



HPE ONEVIEW ARCHITECTURAL ADVANTAGES



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THE HPE ONEVIEW CONCEPT

HPE OneView brings speed, efficiency, and simplicity to IT by combining infrastructure management into a single management solution where infrastructure is software-defined and treated as code. HPE engineers and product management staff continuously study IT trends to keep HPE OneView current, and even cutting edge, in this dynamic world of IT management. This dedication to continuous improvement and market leadership has resulted in the market adoption of HPE OneView to surpass one million licenses worldwide.

When HPE OneView was initially designed, HPE product management staff and software engineers studied how IT managed their servers, storage, networking, and facilities. They found this was often with different foundation services, management requirements, graphical user interfaces (GUIs), and authentication requirements. They realized the need to address both technical and organizational issues in order to support the transition to software-defined technologies such as virtualization and cloud. Also, based on their HPE BladeSystem, Virtual Connect, and Insight Management experience, HPE understood that IT organizations needed a management platform that spanned multiple generations of infrastructure so users could transition to the platform efficiently. From this comprehensive understanding of IT infrastructure management, HPE OneView was created.

WHITE PAPER STRUCTURE

This technical white paper explains HPE’s approach for software-defined and composable infrastructure management that is designed for the future. These key requirements are core to the HPE OneView solution.

- Fast time-to-value with intuitive ease of use
- Inherently software-defined and automated
- Unified compute, storage, networking, and data center management
- Scalable without adding unnecessary layers of management complexity
- Open Application Programming Interface (API) that includes a Software Development Kit (SDK) and a user ecosystem
- Options for secure user and communication configurations that support modern data center policies

HPE OneView is a server-centric data center infrastructure monitoring and management solution. This white paper takes the reader from core functionality, like the user interface and security, through progressively greater sophistication as illustrated in the Figure 1.

Monitoring is a basic and necessary function of any infrastructure management solution. HPE OneView monitoring capabilities are explained first.

After covering infrastructure monitoring concepts, the next level of sophistication, infrastructure management is covered.

Infrastructure composing takes infrastructure management to the next level with the ability to create infrastructure when required from a fluid pool of resources. Infrastructure to support your workloads can be designed in advance and then created on demand. HPE OneView handles infrastructure composing for rack systems slightly different than it does for HPE Synergy blade systems, so they are covered separately in this document.

Next is workload composing that orchestrates the configuration and installation of a workload image as an extension to the HPE Synergy composing process.

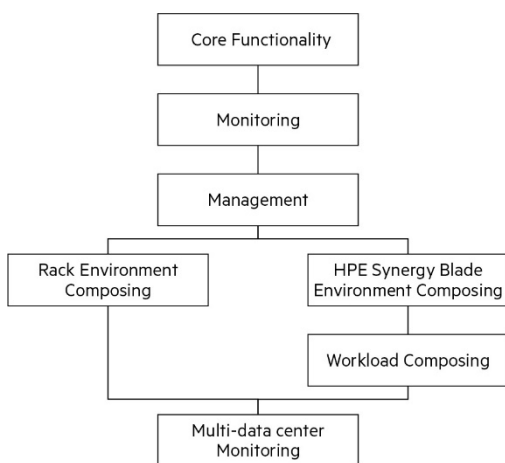


FIGURE 1. White paper content structure



Last, you will see how HPE OneView Global Dashboard does infrastructure monitoring in a single user interface for multiple HPE OneView instances, often spread globally across multiple data center, with drill-down capabilities to the HPE OneView management system of interest.

HPE ONEVIEW CORE FUNCTIONALITY

To understand IT infrastructure management, it is first important to understand the underlying core functionality of the application that facilitates the management capabilities. HPE OneView's underlying structure provides for a secure and intuitive user experience with an open API that encourages a diverse ecosystem of third-party solutions.

HPE OneView is a comprehensive single platform designed from the ground up for infrastructure management. As an integrated platform, productivity of every member of the team is increased across servers, storage, and networking. By streamlining processes, incorporating best practices, and creating a holistic way to work, HPE OneView enhances organizational efficiency. To extend these efficiencies, HPE OneView is designed for open integration with existing tools and processes.

HPE OneView is delivered as an appliance which makes it easy to deploy. It can be either a hardware appliance, called Composer, to manage HPE Synergy environments or a virtual machine appliance to manage other HPE infrastructure environments. When it is fully implemented, HPE OneView manages your server, storage, network, and to a lesser degree rack, power, cooling, and hypervisor resources throughout their lifecycle. Infrastructure management tools are collapsed into a single resource-oriented architecture that provides direct access to all physical and logical resources.

The initial configuration of HPE OneView's monitoring and management of resources is simplified with HPE's Guided Setup that provides a simple to follow step-by-step process. The infrastructure administrator is directed through HPE OneView configuration steps so important steps are not missed.

The Guided Setup varies depending on the resources in the HPE OneView environment. The Figure 2 provides a comprehensive example of the steps you may encounter. Most setups are a subset of these steps.

Not all steps are required, necessary, or even desired. Your specific steps will depend upon your resource management requirements and your internal processes. Steps not performed can often be performed later when they become appropriate. Some steps are prerequisites for later steps.

The Guided Setup takes the administrator through these configuration steps:

- The HPE OneView appliance
- Cryptography and security
- Directory service and users
- HPE OneView licenses
- Firmware repository
- Storage managers
- Hypervisors
- Networks
- Storage
- Enclosures
- Servers
- Racks and PDUs
- Data center
- Traps and alerts
- User scopes

Logical device and template configurations are interspersed throughout the setup process.



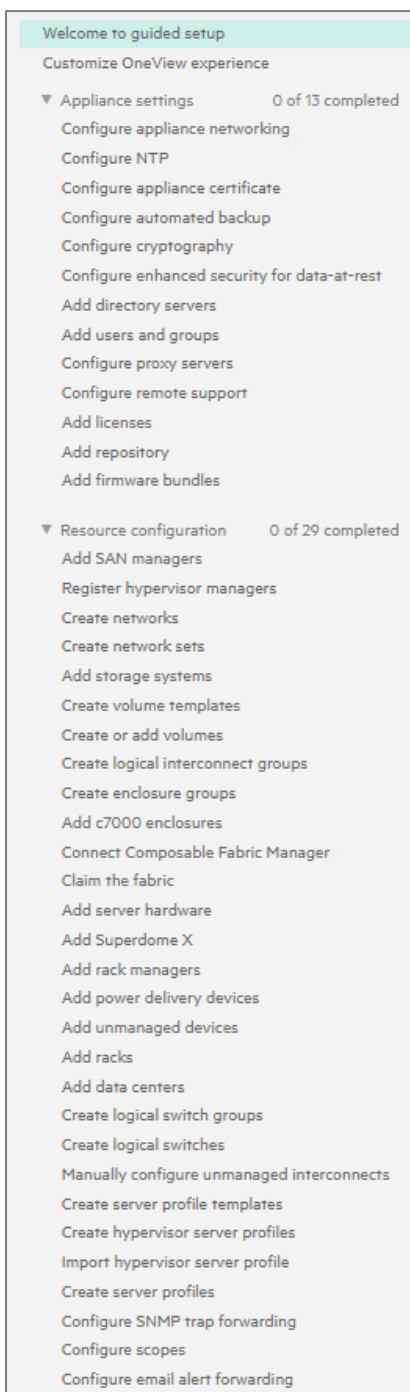


FIGURE 2. HPE OneView Guided Setup

Enhanced user experience

The HPE OneView GUI works on desktops, tablets, and mobile devices. It builds functionality around the administrators work practices and puts resources in the menu. The HPE OneView GUI fully embraces the web experience. Right click to open in a new tab, copy and paste browser bookmarks, easily email links to colleagues, and print diagrams and data. There are search capabilities, newsfeeds, and other functions that work as you've come to expect in a web experience. It is designed to be simple, efficient, and consistent.

The GUI is built on the modern web, using HTML5, CSS3, JavaScript, and AJAX. The GUI is a RESTful programmatic overlay to the HPE OneView set of REST APIs.



In the Figure 3, you see the HPE OneView menu on the left with quick access to the resources of interest. With the Settings option selected, you see your options for configuring the HPE OneView appliance and its environment.

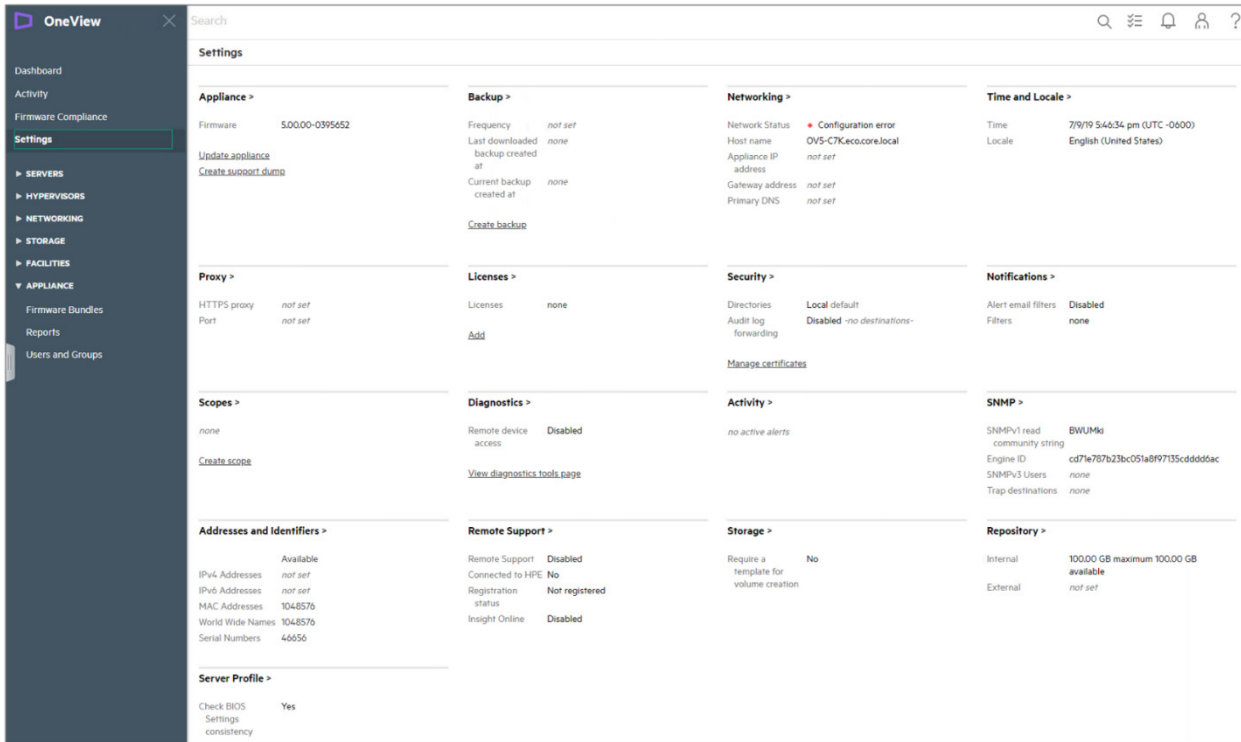


FIGURE 3. HPE OneView comprehensive and intuitive menu and management system for IT infrastructure management

REST API

HPE OneView supports a large collection of REST API calls that allow requests to be issued by any client, including browser clients. HPE OneView REST APIs are fully documented in the HPE OneView [Enterprise Information Library](#).

The REST methodology has advantages like the ability to create web services using an interface similar to those commonly used for large-scale environment management. This well-documented and public API is very useful for developers and end users who wish to create their own apps or provide integration capabilities with other applications.

Security is always a key aspect of any enterprise product, so all REST API calls require HTTPS. HPE OneView generates self-signed certificates out of the box but recommends uploading a Certificate Authority (CA) signed certificate to your management appliance.

For a technical overview of the HPE OneView REST API, please see “Integration with HPE OneView; A technical overview for ISVs and developers” available at hpe.com/oneview. Search for “Integration with HPE OneView”.

HPE OneView Security Foundation

Securing your infrastructure, applications, and your corporate environment is becoming more and more of a priority. It used to be sufficient to have basic security policies in place and call it good enough so long as nothing went wrong. Today, the risk and cost of a security breach is too high to neglect strong security policies and the effort required to implement those policies. Today, every application, and the IT infrastructure that supports those applications, needs strong security controls. For an application such as HPE OneView, that integrates with your IT infrastructure and potentially many third-party applications, security is paramount.

HPE OneView is a security hardened hidden appliance that:

- Has a restricted set of interfaces that control and reduce its attack surface
 - HTTPS, REST APIs, AMQP-based message bus, and a restricted Command Line Interface (CLI)
- Does not allow interactive OS users and, therefore, no local execution
- Encrypts all sensitive data-at-rest



- Performs security scans and penetration testing
- And digitally signs and authenticates all software patches

User access controls

By default, HPE OneView uses local user accounts. For secure production environments, HPE recommends the only local account be an “administrator” maintenance account with a complex password. All other accounts should be integrated with an enterprise directory such as Microsoft Active Directory or OpenLDAP. After enabling the enterprise directory integration, all local user access can be disabled. An optional “break glass in case of emergency” feature may remain enabled to allow Administrator access during the rare circumstances when the enterprise directory is not available.

HPE OneView allows you to take advantage of enhanced security features such as two-factor authentication, Federal Information Processing Standard (FIPS) 140-2 validation, and support for Commercial National Security Algorithm (CNSA) ciphers that provide users with the highest level of cryptography in the industry. Two-factor authentication via Active Directory or OpenLDAP is performed using a Common Access Card (CAC) or Personal Identity Verification (PIV) X.509-based smartcards along with a user supplied PIN.

To define user privileges and control user access, HPE OneView uses a Role-Based Access Control (RBAC) combined with Scope-Based Access Control (SBAC). RBAC grants access rights to a set of users (i.e., role) to perform actions (create, read, update, delete, or use) on all resources in a resource category. HPE OneView has a limited set of user roles:

- Infrastructure Administrator: Full access to create, read, update, and delete resources plus manage resource activities, notifications, and logs
- Read only: View resource information
- Specialized users: Restricted to server, storage, network, software artifact, user, or backup administration

SBAC limits rights within the user’s role to read-only, create, modify, or delete resources, configurations, or events. A resource can be assigned to zero or more scopes in order to restrict operations that can be performed on it. Authorized administrators can assign multiple permissions to a user or a directory group.

The HPE OneView GUI provides a centralized interface to enable security functions as shown in the Figure 4.

