Response Time(hh:mm:ss) on Day 30 |
|---|---|---|
| FilterAlertsByPolicy | https://IP/api/AlertService/Actions/AlertService.FilterAlertsByPolicy?$top=99999999 | 00:00:0.02 |
| getdevicestatussummary | https://IP/api/GroupService/Groups(500)/DeviceStatusSummary?$top=99999999 | 00:00:0.02 |
| eventcatalogs | https://IP/api/MIBImportService/MIBImportService/EventCatalogs?$top=99999999 | 00:00:0.02 |
| getreportdefs | https://IP/api/ReportService/ReportDefs?$top=99999999 | 00:00:0.49 |
| gettimezones | https://IP/api/ApplicationService/Network/TimeZones?$top=99999999 | 00:00:0.12 |
| getalldevices | https://IP/api/DeviceService/Devices?$top=99999999 | 00:04:32 |
| getnetworkcurrentaddressconfiguration | https://IP/api/ApplicationService/Network/CurrentAddressConfiguration?$top=99999999 | 00:00:0.03 |
| groupaudits | https://IP/api/GroupService/GroupAudits?$top=99999999 | 00:00:0.02 |
| groupservice | https://IP/api/GroupService/Groups?$top=99999999 | 00:00:01 |
| mobilesubscriptions | https://IP/api/AlertService/MobileSubscriptions?$top=99999999 | 00:00:0.13 |
| getalljobs | https://IP/api/JobService/Jobs?$top=99999999 | 00:00:0.98 |
| gettemplates | https://IP/api/TemplateService/Templates?$top=99999999 | 00:00:0.19 |
| getbaselines | https://IP/api/TemplateService/Baselines?$top=99999999 | 00:00:0.06 |
| getmibs | https://IP/api/MIBImportService/MIBS?$top=99999999 | 00:00:0.02 |
| templatetypes | https://IP/api/TemplateService/TemplateTypes?$top=99999999 | 00:00:0.02 |
| SubscriptionNotificationService | https://IP/api/AlertService/SubscriptionNotificationService?$top=99999999 | 00:00:0.07 |
| getnetworkproxyconfiguration | https://IP/api/ApplicationService/Network/ProxyConfiguration?$top=99999999 | 00:00:0.02 |
| eventcategories | https://IP/api/MIBImportService/MIBImportService/EventCatalogs?$top=99999999 | 00:00:0.02 |
| getnetworkaddressconfiguration | https://IP/api/ApplicationService/Network/AddressConfiguration?$top=99999999 | 00:00:0.02 |
| querycontextsummaries | https://IP/api/QuerySupportService/QueryContextSummaries?$top=99999999 | 00:00:0.02 |
| getnetwork | https://IP/api/ApplicationService/Network?$top=99999999 | 00:00:0.02 |
| globalexcludes | https://IP/api/DeviceService/GlobalExcludes?$top=99999999 | 00:00:0.02 |
| geatallleafdevices | https://IP/api/GroupService/Groups(500)/AllLeafDevices?$top=99999999 | 00:04:27 |
| templateviewtypes | https://IP/api/TemplateService/TemplateViewTypes?$top=99999999 | 00:00:0.02 |
| geteventstatussummary | https://IP/api/GroupService/Groups(500)/EventStatusSummary?$top=99999999 | 00:00:0.02 |
| eventseverities | https://IP/api/MIBImportService/MIBImportService/EventSeverities?$top=99999999 | 00:00:0.03 |
| getallalerts | https://IP/api/AlertService/Alerts?$top=99999999 | 00:00:11 |
| gettimeconfigurations | https://IP/api/ApplicationService/Network/TimeConfiguration?$top=99999999 | 00:00:0.02 |
| operatorinfo | https://IP/api/QuerySupportService/OperatorInfo?$top=99999999 | 00:00:0.02 |
| getconsolesettings | https://IP/api/ApplicationService/Settings?$top=99999999 | 00:00:0.02 |
| getLicense | https://IP/api/DeviceService/Devices(deviceID)/InventoryDetails('deviceLicense') | 00:00:0.95 |
| getsoftwareinventory | https://IP/api/DeviceService/Devices(deviceID)/InventoryDetails('deviceSoftware') | 00:00:0.93 |

# 6. Scalability and performance test results of OpenManage Enterprise 3.4 (tested on a Single PowerEdge servers)

## 6.1 Test setup and results of the Discovery, Inventory, and Status Poll feature in OpenManage Enterprise 3.4 (tested on a single server)

Table 21 Test setup of Discovery, Inventory, and Status poll feature in OpenManage Enterprise 3.4 for single server

| Load Parameter | YX4X Server | YX3X Server |
|---|---|---|
| **Model** | PowerEdge R 940 | PowerEdge M830 |
| **Processor** | 4 | 2 |
| **iDRAC version** | 4.10.10.10 | 2.70.70.70 |
| **Physical Drives No.** | 24 | 5 |
| **NICs** | 2 | 2 |
| **DIMMs** | 40 | 4 |

Table 22 Discovery and Inventory of a single PowerEdge server by using server category

| Protocol used for Discovery | WS-Man | |
|---|---|---|
| Load parameter | **YX4X servers** | **YX3X servers** |
| **Time taken for first discovery, inventory, and onboarding** | 2m 22s | 2m 23s** |
| **Time taken for re-discovery and onboarding** | 2m 18s | 2m 4s |
| **Time taken for re-inventory** | 2m 01s | 1m 36s |
| **Time taken for status-poll** | 2s | 6s |