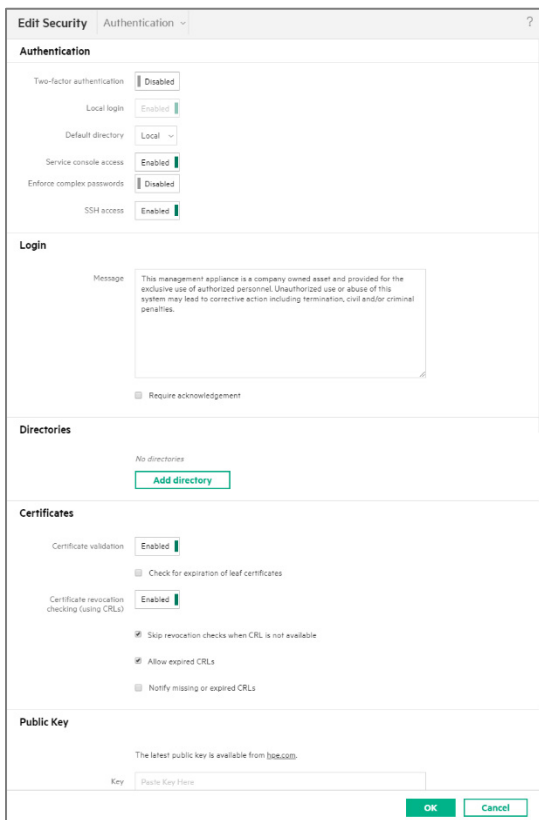


FIGURE 4. HPE OneView user authentication security configuration



IT infrastructure communication controls

With HPE OneView, all browser operations and REST API calls use HTTPS over Transport Layer Security (TLS).

In addition, Simple Network Management Protocol (SNMP) can be used for device communications. If a device is SNMPv3 enabled, HPE OneView supports SNMPv3 communication with the device. SNMPv3 communication is available for servers using Integrated Lights Out (iLO) version 4 or later. HPE OneView will use SNMPv1 to communicate with all other SNMP enabled devices.

In addition, HPE OneView can forward SNMP traps using SNMPv3. This includes automatically converting any incoming SNMPv1 traps to SNMPv3 prior to forwarding the traps. Support for trap forwarding via SNMPv1 is preserved for backward compatibility. Supported SNMP authentication and privacy protocol (SNMPv1 or SNMPv3) varies with the type of devices or trap forwarding requirements.

HPE OneView has extensive certificate management features, only available through the REST APIs, which include:

- Option to automatically trusted self-signed certificates during initial device discovery
- CA signed certificates for iLOs, Onboard Administrators, Frame Link Modules, remote repositories, proxy servers, etc.
- Support for Certificate Revocation Lists (CRLs)
- Management of the HPE OneView certificate store
- Alerts for certificate expiration related events
- Security preferences to control the strictness of certificate validation

Additional security features are available for HPE OneView connectivity, communication, and management of HPE Gen10 servers, such as:

- Two-factor authentication
- TLS encryption and Advanced Encryption Standard (AES) encryption
- Firmware update validation using a 4096-bit private key digital signature
- Trusted Platform Module (TPM) for securely storing passwords, certificates, and encryption keys
- FIPS 140-2 and CNSA Suite security
- Silicon Root Trust with Runtime Firmware Verification and secure recovery of essential firmware in the unlikely event of a breach into the HPE server firmware

For additional information, see the “[HPE Gen10 Security Reference Guide](#)”.

Connecting from core to cloud

A primary objective of cloud services is to easily provide users with the infrastructure resources required for their workloads. This fluid pool of resources, available on demand, allows resource provisioning to move up the management stack from the IT administrators to the users. The Software-Defined Data Center (SDDC) is an evolution that moves the control even further up the stack, so applications ultimately have control of the underlying infrastructure resources as is shown in the Figure 5. The HPE OneView’s REST APIs and message bus are core design elements that enable end user, application, and third-party control of the OneView managed resources. Cloud and application layers can perform control functions at the management layer where IT administrative control resides. This framework is rapidly gaining acceptance as technologies mature and the architectural design is validated.

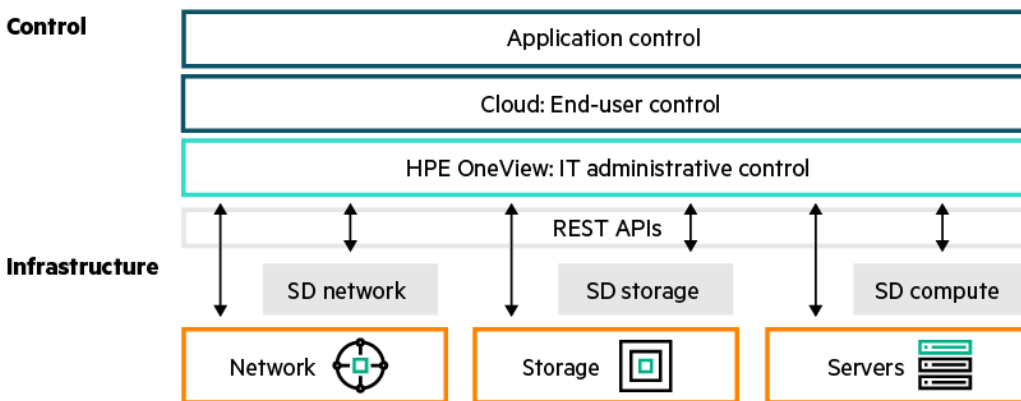


FIGURE 5. Conceptual overview of the role of HPE OneView in the management stack



Cloud and the SDDC require managing infrastructure as a pool of resources that can be dynamically allocated. The infrastructure is abstracted from the underlying hardware components. The cloud administrator can provision cloud infrastructure (compute nodes, storage nodes, controller nodes, etc.) dynamically from pools of physical infrastructure. HPE OneView provides a composable infrastructure management plane that supports software-defined compute, storage, and networking, to unify these previously isolated silos. HPE OneView's REST APIs allow for an open and extensible means of managing the infrastructure based on established industry standards. The lifecycle management of the infrastructure is automated to support rapid deployment or retiring of IT services. Software-defined templates provide a structured and consistent means of implementing routine tasks and ensuring quality by establishing a common set of best practices.

While HPE OneView reduces the number of tools that system administrators need to use, most organizations will continue to use many additional tools in their environment, including:

- Virtualization and systems management tools such as VMware vCenter® and Microsoft System Center
- Automation tools such as Ansible, Chef, Puppet, PowerShell, Python, and Terraform
- Cloud and container management tools like Red Hat® OpenShift, Docker, SUSE, and Morpheus Data
- Facilities management tools such as Schneider Electric, Nlyte, and Eaton

HPE OneView is designed to interoperate with these and other software environments. Applications can use HPE OneView to generate a baseline of information about infrastructure and capture data on any state or metrics changes that are relevant. To do this, the RESTful implementation is used to first discover what is in the infrastructure and then receive updates on any changes via subscription to the infrastructure message bus. HPE OneView passes back the initial configuration information that it has already discovered and then shares state changes.

Applications can also use the software-defined approach of HPE OneView to control and automate changes in IT infrastructure directly from their applications. HPE OneView provides software-defined resources, including templates, profiles, and groups that serve as an innovative way to manage the entire data center.

HPE OneView was architected using proven technologies that provide a fundamentally better foundation for the future. It provides a platform for software-defined management at the infrastructure level by delivering template-based policy automation. HPE OneView integrates cleanly as a physical infrastructure provider into a variety of environments through its REST APIs, message bus, and SNMP trap forwarding capabilities.

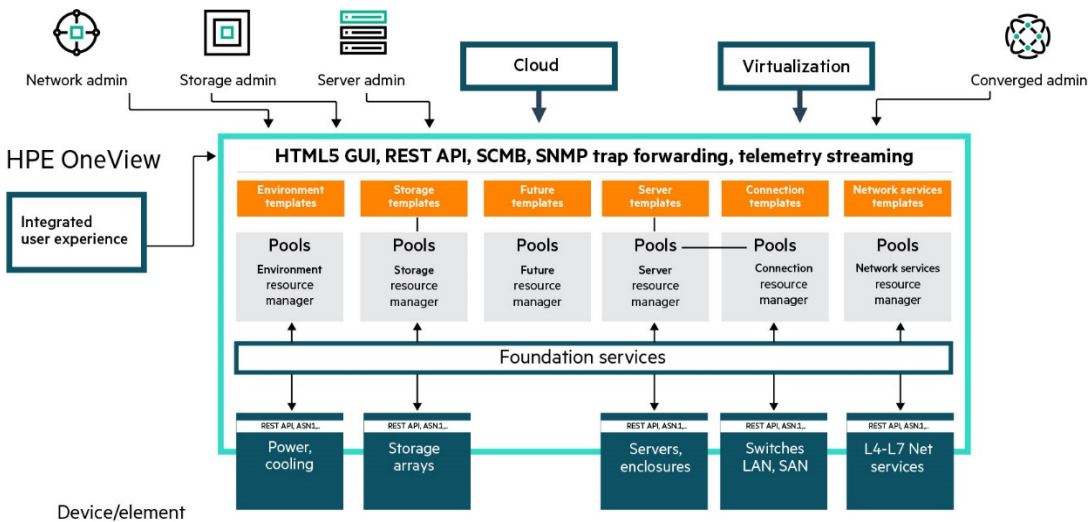


FIGURE 6. Overview of relationship between administrators, REST APIs, resource managers, and infrastructure

HPE OneView Remote Support

Optional HPE OneView Remote Support (OVRs) is provided as part of the HPE OneView warranty or contract. OVRs utilizes HPE OneView's monitoring capabilities to initiate proactive care for your OVRs supported IT infrastructure per the following process:

- Securely monitors supported hardware 24x7
- Automatically triggers a support case with HPE in the event of a hardware failure, with Case ID displayed in the OneView UI



- HPE contacts you to arrange shipment of a replacement part or to dispatch an engineer
- Proactive Service reports are generated with recommendations based on your monitored configuration and history
- OVRS displays contract & warranty information on each device, with weekly alerts and a CSV file of devices expiring within 30, 60, or 90 days

HPE OVRS uses highly secure technology that is detailed in the [HPE Remote Support Security White Paper](#).

Optional integrations with HPE Insight Online or HPE OneView Global Dashboard can be used to view health, contract & warranty status, and support cases for connected devices.

HPE OVRS resources are available at:

- [HPE Remote Support Presentation](#)
- [HPE Remote Support Enablement FAQ](#)
- [HPE Remote Support Information Library](#)

Edit Remote Support General ?

General

Enabling HPE Remote Support configures your monitored devices to be remotely supported and/or serviced. Service, diagnostic, configuration, telemetry and contact information will be securely transmitted to HPE. No other business information is collected and the data is managed according to the HPE Data Privacy policy. [Learn more](#)

Enable remote support

Configure existing and automatically setup devices as they are discovered for monitoring and service events

I consent to having HPE or my HPE authorized reseller contact me to discuss optimizing my IT environment. [Learn more](#)

Registration Information

Registration status: Not registered

Company name:

Initial Contact

First name:

Last name:

Email address:

Preferred language: English

Phone number:

Alternate phone number: optional

Special instructions: optional

Default Data Center Address

Address line 1:

Address line 2: optional

City:

State/Province:

Postal code: optional

Country: Search

Time zone: Search

[Register with Hewlett Packard Enterprise](#)

Checked: Enable remote support **OK** **Cancel**

FIGURE 7. Optional HPE OneView Remote Support enablement within HPE OneView



INFRASTRUCTURE MONITORING

Data collection from infrastructure devices (i.e., monitoring) is a most basic function of any infrastructure management solution. This section will cover capabilities of HPE OneView, per its architecture design, when it is used for monitoring. From a single instance of HPE OneView, monitoring exists for all discovered infrastructure devices while management of those devices has to be specifically enabled via HPE OneView advanced licensing.

There are two types of licenses available for HPE OneView:

- **HPE OneView Standard License** enables monitoring of server and enclosure inventory, health, and alerting. HPE OneView then reports the monitored content, can forward alerts to service desk and other management applications, and provides an API for other applications to integrate directly with HPE OneView. With the standard license, servers and enclosures are not managed. For all supported HPE tower servers, rack servers, and blade server enclosures; this License to Use (LTU) is included with the hardware purchase. HPE OneView does not require any license keys with this license.
- **HPE OneView Advanced License** to monitor and manage supported servers, enclosures, and connected devices. This license can be purchased with or without an embedded license for HPE iLO. For HPE Synergy systems, this license is included at no additional charge. The HPE Synergy Composer does not require any license keys, but all other supported servers and enclosures will require license keys that are managed in HPE OneView. In addition to the HPE OneView Standard License, this license provides for:
 - Firmware and driver updates
 - Lifecycle management of the data center
 - Partner integrations
 - Remote access to server power control and event logs
 - Software-defined abstracts and templates

For the remainder of the monitoring section of this document, the content assumes only the HPE OneView Standard License is applied.

For infrastructure monitoring, HPE OneView uses a set of cooperating resource managers that each focus on specific resources such as servers, storage, networking, hypervisors, and facilities. The resources managers provide REST APIs for those resources and publish State Change Messages (SCMs) and metrics to the State Change Message Bus (SCMB). Changes may be user-initiated, or they may be detected through monitoring. Subscribers to the SCMB are notified of the changes and/or current state. Subscribers may include the OneView GUI, partner integrations, or higher-level automation scripts.

The following diagram illustrates how the HPE OneView REST APIs and the SCMB are heavily used within the HPE OneView appliance for communication between resource managers and the foundation services.

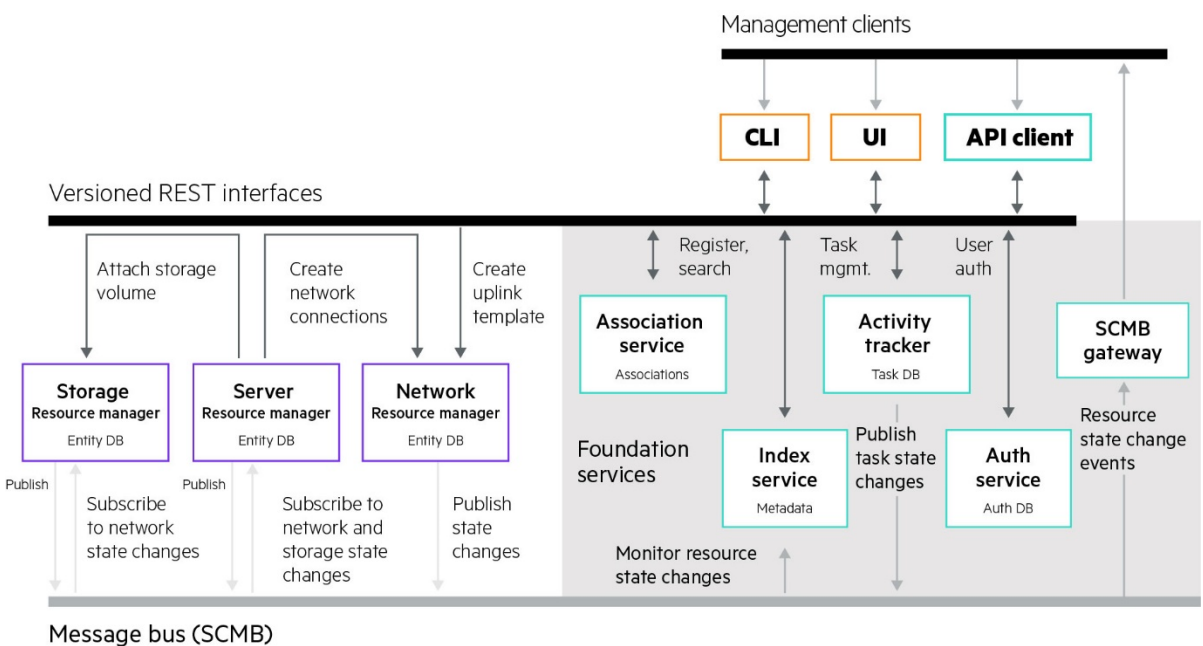


FIGURE 8. Interactions between the REST APIs, SCMB, resource managers, and foundation services



Message bus monitoring

The SCMB is a messaging broker, or intermediary, for exchanging messages that is well suited for large-scale management of virtualized and cloud environments. It contains messages about any change in the resources monitored by HPE OneView.

The SCMB is paired with the industry standard REST API to form a symbiotic relationship where HPE OneView “listens” to changes in the environment and publishes messages about the changes to all the consumers on the bus. Message bus consumers can then leverage the HPE OneView REST APIs to carry out Create, Read, Update, and Delete operations or to integrate with other systems. This powerful combination of the REST APIs and the message bus provides the foundation for building higher level IT automation and integration with a broad ecosystem of management partners. This includes service desk, orchestration, monitoring, Configuration Management Database (CMDB), and other tools. For additional details, please see the developer ecosystem sites at: hpe.com/us/en/solutions/developers/composable.html and developer.hpe.com.

HPE OneView embeds [RabbitMQ](#), a highly scalable and distributed message bus infrastructure that supports the industry standard [Advanced Message Queuing Protocol \(AMQP\)](#). RabbitMQ offers a variety of features that are important for enterprise-class management. These include reliability, high availability, flexible routing, clustering, federation, guaranteed delivery, multi-protocol, and tracing. There is a large [community around RabbitMQ](#), producing a variety of clients, plugins, guides, and more that make it easy to consume HPE OneView's SCMB messages. RabbitMQ supports a large collection of programming languages. The SCMs produced by the HPE OneView resource managers are made available to external clients via an SCMB gateway as shown in the Figure 8.

The SCMB is an interface that uses asynchronous messaging to notify subscribers of changes to monitored logical and physical resources. It is used to notify anyone listening on that bus of state changes of any current version of a resource. Applications can be programmed to receive notifications when new server hardware is added to the managed environment or when the health status of physical resources change. This is done without requiring continuous poll the appliance. The SCMB provides an effective way of passing information about changes to the environment so other applications can take specific actions.

With HPE OneView REST APIs, you can obtain certificates to access the SCMB. The message content is sent in JavaScript Object Notation (JSON) format and includes the resource model. Before you can set up a subscription to messages, you must create and download an AMQP certificate from the appliance using the appropriate REST APIs. Next, you connect to the message bus using an external authentication mechanism with, or without, specifying a user name and password. This ensures that you use certificate-based authentication between the message bus and your client. After connecting to the message bus, you set up a queue with the queue name empty, and AMQP generates a unique queue name. You use this queue name to bind your client to exchanges and receive messages. To connect to the message and set up a queue, you must use a client that supports the AMQP.

Most monitoring tools rely on polling using SNMP or other methods that scan infrastructure periodically, say every 60 seconds. Vast amounts of data are collected that often indicate no change. With HPE OneView, the SCMB sends instantaneous messages on changes to the state of the infrastructure, thereby updating your infrastructure current state details while only requiring infrequent polling for verification and current state synchronization.

Trap monitoring

Many network management systems use SNMP to monitor network-attached devices for conditions that require administrative attention. An SNMP manager typically manages a large number of devices, and each device can have a large number of objects. It is impractical for the manager to poll information from every object on every device. Instead, each agent on the managed device notifies the manager without solicitation by sending a message known as an event trap. Also, you can configure HPE OneView to forward SNMP traps received from servers and enclosures to enable the third-party managers to monitor these devices.

There are two configuration options for trap monitoring with HPE OneView:

- Appliance global trap forwarding for all servers and enclosures managed by HPE OneView
- Virtual interconnect trap forwarding via logical interconnect groups

Choosing between message bus and SNMP trap monitoring

In most cases, HPE recommends using the message bus process to capture state changes since it provides more information categories and a richer set of alerts. Also, it is the preferred method for Independent Software Vendor (ISV) integrations since they can consume the message bus directly instead of forwarding traps. With the message bus, you can specify the types of alerts that are relevant for your application and understand their state in depth. The message bus provides access to all alerts that HPE OneView displays, including both alerts that come from traps as well as from additional monitoring built into HPE OneView. Ideally, the SCMB should be used to provide a complete picture of your environment. However, for legacy systems, SNMP trap forwarding from HPE OneView remains available.



Monitoring content

In addition to collecting message bus and trap events, and the ability to forward SNMP traps, HPE OneView will monitor management applications for current state data. The HPE OneView standard license provides monitoring of these management applications:

- **Integrated Lights Out** (iLO) on the monitored HPE rack servers via iLO's Management Component Transport Protocol (MCTP) interface
- **Onboard Administrator** (OA) for HPE BladeSystem enclosures via OA's Command Line Interface (CLI) for enclosure, blade, and interconnect data
- **Rack and Power Manager** for HPE racks via the manager's CLI
- **Rack Management Controller** (RMC) for HPE Superdome Flex Servers via RMC's Distributed Management Task Force (DMTF) Redfish APIs
- **HPE 3PAR StoreServ, HPE Nimble, and HPE StoreVirtual** storage system applications for metrics, storage pools, and storage system ports

Plus, the standard license includes single sign-on (SSO) to iLO and OA consoles, including the ability to power on and off a server from the HPE OneView console.

An HPE OneView advanced license is required for server management, server composing, and monitoring and management of external devices connected to servers that are not listed here. In addition, other than the management applications mentioned above, an HPE OneView advanced license is required for integrating HPE OneView with other applications, including HPE extensions to HPE OneView like HPE OneView Global Dashboard.

An HPE OneView advanced license is only required for the servers you wish to manage from HPE OneView. The same HPE OneView appliance that is used to manage some servers can be used to monitor other servers. As of the date of this white paper, a single instance of HPE OneView can monitor up to 1024 servers, of which 740 can be managed. Please see the latest [HPE OneView Support Matrix](#) for current support limitations that may apply for your environment.

Another consideration for what servers to monitor versus manage is that, in general, you want your hardware management system to be local where it isn't impacted by network bandwidth, latency, and downtimes. Typically, remote site monitoring isn't as concerned with network delays. For remote sites, you will need to consider if you wish to:

- Manage your remote systems with a remote site local HPE OneView appliance
- Manage the remote hardware from your data center instance of HPE OneView
- Monitor your remote hardware from your data center and manage it locally outside of HPE OneView

Please see the [HPE OneView Global Dashboard](#) section of this document of additional remote site options and considerations.

With a standard license, HPE OneView monitors hardware for inventory, events, and status. HPE rack servers are added individually for monitoring or as a range of IP addresses. Monitoring of blade servers is done via the addition of OA. When an OA is added, the enclosure and all servers in the enclosure are added for monitoring.

When an HPE Superdome Flex Rack Manager is added, the rack and all servers in the rack are added for monitoring. HPE Superdome X enclosure monitoring includes:

- Crossbar Fabric Module (XFM) Bays, including part number and serial number
- Hard partitions, including partition name, UUID, health, run state, and hardware details

The following examples show the content that HPE OneView can gather and monitored for rack and blade servers. Additional standard license monitoring capabilities are not shown here such as HPE Superdome rack manager monitoring, hypervisor monitoring, and additional storage monitoring options.



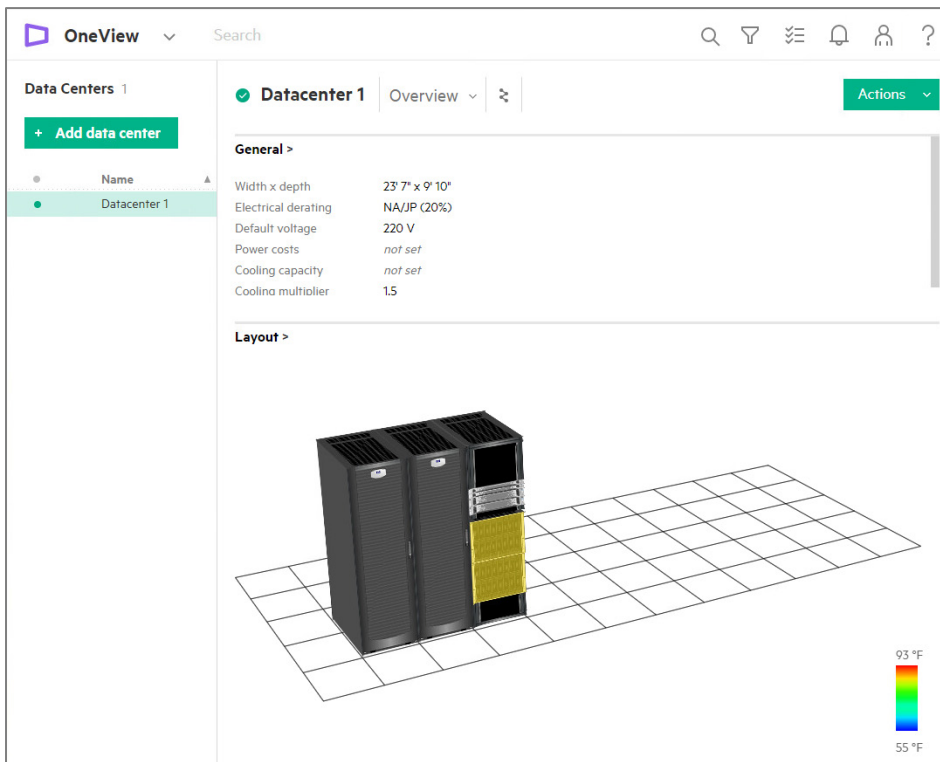


FIGURE 9. Visualization of the data center layout with a heat map showing the enclosure in yellow to indicate they are warm