** YX3X server discovery time is less as the number of hardware components are very less in comparison to YX4X server.

## 6.2 Test setup and results of the Firmware Upgrade feature in OpenManage Enterprise 3.4 (tested on a single server)

Table 23 Test setup of Firmware Upgrade feature in OpenManage Enterprise 3.4 for single server

| Load Parameter | YX4X Server | YX3X Server |
|---|---|---|
| **Model** | PowerEdge R 740xd2 | PowerEdge R830 |
| **Processor** | 2 | 2 |
| **iDRAC version** | 4.10.10.10 | 2.63.60.61 |
| **Physical Drives No** | 15 | 5 |
| **NICs** | 3 | 2 |
| **DIMMs** | 4 | 4 |

Table 24 Firmware Update of a single PowerEdge server

| Test Environment | | Test result | |
|---|---|---|---|
| **Server Generation** | | **YX3X** | **YX4X** |
| Time taken for firmware update | DUP download time | 1m 13s | 2m |
| | Firmware update time | 58m 12s | 30m 54s |
| | Post update inventory time | 2m 40s | 1m 24s |

## 6.3 Test setup and results of the Configuration Deployment feature in OpenManage Enterprise 3.4 (tested on a single server)

**Test setup**:

Table 25 Test setup for testing Configuration deployment on single server

| Load Parameter | YX4X Server | YX3X Server |
|---|---|---|
| **Model** | PowerEdge R 740xd2 | PowerEdge R730xd |
| **Processor** | 2 | 2 |
| **iDRAC version** | 4.10.10.10 | 2.70.70.70 |
| **Physical Drives No** | 15 | 12 |
| **NICs** | 3 | 3 |
| **DIMMs** | 4 | 2 |

- For test setup, 18 attributes were selected for deployment from the following components:
  - BIOS
  - iDRAC
  - System
  - RAID
  - NIC

**Test results:**

Table 26 Configuration deployment of a single server with 18 attributes

| Test Environment | Test result | |
|---|---|---|
| Server generation | YX4X | YX3X |
| Time taken for configuration inventory | 48s | 2m 52s |
| Time taken for configuration deployment | 9m 44s | 12m 16s |

# A Technical support and resources

- Dell.com/support is focused on meeting customer needs with proven services and support.
- To watch quick and short videos about handling the PowerEdge server components, visit the QRL video website.

## A.1 Related resources

### A.1.1 Contacting Dell EMC

Dell provides several online and telephone-based support and service options. Availability varies by country and product, and some services may not be available in your area. To contact Dell for sales, technical support, or customer service issues:

1. Visit www.dell.com/support.
    a. Select your support category.
    b. Verify your country or region in the Choose a Country/Region drop-down menu at the top of page.
    c. Select the appropriate service or support link based on your need.

For information about documentation support:

1. Go to dell.com/support/manuals.
    a. In the Tell us about your Dell system section, under No, select Choose from a list of all Dell products and click Continue.
    b. In the Select your product type section, click Software, Monitors, Electronics & Peripherals.
    c. In the Choose your Dell Software, Monitors, Electronics & Peripherals section, click Software.
    d. In the Choose your Dell Software section, click the required link from the following:
        i. Client System Management
        ii. Enterprise System Management
        iii. Remote Enterprise
        iv. System Management–Serviceability Tools
    e. To view the document, click the required product version.

### A.1.2 About Dell EMC OpenManage Enterprise

Dell EMC OpenManage Enterprise is a hardware management and monitoring application that provides a comprehensive view of the Dell EMC servers, chassis, storage, network switches, and other devices on the enterprise network. With Dell EMC OpenManage Enterprise, a web-based and one-to-many Systems Management application for Dell EMC systems and other third-party devices, you can:

- Discover and manage devices in a data center environment.
- Create and manage Dell EMC OpenManage Enterprise users and their permissions.
- Group and manage devices.
- Monitor the health of your devices.

- Manage device firmware versions and perform system updates and remote tasks.
- Create and deploy device configuration templates.
- View and manage system alerts and alert policies.
- View hardware inventory and compliance reports.
- Monitor and report about warranty and licenses.

**Note**—For information about supported browsers, see the Dell EMC OpenManage Enterprise Support Matrix available on the support site.

Some of the security features of Dell EMC OpenManage Enterprise are:

- Role-based access that limits access to console settings and device actions.
- Hardened appliance with Security-Enhanced Linux (SELinux) and an internal firewall.
- Encryption of sensitive data in an internal database.
- Use of encrypted communication outside the appliance (HTTPs).
- Create and enforce firmware and configuration-related policies.
- Provision for configuring and updating the bare-metal servers.

**Note**—Dell EMC OpenManage Enterprise has a domain-task-based GUI, where the navigation is designed by considering the sequence of tasks that are predominately used by an administrator and device manager. When you add a device to an environment, Dell EMC OpenManage Enterprise automatically detects the device properties, places it under relevant device group, and enables you to manage the device. The typical sequence of tasks performed by Dell EMC OpenManage Enterprise:

- Deploy and managing Dell EMC OpenManage Enterprise
- Configure Dell EMC OpenManage Enterprise by using Text User Interface
- Discover devices for monitoring or management
- Manage All Devices
- Monitor devices by using the Dell EMC OpenManage Enterprise dashboard
- Organize devices into groups
- Manage the device firmware
- View and configuring devices
- Monitor device alerts
- View archived alerts
- View device warranty information
- Manage device configuration templates
- Manage the device configuration compliance baseline
- Monitor device compliance with compliance templates
- Manage audit logs
- Manage Dell EMC OpenManage Enterprise appliance settings
- Run an inventory job now
- Manage the device warranty
- Manage reports and MIB files