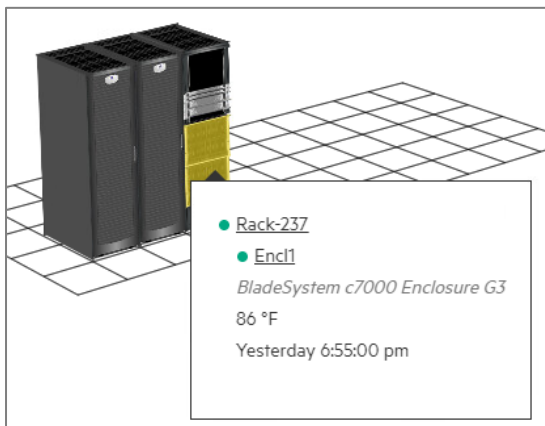


FIGURE 10. Mouse over a device to get details, including temperature details



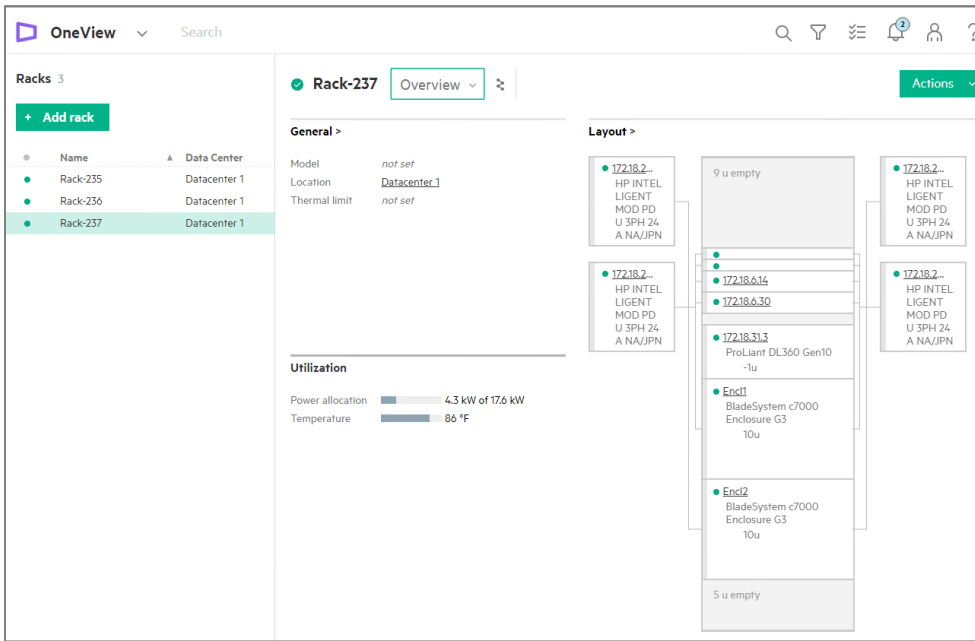


FIGURE 11. Drilling down to a visualization of an individual rack

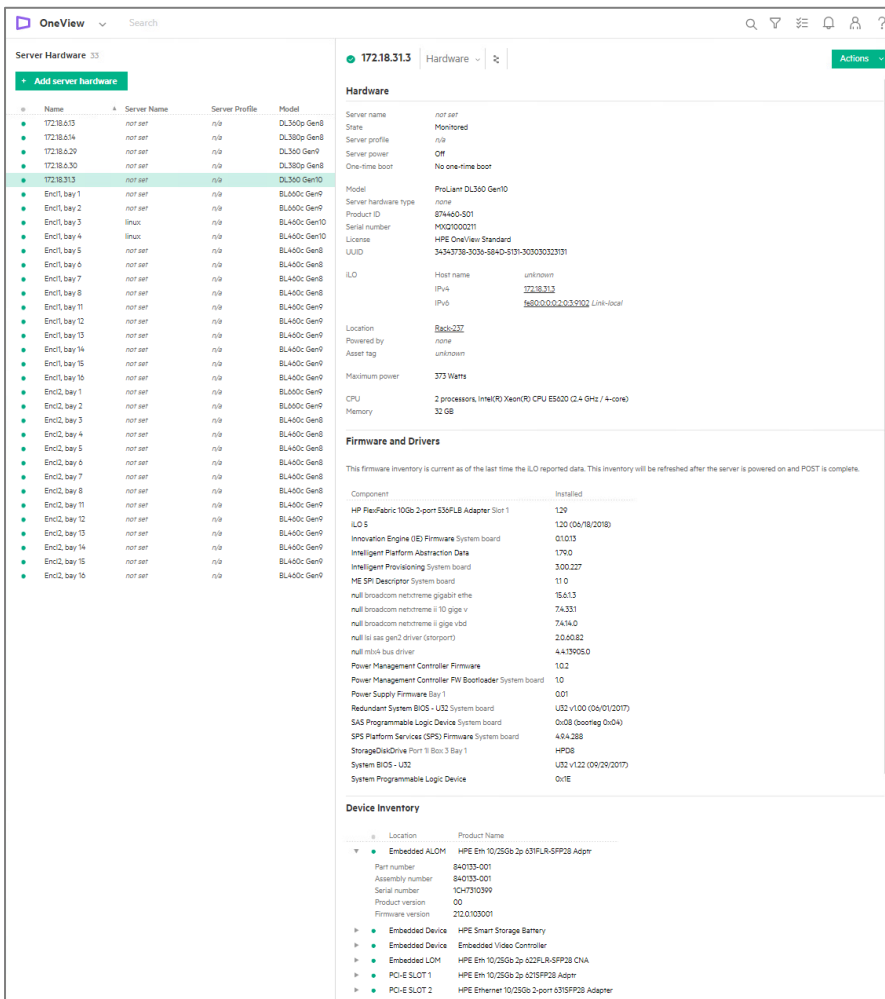


FIGURE 12. Robust information provided for a HPE ProLiant DL360 Gen10 server



Memory

Total memory 64 GB
 Operating frequency 2666 MHz
 Operating voltage 1.2 V

Advanced Memory Protection (AMP)
 Configured AMP mode Advanced ECC
 AMP mode status Advanced ECC

Location	Size	Part Number	Type
Processor 1 DIMM 1	8 GB	n/a	DRAM
Manufacturer HPE HPE Memory Yes Minimum voltage 1.2 V Frequency 2666 MHz Ranks 1 Technology RDIMM Device type DDR4 Error correction MultiBIECC Data width bits 64 Bus width bits 72 Channel 3 Memory controller 1 Slot 1 State Enabled			
Processor 1 DIMM 2	8 GB	n/a	DRAM
Processor 1 DIMM 3	8 GB	n/a	DRAM
Processor 1 DIMM 4	8 GB	n/a	DRAM
Processor 2 DIMM 1	8 GB	n/a	DRAM
Processor 2 DIMM 2	8 GB	n/a	DRAM
Processor 2 DIMM 3	8 GB	n/a	DRAM
Processor 2 DIMM 4	8 GB	n/a	DRAM

Storage

Location	Model	Type
slot 0	EMBEDDED CONTROLLER	HPE Smart Array

Utilization

This server hardware uses an HPE OneView Standard license. To view utilization data, add an iLO Advanced license key to the iLO. [Learn more](#)

Remote Support [Edit](#)

Remote Support is not enabled on the appliance. [Remote Support settings](#)

FIGURE 13. DL360 server details continued. Note that utilization information requires an iLO advanced license for the server. HPE OneView can then collect and report utilization details with an HPE OneView standard or advanced license



The screenshot displays the OneView management console. On the left, a table lists server hardware across multiple bays. The selected item, 'Enc1, bay 4', is highlighted. The main panel shows detailed hardware information for this server, including its name, state, model, and specifications. Below this, a 'Firmware and Drivers' section lists various components and their installed versions. At the bottom, a 'Device Inventory' section provides a list of internal components like the ALOM adapter, storage battery, and video controller.

Name	Server Name	Server Profile	Model
172.18.0.13	not set	n/a	DL380p Gen8
172.18.0.14	not set	n/a	DL380p Gen8
172.18.0.29	not set	n/a	DL380 Gen9
172.18.0.30	not set	n/a	DL380p Gen8
172.18.3.13	not set	n/a	DL380 Gen10
Enc1, bay 1	not set	n/a	BL440c Gen9
Enc1, bay 2	not set	n/a	BL440c Gen9
Enc1, bay 3	linux	n/a	BL440c Gen10
Enc1, bay 4	linux	n/a	BL440c Gen10
Enc1, bay 5	not set	n/a	BL440c Gen8
Enc1, bay 6	not set	n/a	BL440c Gen8
Enc1, bay 7	not set	n/a	BL440c Gen8
Enc1, bay 8	not set	n/a	BL440c Gen8
Enc1, bay 11	not set	n/a	BL440c Gen9
Enc1, bay 12	not set	n/a	BL440c Gen9
Enc1, bay 13	not set	n/a	BL440c Gen9
Enc1, bay 14	not set	n/a	BL440c Gen9
Enc1, bay 15	not set	n/a	BL440c Gen9
Enc1, bay 16	not set	n/a	BL440c Gen9
Enc2, bay 1	not set	n/a	BL440c Gen9
Enc2, bay 2	not set	n/a	BL440c Gen9
Enc2, bay 3	not set	n/a	BL440c Gen8
Enc2, bay 4	not set	n/a	BL440c Gen8
Enc2, bay 5	not set	n/a	BL440c Gen8
Enc2, bay 6	not set	n/a	BL440c Gen8
Enc2, bay 7	not set	n/a	BL440c Gen8
Enc2, bay 8	not set	n/a	BL440c Gen8
Enc2, bay 11	not set	n/a	BL440c Gen9
Enc2, bay 12	not set	n/a	BL440c Gen9
Enc2, bay 13	not set	n/a	BL440c Gen9
Enc2, bay 14	not set	n/a	BL440c Gen9
Enc2, bay 15	not set	n/a	BL440c Gen9
Enc2, bay 16	not set	n/a	BL440c Gen9

Hardware Details for Enc1, bay 4:

- Server name: linux
- State: Monitored
- Server profile: n/a
- Server power: Off
- One-time boot: No one-time boot
- Model: ProLiant BL440c Gen10
- Server hardware type: BL440c Gen10
- Product ID: 878625-001
- Serial number: SGH103QRN
- License: HPE OneView Standard
- UI/ID: 3653778-3532-4753-4831-3035832524E
- ILO: Host name: unknown, IPv4: 172.18.31.1, IPv6: fe80:0000:0203:0101::Link-local
- Location: Rack217, Enc1, bay 4
- Powered by: none
- Asset tag: unknown
- Maximum power: 373 Watts
- CPU: 2 processors, 12-Core Intel(R) Corporation Xeon (2.4 GHz / 4-core)
- Memory: 1024 GB

Firmware and Drivers:

Component	Installed
HP FlexFabric 10Gb 2-port 530FLB Adapter Slot 3	120
iLO 5	120 (06/18/2018)
Innovation Engine (IE) Firmware System board	01.013
Intelligent Platform Abstraction Data	176.0
Intelligent Provisioning System board	5.00.227
ME SPS Descriptor System board	11.0
null Broadcom netxtreme gigabit ethe	15.613
null Broadcom netxtreme ii 10 gige v	74.331
null Broadcom netxtreme ii gige vbd	74.14.0
null lsi sas gen2 driver (storport)	20.20.82
null mliob bus driver	4.4.13905.0
Power Management Controller Firmware	1.0.2
Power Management Controller FW Bootloader System board	1.0
Power Supply Firmware Bay 1	0.01
Redundant System BIOS - I41 System board	I41 v1.00 (04/01/2017)
SAS Programmable Logic Device System board	0x08 (boorteg 0x04)
SPS Platform Services (SPS) Firmware System board	4.9.4.288
StorageDiskDrive Port 11 Box 3 Bay 1	HPD8
System BIOS - I41	I41 v1.00 (07/05/2016)
System Programmable Logic Device	0x1E

Device Inventory:

- Embedded ALOM: HP FlexFabric 10Gb 2-port 530FLB Adapter
- Embedded Device: Empty
- Embedded Device: HPE Smart Storage Battery
- Embedded Device: Embedded Video Controller
- Embedded RAID: EMBEDDED CONTROLLER
- Mezzanine Slot 1: Empty Slot 1
- Mezzanine Slot 2: Empty Slot 2

Ports:

- FlexIB4LOM 1: HP FlexFabric 10Gb 2-port 530FLB Adapter
- Port 1:
 - Addresses: 04:35:12:18:4B:1B MAC, 10:00:04:35:12:18:4B:1C WWPN
- Port 2:
 - Addresses: 04:35:12:18:4E:1F MAC, 10:00:04:35:12:18:4B:20 WWPN
- Mezzanine 1: empty
- Mezzanine 2: empty

FIGURE 14. Similar information is collected and reported for HPE Blade servers



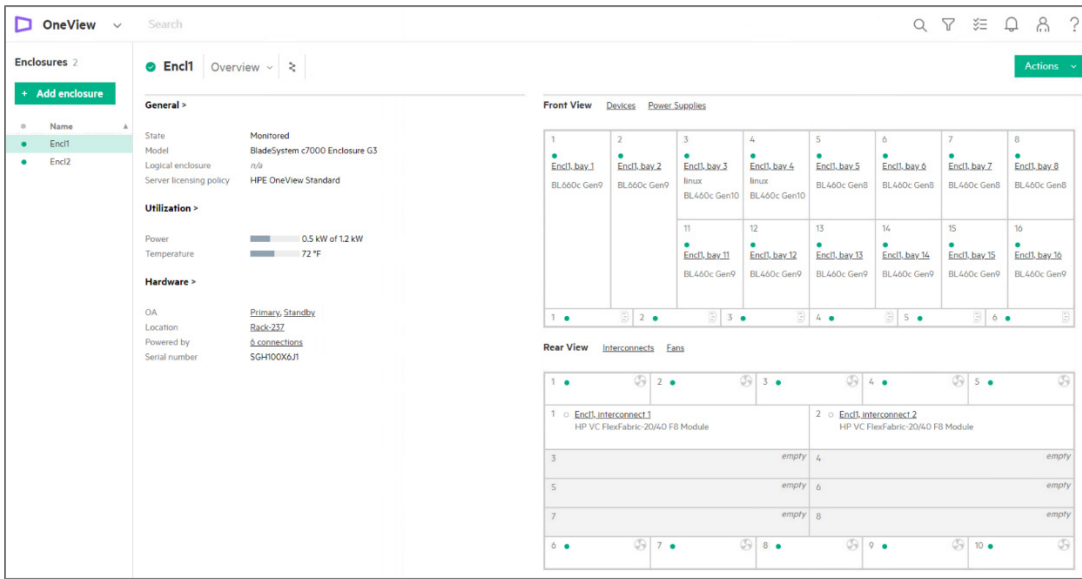


FIGURE 15. A visual representation is available for the blade system enclosure

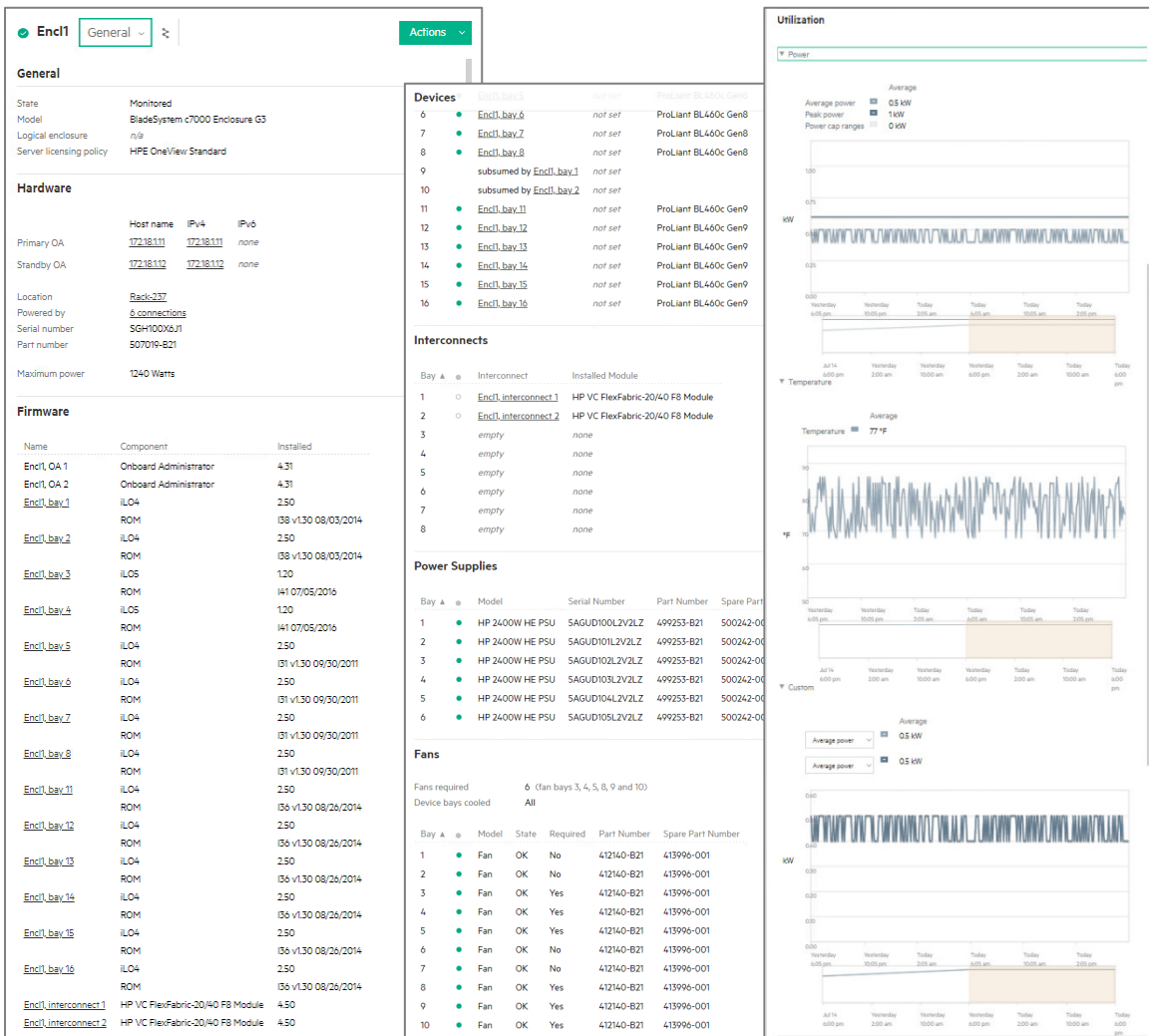


FIGURE 16. In addition to the visual representation, a robust set of data is available for the blade system enclosure, including performance data collected from the blade system Onboard Administrator



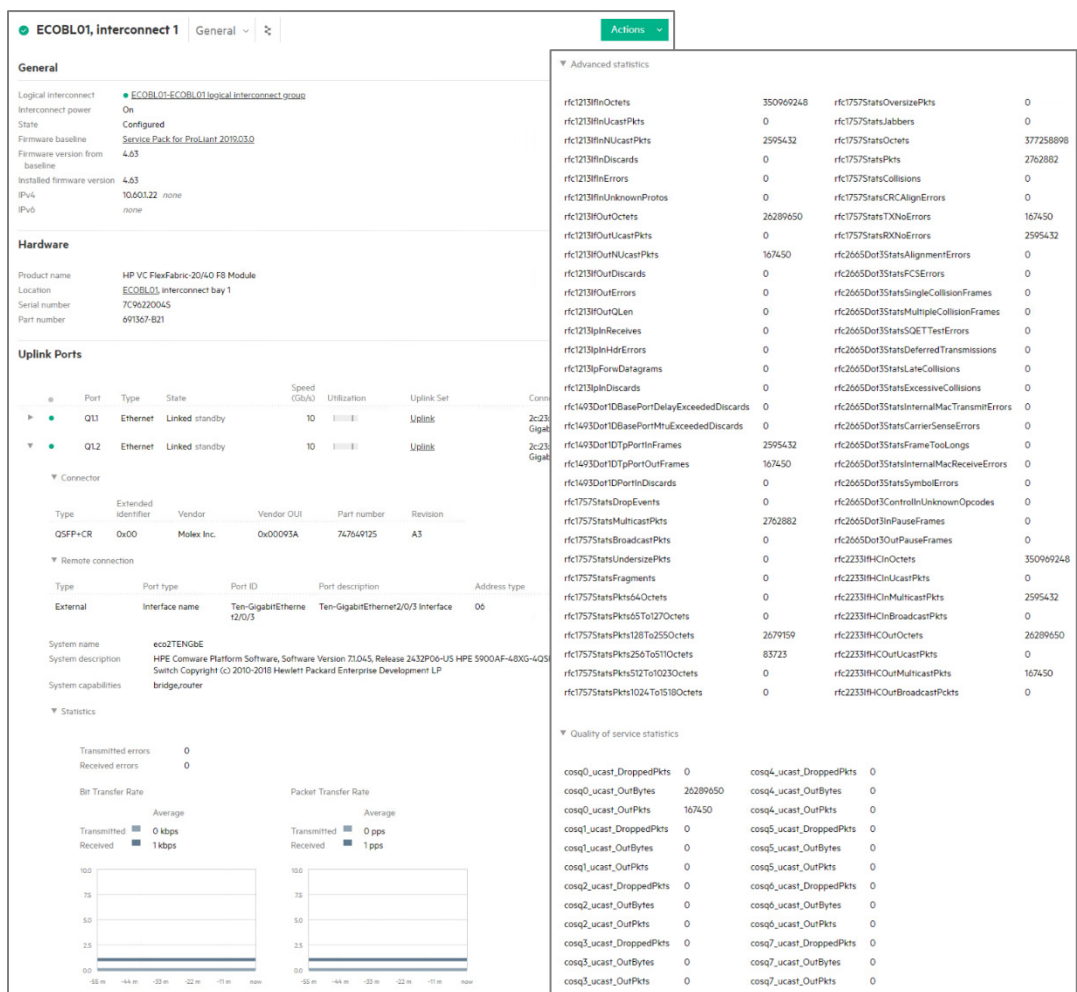


FIGURE 17. Extensive blade system interconnect information is available



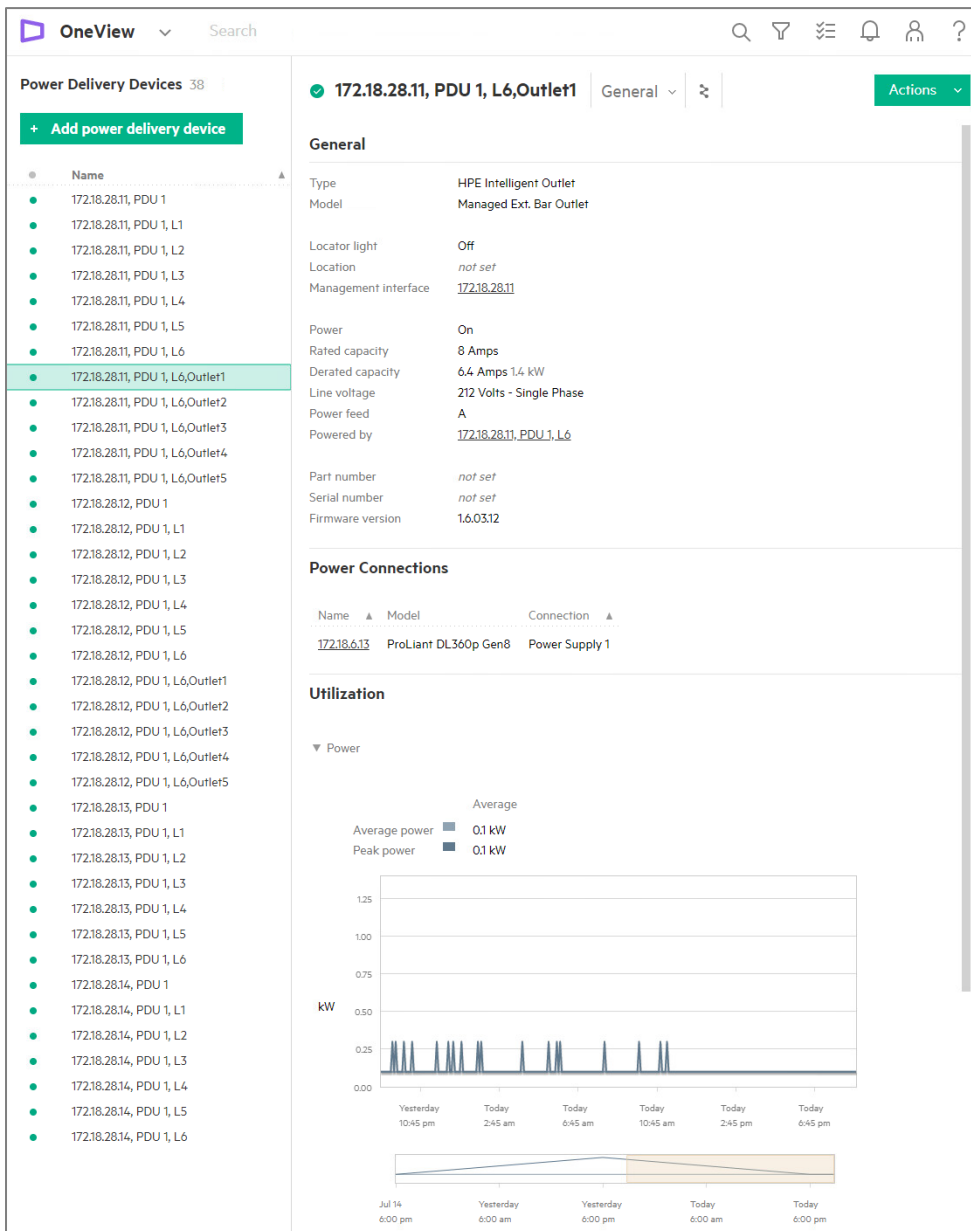


FIGURE 18. Extensive blade system interconnect information is available



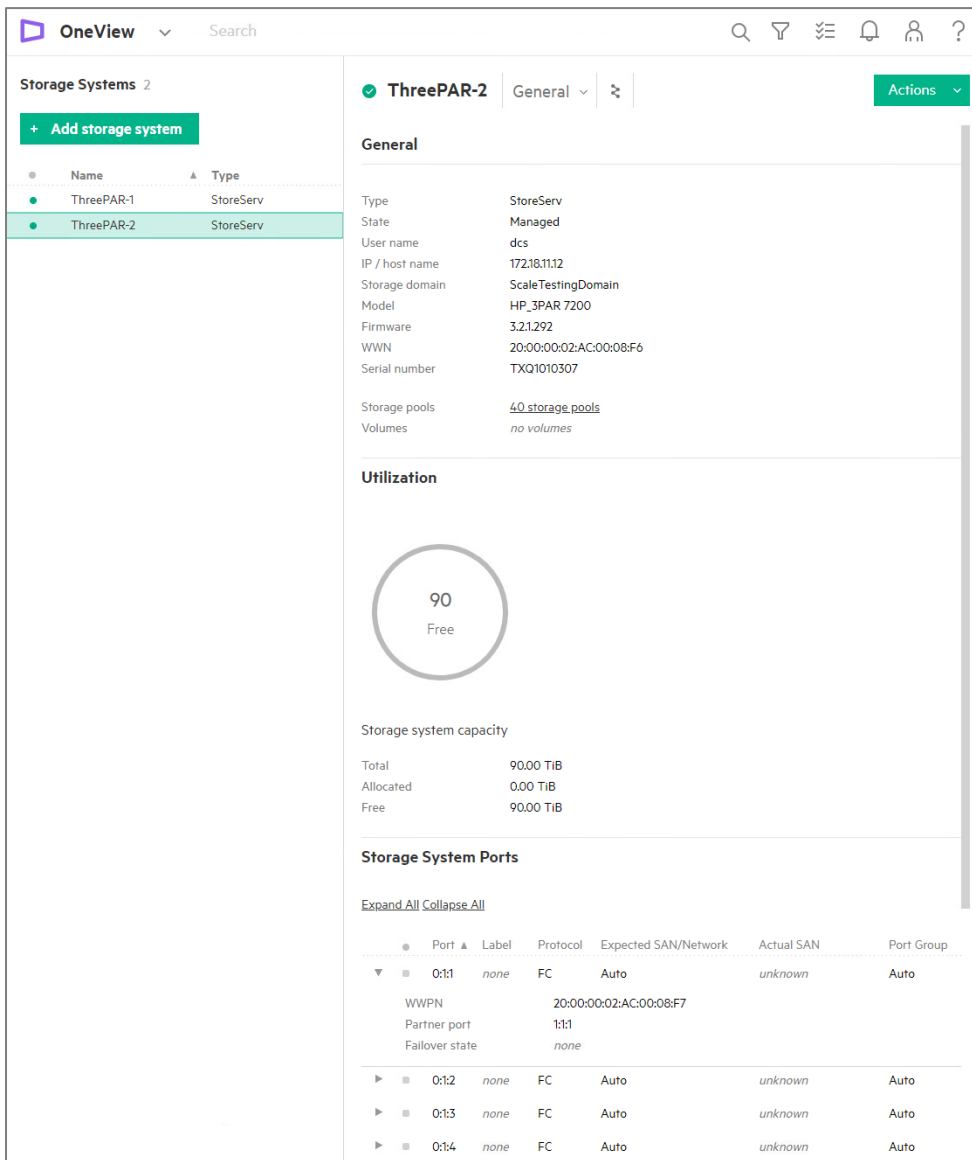


FIGURE 19. Storage system monitoring data collection example



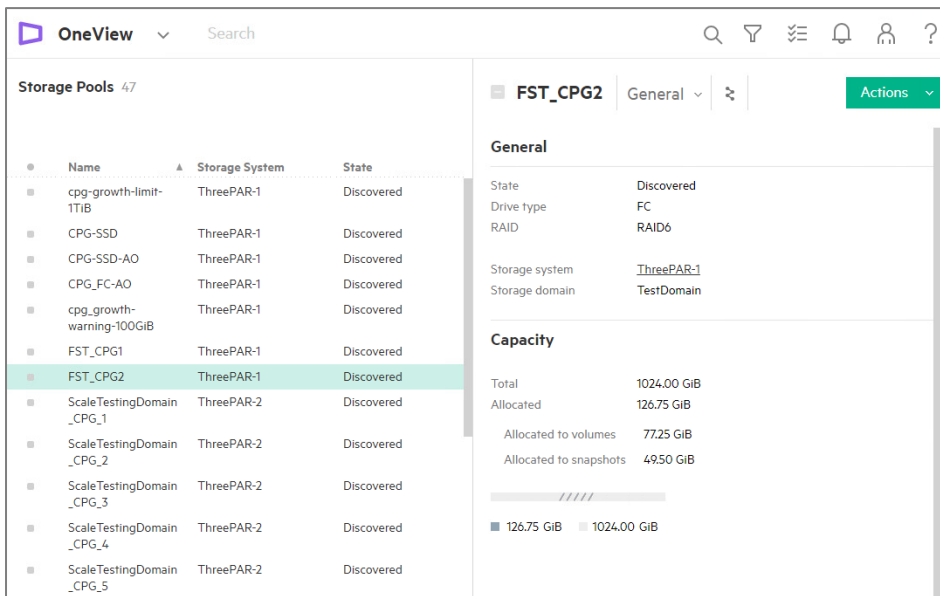


FIGURE 20. Storage pools details

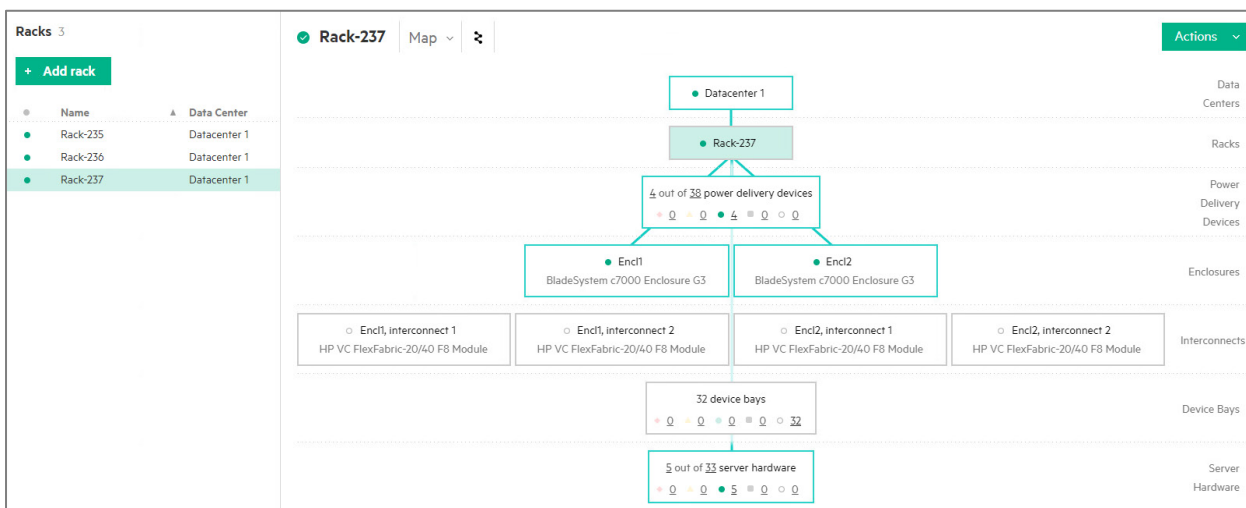


FIGURE 21. Map view of the relationship of monitored devices

Monitoring summary

HPE OneView monitoring gathers content from servers, storage, networks, hypervisors, enclosures, power systems, and cooling systems to provide a consolidated data center presentation. This is accomplished with an HPE OneView standard licenses that is provided at no additional charge with the purchase of supported HPE servers.

HPE OneView infrastructure monitoring is implemented using advanced security controls to gather content from the SCMB, SNMP traps, and specific infrastructure management systems. Monitored content consists of hardware inventory, current state information, and events to provide a current status of your infrastructure.

The monitored content is made available for consumption via the HPE OneView REST API. The HPE OneView GUI consumes the API content and organizes it for presentation in a format that is easy for end users to navigate and understand.



INFRASTRUCTURE MANAGEMENT

HPE OneView, at its core, monitors supported hardware to provide a consolidated view of the data center infrastructure. With the HPE OneView advanced license, capabilities are added that, depending on the hardware, include management for:

- Maintenance of firmware, drivers, and patches
- BIOS, boot, and Unified Extensible Firmware Interface (UEFI) configurations
- iLO configuration
- Assignment of Media Access Control (MAC) addresses, World Wide Names (WWNs), and serial numbers
- Local RAID configuration
- Storage volume assignments
- SAN storage provisioning
- Network configuration and connectivity, including edge LAN and SAN connectivity

These management capabilities are automated through the creation of a software-defined abstraction of physical hardware into virtual constructs that can be grouped according to common attributes. Devices can be managed individually or like devices can be grouped together so they are maintained in a consistent manner. Depending on the device and how it is managed, HPE OneView allows for the grouping of physical devices and their software-defined constructs. Devices that will be maintained with the same configuration can have that configuration defined using a template.

The following table shows the HPE OneView management system’s relationship of devices to software-defined constructs and templates.

TABLE 1. Table of device physical, logical, grouping, and template relationships

Device	Physical common group	Software-defined construct	Logical common group	Configuration template
Server Hardware	Server Hardware Type	Server Profile		Server Profile Template
Enclosure	Enclosure Type ¹	Logical Enclosure ¹	Enclosure Group ¹	
Interconnect ¹	Interconnect Type ¹	Logical Interconnect ¹	Logical Interconnect Group ¹	
Switch ²		Logical Switch ²		Logical Switch Group ²
Network	Network Sets			
Storage System ³	Storage Pool ³	(Storage) Volume ³	Volume Set ³	Volume Template ³

¹ When an enclosure is added, interconnects are added automatically in a monitored state. In addition, with an advanced license, when an enclosure is added, the following automatically occurs:

- A logical enclosure is created
- The enclosure type is defined which can be seen in the map view
- A logical interconnect is created containing the enclosure interconnects
- For each interconnect port, a port type is identified as uplink, downlink, or stacking links and is used to segregate port information in the interconnect and logical interconnect views
- A logical interconnect group is defined
- Interconnects are moved to a managed state
- An enclosure group is defined

As an alternative to just adding an enclosure from the enclosure view, when an airgap is desired between Ethernet networks, you can add enclosures from the Enclosures view by first creating your desired logical interconnect groups, then add an enclosure group containing the logical interconnect groups, and then specify the enclosure group when you add the enclosure.

² Up to two supported top-of-rack (ToR) switches are discovered automatically. To bring the switches under management, a template for a logical switch, known as a logical switch group, must first be created and then a logical switch can be created for the two switches. The logical switch defines a high availability ToR switch.

³ Storage pools are defined using the HPE StoreServ, HPE StoreVirtual, or HPE Nimble Storage management software and they are added automatically to HPE OneView when the storage system connection is added. Storage Volumes can be created in HPE OneView to represent a logical disk. The Volume Set is used to govern common data protection policies. At the time of this document, volume sets are only available with Nimble integrations and they are defined in Nimble as “data protection volume collections”. A storage Volume Template is a standard configuration used to create and maintain storage volumes.



Transform with software-defined constructs

HPE OneView's software-defined logical constructs provide an innovative way to manage your data center resources. They include profiles, templates, and groups that let you specify and control the desired configuration of your environment. Best practices of your compute, storage, networking, and operating system experts can be captured and used to automate the transformation of your infrastructure to your desired configuration.

HPE OneView keeps your best-practice approaches intact as you grow, but it still allows for customization, so you maintain ultimate control. Groups and templates enable you to define configurations that are specific to the environment you want to build, such as VMware vSphere® virtual hosts, container hosts, or web servers. They provide flexibility to simplify changes across your data center while preserving change management controls. This facilitates faster provisioning, greater consistency, and fewer errors.

Server profiles make it easier to prepare bare-metal servers for operating system deployments by defining and configuring the entire desired configuration, including firmware, BIOS settings, local storage configurations, SAN storage, and network connectivity. In blade systems, logical enclosures enhance this capability. The following diagram summarizes some of the most frequently used resources and shows their relationships.

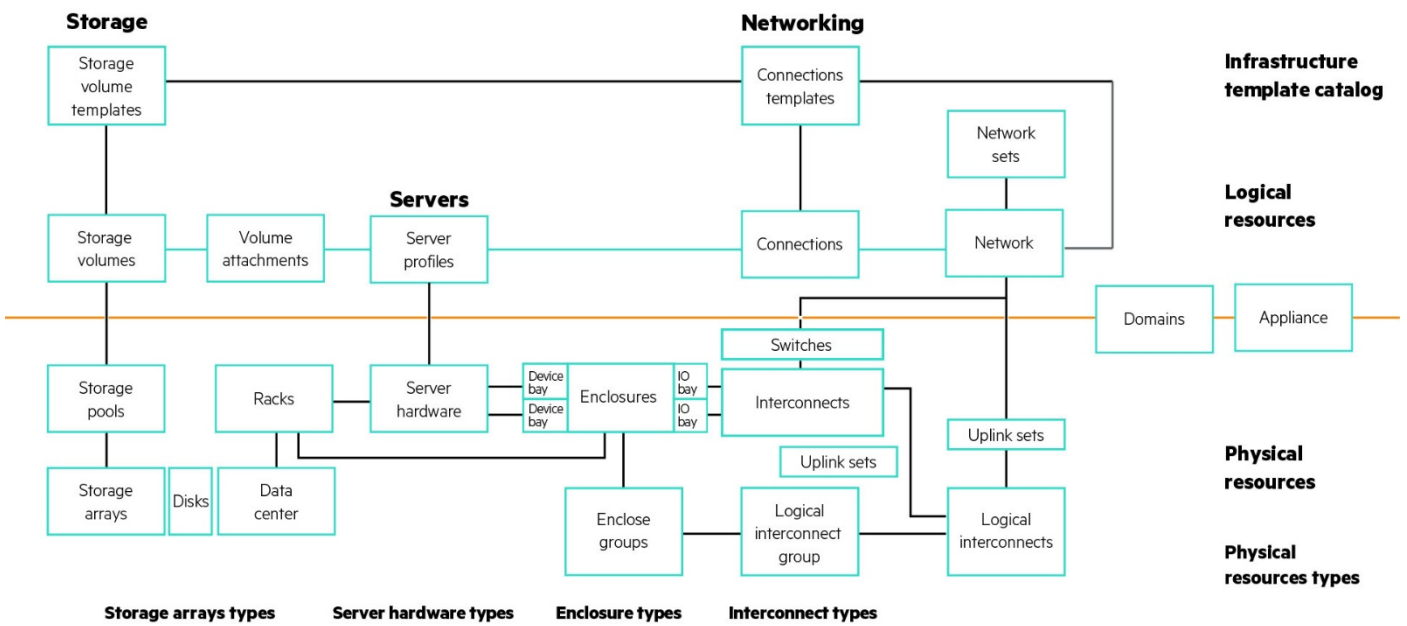


FIGURE 22. Resource model summary diagram

HPE OneView managed servers are made available as raw hardware in a pool awaiting configuration. A server profile is allocated to the server in a one-to-one relationship to define the server configuration. A server profile template can be created for a one-to-many relationship to facilitate using the same server profile configuration for multiple servers. A server profile template supports dynamic reconfiguration of hardware while preserving the simplicity of provisioning a new server just like the last one. It guarantees the server will successfully deploy to the allocated hardware based on deep knowledge of the server hardware type.

The following images in Figure 23 shows an example of the configuration details in a server profile. A server profile template can be created from the server profile to capture this configuration for use with additional servers. From the server profile template, server profiles can be created for additional servers. During the server profile creation process, customizations can be done for the specific server.



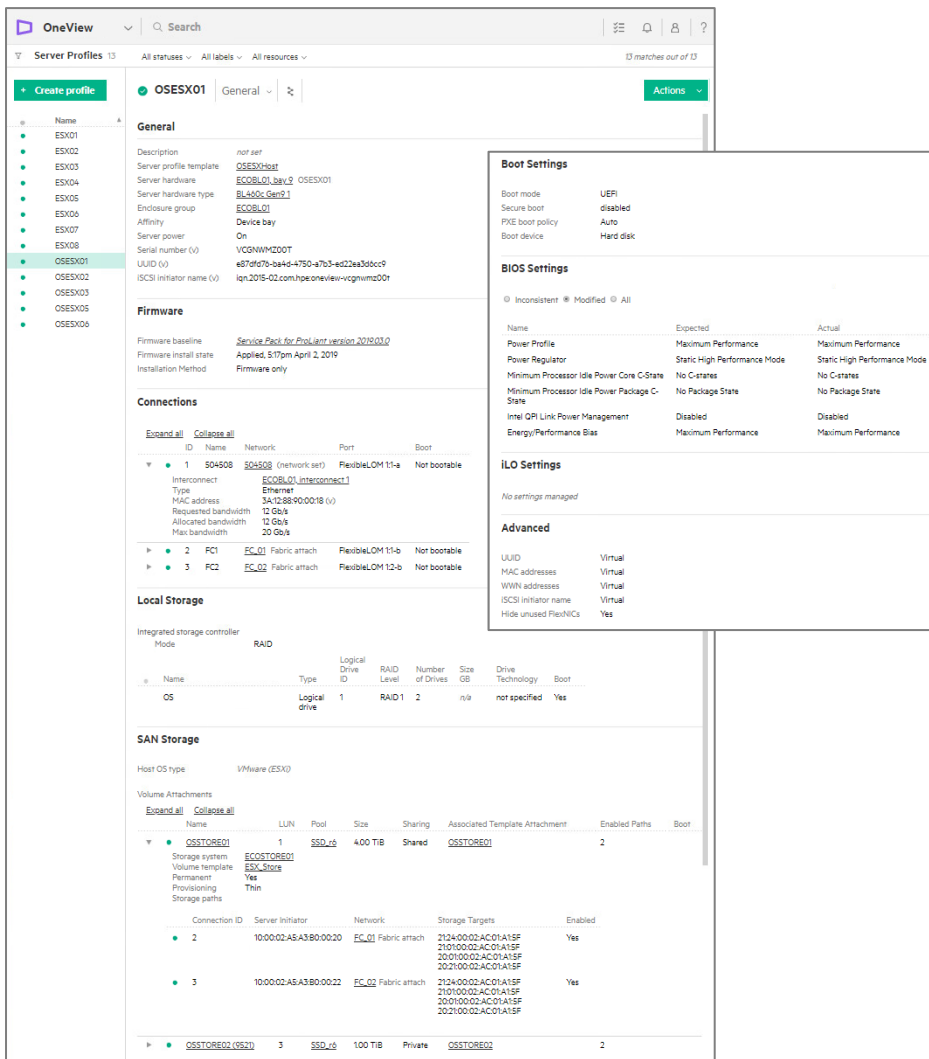


FIGURE 23. Example of configuration details captured in Server Profiles and Server Profile Templates. The configuration details continue with insert superimposed to the right

Cluster management

Data centers may appear to be a collection of individual servers, storage, and networking; but in reality, these components are often grouped together as clusters for the workloads they serve. HPE OneView can import and manage vSphere clusters as one entity, taking advantage of the template-based provisioning that is core to HPE OneView. With the HPE OneView cluster profiles capability, you can deploy, update, and automate configuration changes for clusters.

HPE OneView rolling cluster updates allow users to automate cluster updates and eliminate downtime by keeping the workload online with available VMs while other servers are updated. HPE OneView online BIOS and firmware updates apply the profile to the server while it is online, with zero downtime and a reduced risk of error using an automated process. If the updates require a server reboot, the updates are applied via the profile when the server is rebooted during the next maintenance window.

Resource relationships and map view

The resource model in HPE OneView tracks the relationships between resources. It generates a map view that replaces static diagrams with dynamic interactive visualizations. The map view allows you to examine the configuration and understand the relationships between logical and physical resources in your data center. Map view gives you immediate visibility into your resources from the individual Ethernet and Fibre Channel networks all the way up to the enclosure, rack, and top-level physical data center. You can instantly see the big picture and what may be affecting the resource you're evaluating.

An added benefit of map view is that it helps minimize user errors caused by changing resources without understanding all the associations and potential impact. For example, HPE OneView automatically synchronizes physical and virtual networks as well as servers and associated SAN storage volumes. It can identify network connectivity issues (Layer 2) and notify the user of a potential problem if they plan to make a



change to the network that will have a negative impact. Also, it will warn the end user if they plan to delete storage volumes currently in use by servers in the environment.

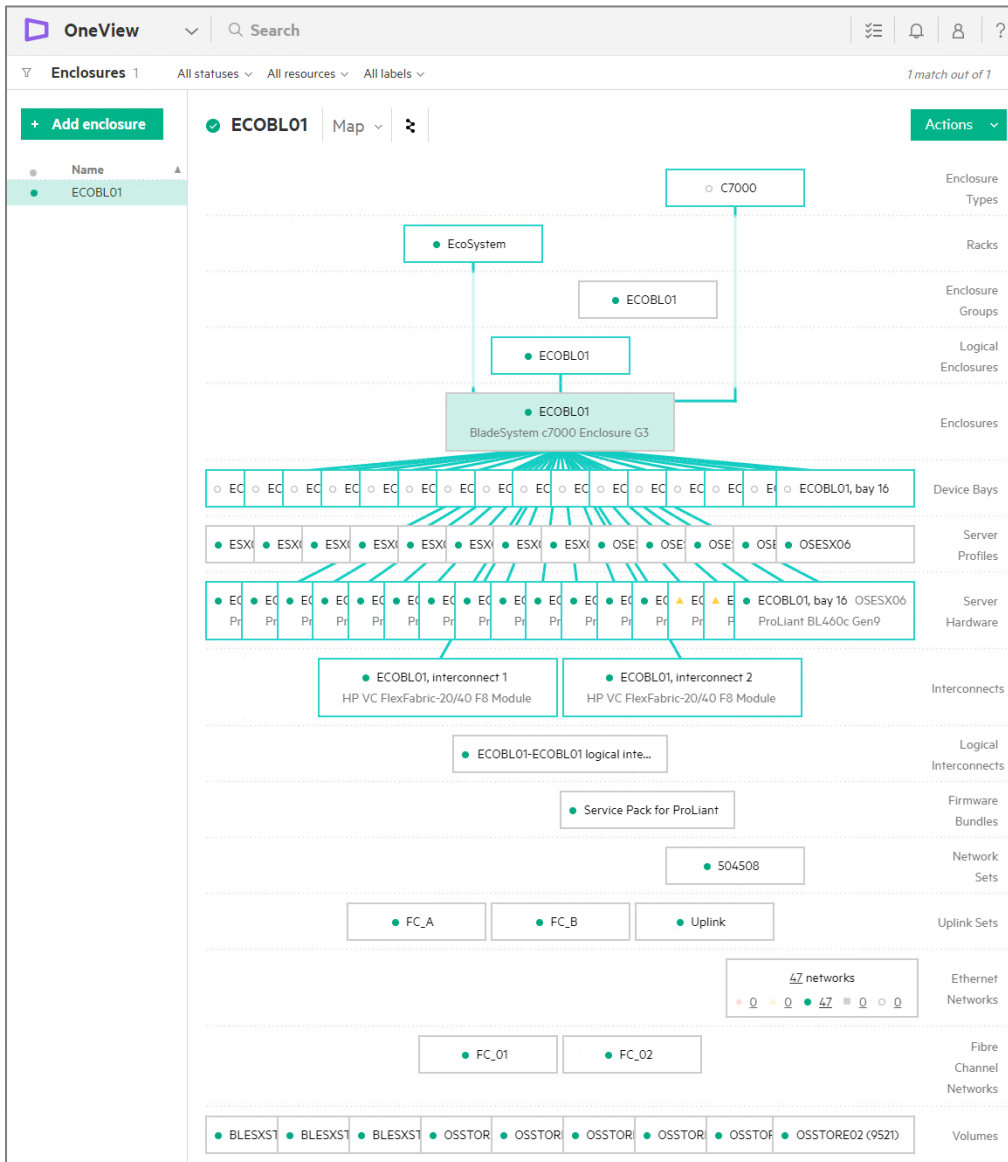


FIGURE 24. Interactive map view showing the relationships of physical and logical resources

Expanding interoperability to a broader range of devices

HPE OneView is an infrastructure management platform that was architected to provide support for a wide range of devices from HPE and third parties. This allows organizations to preserve their investment in existing systems and operational processes while incorporating new technologies into their environment. Also, it reduces the risk of vendor lock-in by providing greater choice. The adaptability of HPE OneView is demonstrated by support for multiple types and generations of products. There is a long list of supported devices in the latest support matrix at hpe.com/info/oneview/docs.

The support for the Cisco Nexus ToR switch is an example of the interoperability of the HPE OneView architecture to support heterogeneous environments. This support includes the ToR switch associated with interconnects, specifically the Cisco Fabric Extender (FEX) for HPE BladeSystem modules within an enclosure. Cisco FEX information is obtained from the Onboard Administrator (OA) and relationships to the ToR Nexus 5000 or 6000 Switch Series are displayed in the HPE OneView map view. HPE OneView supports multiple devices from third-party vendors; including Brocade, Cisco, Emulex, and QLogic.

As another example of interoperability is when you bring a new enclosure or rack of equipment online, HPE OneView automatically generates notifications to management tools that are registered as listeners on the message bus. An example of such a listener is the



HPE Intelligent Management Center (IMC) that manages data center switches. IMC can be used to configure the adjacent Ethernet switch ports with the appropriate Virtual Local Area Networks (VLANs) with Link Aggregation Control Protocol (LACP) aggregates. This and other integrations provide users with the advantage of managing their environment from a familiar console while taking advantage of the automation and the capabilities of infrastructure lifecycle management in HPE OneView.

Firmware compliance

A critical requirement for infrastructure management is to maintain firmware, driver, and patch updates. HPE OneView monitors servers and enclosures to provide a consolidated list of their firmware and driver version details. In addition, HPE hardware is supported with regular packaged updates known as Service Pack for ProLiant (SPP) ISO image packages. These packages contain new component features, security patches, and other updates for the HPE hardware. HPE tests the updates and creates a recipe within the package for application of firmware components. These packages can be downloaded from HPE to a specific HPE OneView appliance or to an external firmware repository. Multiple versions of the SPP may be downloaded to HPE OneView to support different hardware generations and workloads.

The following image in Figure 25 shows HPE OneView managed firmware bundles, a description of the bundle, and the number of devices for which it is recommended.

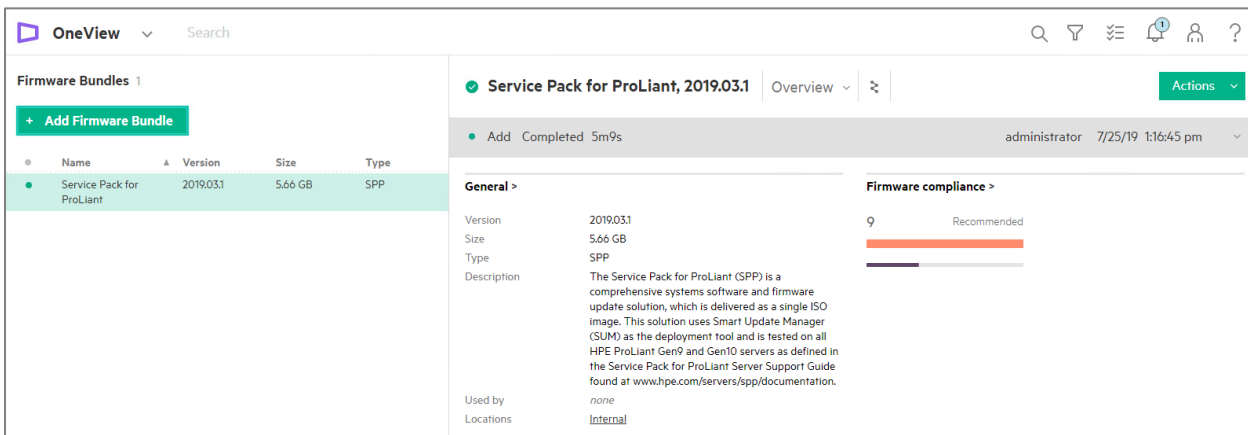


FIGURE 25. Firmware bundles in the firmware repositories

A downloaded SPP can be applied to a server profile or server profile template. This will result in identification in the server profile or server profile template of the changes that will result. All servers that correspond to the profile or template will initiate a warning event that they are out of sync with their profile. The SPP can be scheduled for automatic implementation or implemented manually when desired. An SPP applied from a server profile template will be implemented to all servers covered by the template.

The firmware compliance report can be accessed from the HPE OneView menu or by selecting “Firmware compliance” in the firmware bundle listing. This report, which covers all HPE enclosures and HPE Gen10 servers in the managed environment, details the devices that would benefit from the firmware bundles available in the HPE OneView repositories.



Firmware Compliance
9 matches out of 9

This view shows the firmware compliance for shared infrastructure and Gen10 server hardware which are not compliant with the firmware bundles available in the OneView repositories. This is generated by comparing the installed firmware versions of the resources with the versions included in the firmware bundles.

Hardware	Model	Logical Resource	Firmware Bundle	Update Category	Estimated Update Time																								
17218.31.3	ProLiant DL360 Gen10	none	Service Pack for ProLiant 2019.03.1	3 Recommended 2 Optional	39 min 40 sec																								
<table border="1"> <thead> <tr> <th>Update Category</th> <th>Name</th> <th>Installed</th> <th>Available</th> </tr> </thead> <tbody> <tr> <td>Optional</td> <td>HP FlexFabric 10Gb 2-port 536FLB Adapter Slot 1</td> <td>1.29</td> <td>Update to 7.17.71</td> </tr> <tr> <td>Optional</td> <td>Power Management Controller Firmware System Board</td> <td>1.0.2</td> <td>Update to 1.0.4</td> </tr> <tr> <td>Recommended</td> <td>System BIOS - U32 System Board</td> <td>U32 v1.22 (09/29/2017)</td> <td>Update to v2.04 (04/18/2019)</td> </tr> <tr> <td>Recommended</td> <td>iLO 5 System Board</td> <td>1.20 (06/18/2018)</td> <td>Update to 1.40</td> </tr> <tr> <td>Recommended</td> <td>StorageDiskDrive Port 1 Box 3 Bay 1</td> <td>HPD8</td> <td>Update to HPD9</td> </tr> </tbody> </table>						Update Category	Name	Installed	Available	Optional	HP FlexFabric 10Gb 2-port 536FLB Adapter Slot 1	1.29	Update to 7.17.71	Optional	Power Management Controller Firmware System Board	1.0.2	Update to 1.0.4	Recommended	System BIOS - U32 System Board	U32 v1.22 (09/29/2017)	Update to v2.04 (04/18/2019)	Recommended	iLO 5 System Board	1.20 (06/18/2018)	Update to 1.40	Recommended	StorageDiskDrive Port 1 Box 3 Bay 1	HPD8	Update to HPD9
Update Category	Name	Installed	Available																										
Optional	HP FlexFabric 10Gb 2-port 536FLB Adapter Slot 1	1.29	Update to 7.17.71																										
Optional	Power Management Controller Firmware System Board	1.0.2	Update to 1.0.4																										
Recommended	System BIOS - U32 System Board	U32 v1.22 (09/29/2017)	Update to v2.04 (04/18/2019)																										
Recommended	iLO 5 System Board	1.20 (06/18/2018)	Update to 1.40																										
Recommended	StorageDiskDrive Port 1 Box 3 Bay 1	HPD8	Update to HPD9																										
Encl1_bay_3	ProLiant BL460c Gen10	none	Service Pack for ProLiant 2019.03.1	3 Recommended 2 Optional	39 min 40 sec																								
Encl1_bay_4	ProLiant BL460c Gen10	none	Service Pack for ProLiant 2019.03.1	3 Recommended 2 Optional	39 min 40 sec																								
Encl1	BladeSystem c7000 Enclosure G3	none	Service Pack for ProLiant 2019.03.1	1 Recommended	18 min 20 sec																								
Encl2	BladeSystem c7000 Enclosure G3	none	Service Pack for ProLiant 2019.03.1	1 Recommended	18 min 20 sec																								
Encl1_interconnect_1	HP VC FlexFabric-20/40 F8 Module	none	Service Pack for ProLiant 2019.03.1	1 Recommended	10 min																								
Encl2_interconnect_2	HP VC FlexFabric-20/40 F8 Module	none	Service Pack for ProLiant 2019.03.1	1 Recommended	10 min																								
Encl1_interconnect_2	HP VC FlexFabric-20/40 F8 Module	none	Service Pack for ProLiant 2019.03.1	1 Recommended	10 min																								
Encl2_interconnect_1	HP VC FlexFabric-20/40 F8 Module	none	Service Pack for ProLiant 2019.03.1	1 Recommended	10 min																								

FIGURE 26. Firmware compliance report for HPE enclosures and Gen10 servers

External firmware repository

In addition to the HPE OneView appliance internal firmware repository, HPE OneView allows for a user-maintained external HTTP/HTTPS web server firmware repository. Microsoft Internet Information Services (IIS) is used to create a virtual directory that is mapped to a physical directory on a local or remote server. Secure HTTPS communication with the virtual directory is established via the server certificate and user credentials specified in the HPE OneView configuration screen. External firmware repository configuration details are provided in the “HPE OneView User Guide”. An external firmware repository is added for HPE OneView access using a simple add repository form.

Add Repository

General

Name

Webservice address

Credentials

Requires authentication

Username

Password

FIGURE 27. Adding an external firmware repository



Infrastructure management summary

HPE OneView management creates software-defined constructs for the managed devices that are grouped so similar devices can be managed in a consistent way. Templates enable consistent device configurations for specific workloads and for the devices to be updated and maintained consistently. With HPE OneView's cluster awareness, you have the added satisfaction that your device changes won't break your hardware clusters. This results in streamlined IT operations that are automated, efficient, and easier to maintain.

With HPE OneView's knowledge of the inter-relationships of managed devices, interactive maps can be generated that illustrate the relationship between physical and logical devices. The maps are a valuable visual aid to help understand the impact a change made to one device may have on other devices or to understand the root cause of an issue.

Firmware management is critical for successful maintenance of IT infrastructure and HPE OneView offers a number of advantages. Internal and external firmware repositories make firmware packages available for the managed resources. Firmware compliance reports and firmware exception alerts make it easy to identify devices requiring attention. And with software-defined constructs and templates, it is easy to maintain firmware in a desired state.

COMPOSE FOR ANY WORKLOAD

HPE composability with HPE OneView takes infrastructure management to the next level. With composability, you manage your infrastructure as a dynamic fluid pool of compute, storage, and fabric resources that can dynamically self-assemble to meet the needs of an application or workload. These resources are defined in software and controlled programmatically through a unified API, thereby transforming physical infrastructure into code that is optimized to the needs of the application. Effectively, physical infrastructure becomes code.

You can compose and deploy fully configured bare-metal servers on demand with their associated BIOS settings, networking, and storage. In some cases, as you will see in this section, you can even deploy the infrastructure with operating system and workloads installed and configured.

Composability is about making your life easier when you need to deploy multiple instances of bare-metal servers with similar workload and infrastructure configuration requirements. Examples of where this applies are when you:

- Have changing business demands and perhaps need to spin up more servers to support a sales campaign or some other event
- Have workloads you need to run at night that are different than what you run in the day, but you want to use the same servers and infrastructure for those workloads
- Need multiple instances of a configuration for development, testing, or diagnostics

Due to the resource integration and automation requirements necessary for composability, specific hardware is required. At the time of this document, HPE has two different supported sets of hardware, one for rack systems and the other for blade systems. This section will describe the hardware requirements for each and how composability works with that hardware.

HPE Synergy Composability

HPE Synergy is a rack mounted blade system enclosure, referred to as a frame, designed to enable composability.

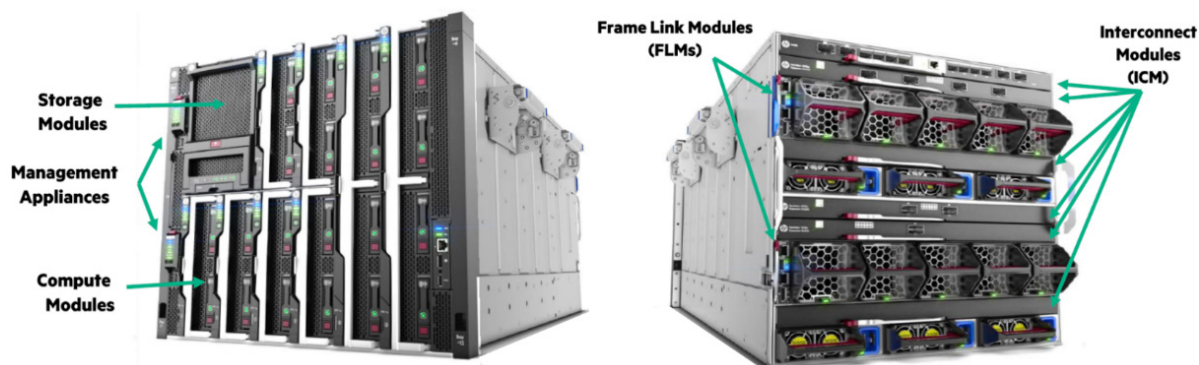


FIGURE 28. Front and rear views of the HPE Synergy frame



The HPE Synergy 10U frame has these components:

- Up to 12 blade bays for HPE Synergy compute modules
 - Optional HPE Synergy 12Gb SAS storage modules can occupy the space of two blade bays and can host up to 40 SFF drives
- 6 interconnect module bays for 3 redundant interconnects
 - Interconnect options exist for SAS storage modules, Ethernet, iSCSI, and Fibre Channel
- 2 management appliance bays for HPE Synergy Composer or Image Streamer modules
 - Composer is a dedicated HPE OneView server with a repository for storing configuration data, patches, and firmware
 - Image Streamer is a dedicated server hosting an optional extension to HPE OneView that is covered later in this document
- 2 frame link module slots for a private air-gapped management network link for up to 21 frames
- 6 bays for power supplies plus 10 bays for fans

Just like the rack systems, HPE Synergy requires a specific set of hardware to facilitate the fluid pool of composable resources. With HPE Synergy, the interconnect modules become your composable network fabric and local storage composability is extended with the optional storage module.

With HPE Synergy, HPE OneView is included with the advanced license as a dedicated management appliance server called the Composer. As a dedicated appliance, the latest Composer releases are able to provide additional security features like:

- Data-at-rest encryption for sensitive HPE OneView data on its internal hard drive with the encryption key is stored off-disk in the Composer's secure NVRAM
- Embedded silicon root of trust to ensure the appliance firmware has not been compromised
- Secure boot that validates the integrity and authenticity of the boot loader, OS kernel, and OS drivers

A significant advantage of the HPE Synergy architecture is the ability to use end-of-row switches instead of traditional top-of-rack switches. The interconnect modules support up to five frames connected together for a single logical interconnect. This logical interconnect, with up to 60 compute modules, often spans more than one rack. Each logical interconnect connects to a pair of end-of-row switches or, in smaller data centers, to aggregation switches or spine switches. The result is significantly fewer switches are required for your data center.

With this architecture, a private VMware vSAN™ network can be used internally within the logical enclosure that provides up to 240 Gb east-west traffic. It can also be externally exposed to the end-of-row switches to extend the cluster beyond a single logical enclosure. Utilizing an internal-only vSAN network eliminates the need for data center-wide Jumbo Frame enablement on all ToR and core switches since Jumbo Frames are natively enabled with the HPE Synergy fabric. If the environment requires that vSAN cluster nodes participate with nodes beyond an HPE Synergy logical enclosure, then it is necessary to define the vSAN network on an HPE Synergy logical interconnect group uplink set to enable vSAN traffic to participate in the data center network. Scaling beyond a single logical enclosure can also be accomplished using VMware® Stretched Clusters without plumbing the vSAN network externally.

Workload composing

With HPE Synergy Composer's on-demand composing of bare-metal servers with their storage and networking infrastructure, the next logical request is to extend composing to the OS. HPE Synergy Image Streamer provides server composing with configured OS, drivers, applets, and in some cases even applications.

HPE Synergy Image Streamer composability is all about hosting workloads on demand, whether they be traditional workloads or cloud-native workloads. With Image Streamer, you can run CAD or VDI workloads like Microsoft Exchange, SharePoint, or Citrix® XenDesktop® during the day. Then, at night, switch to modeling and analytics workloads. During an end-of-the-month push, you may need to spin up additional mission critical database servers hosting SAP HANA®, Oracle, or Microsoft SQL Server. When the push is over, you may want to use the same compute resources for dev/test applications like Docker, Mesosphere, Chef, Puppet, Ansible, Terraform, or Red Hat OpenShift. The choice is yours to use the servers for what you need when you want.

HPE Synergy Image Streamer, like Composer, is a dedicated server hosting an optional extension to HPE OneView that orchestrates the on-demand deployment of a server image with a fully configured OS and applications. This allows the same server resources to be able to switch between workloads as needed to meet the demands of the business. This is accomplished by using the Composer to compose the required bare-metal servers and infrastructure and then using Image Streamer to provision the OS and workloads.



The process required to orchestrate workload composing on-demand is more complex than what was required to just compose servers and infrastructure. The on-demand workload composing process, at its simplest level, looks like this:

1. A server **Golden Image**, in a required state that includes the OS, is created and stored in the Image Streamer appliance.
2. A **Deployment Plan**, that includes orchestration scripts for deploying the Golden Image, is created and stored in the Image Streamer appliance.
3. A **Server Profile** software-defined abstract, that references the Deployment Plan, is created in the HPE Synergy Composer for a physical server.
4. When an action initiates the deployment of the Server Profile to the server, the Deployment Plan is initiated and the Golden Image is automatically configured and deployed to the server.

The HPE Synergy Composer will automatically compose the networking, storage, and BIOS settings you specify for each server where your Golden Image is deployed. Composer deploys the bare-metal policy, while Image Streamer then deploys a stateless OS that includes the necessary personalization (hostname, IP Addresses, security, and any other custom attributes you define). When you deploy the image to a server, HPE Image Streamer will create an OS Volume for that server and store it in the Image Streamer module.

With Image Streamer, the OS always boots directly from the Image Streamer module's Solid State Drive. Image Streamer is an iSCSI Boot-from-SAN solution where the boot volume is stored on the Image Streamer appliances, instead of more complex and expensive Fibre Channel or Fibre Channel over Ethernet solutions.

Key to workload composing is the concept of a stateless server architecture. The following diagram in Figure 29 illustrates the HPE Synergy Image Streamer integration with compute and storage. The primary focus of this diagram is where content is stored with a stateless architecture.

The Image Streamer modules contain the required applications, storage, and other components necessary to compose and manage the OS Volumes for Compute Modules. When an OS Volume that is assigned to a specific compute module, personalization information is added such as hostname and IP address. The Compute Modules remain stateless since the state-defining content is hosted separately in the OS Volume in the Image Streamer Module.

If desired, when the Server Profile defines the OS Volume personalization, it can also define the storage that is assigned to the Compute Module. The storage may be HPE Synergy storage module drives or it may be external NAS or SAN storage. The storage device is where your application data is stored.

The compute modules remain stateless since they contain no permanent content. They can be used for one application by day, a different by night, and a third for end-of-month reports. Merely compose the OS Volume via the Server Profile for workload desired. Data files are persistent provided that storage wasn't used for something else during the interim.

STATELESS ARCHITECTURE EXAMPLE

HPE Synergy Composer Management Network and other networking details are not illustrated

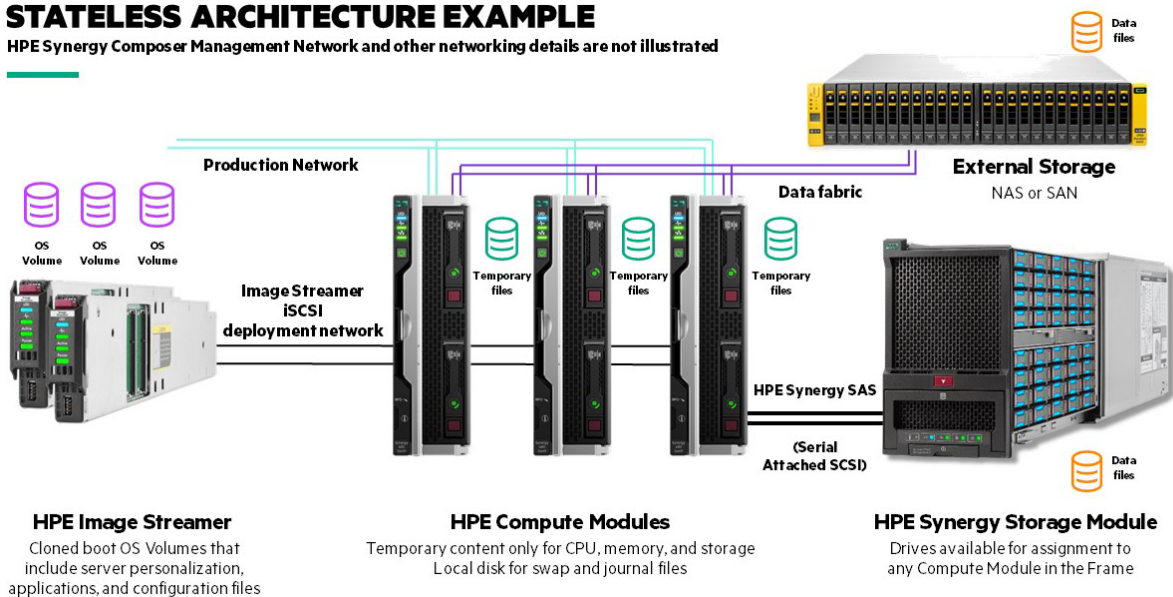


FIGURE 29. HPE Synergy Image Streamer stateless server architecture



In general, and in accordance with the HPE provided Reference Architectures and Reference Configurations, the application is installed and configured along with the OS. When application customization is required at the time of deployment, Plan Scripts that are referenced by the Server Profile can be used to define the customizations as part of the OS Volume personalization.

Composing summary

HPE OneView infrastructure composing for bare-metal server deployments is available for specific hardware configurations. Infrastructure composing allows for predefined configurations to be deployed on demand utilizing whatever acceptable server, storage, and networking infrastructure is available when it is needed for the deployment. The infrastructure components are selected from the fluid pool of resources.

HPE ONEVIEW GLOBAL DASHBOARD

HPE OneView was developed with an architecture designed for high availability, scalability, and good performance while still making it easy to deploy and use. To expedite setup and implementation, HPE OneView is deployed as a ready to run software appliance hosted in a VMware ESXi™, Microsoft Hyper-V, or KVM environment. It is intended for local environments and has restricted capabilities if managing across a WAN. With HPE Synergy systems, HPE OneView is supplied as the HPE Synergy Composer hardware appliance for up to 21 local HPE Synergy frames. For customers with large environments, distributed environments, or environments with a combination of HPE Synergy and other servers, multiple HPE OneView appliances can be aggregated for monitoring in a “single pane of glass” using HPE OneView Global Dashboard.

HPE OneView Global Dashboard is delivered as an additional virtual appliance that provides a web interface to unify HPE OneView appliances along with other monitored servers. HPE OneView Global Dashboard provides:

- Simple import of HPE OneView management appliances to support up to:
 - 75 HPE OneView appliances or HPE Synergy Composers
 - 150 HPE HC380 systems
 - 25 HPE SimpliVity systems
 - or a mix of the above

Other limitations likely apply when approaching these limits. For details, please see the [HPE Global Dashboard](#) and [HPE OneView](#) documentation.

- A consolidated dashboard with links to HPE OneView managed enclosures and frames, systems, and profiles
- Flexible access through the GUI or the REST API
 - Optional two-factor user authentication and FIPS compliance
- Enclosure or system summary data and in-context, single sign-on, launch to managed systems, enclosures, and their embedded management controllers (e.g., Onboard Administrator [OA] and integrated Lights Out [iLO])
- Reports that provide details on:
 - Resource inventory, health, availability, utilization, firmware, and firmware baseline compliance
 - Remote support status for hardware and service events
 - SPP bundle availability and utilization
 - Virtual ID conflicts
 - HPE OneView license assignment
 - Contract and warranty status
- Ability to schedule and email reports to users, administrators, and managers
- Unified view of activities and alerts logged with all HPE Synergy Composers and HPE OneView virtual appliances
- Unified view of basic inventory data
- Search bar that enables rapid search for managed devices, device attributes, and/or activities/alerts by name or other criteria across all infrastructure monitored or managed by HPE OneView



As a result, end users no longer need to understand which systems are managed by which HPE OneView management appliance. Now they can consolidate management of data from multiple management appliances into one or multiple HPE OneView Global Dashboard instances.

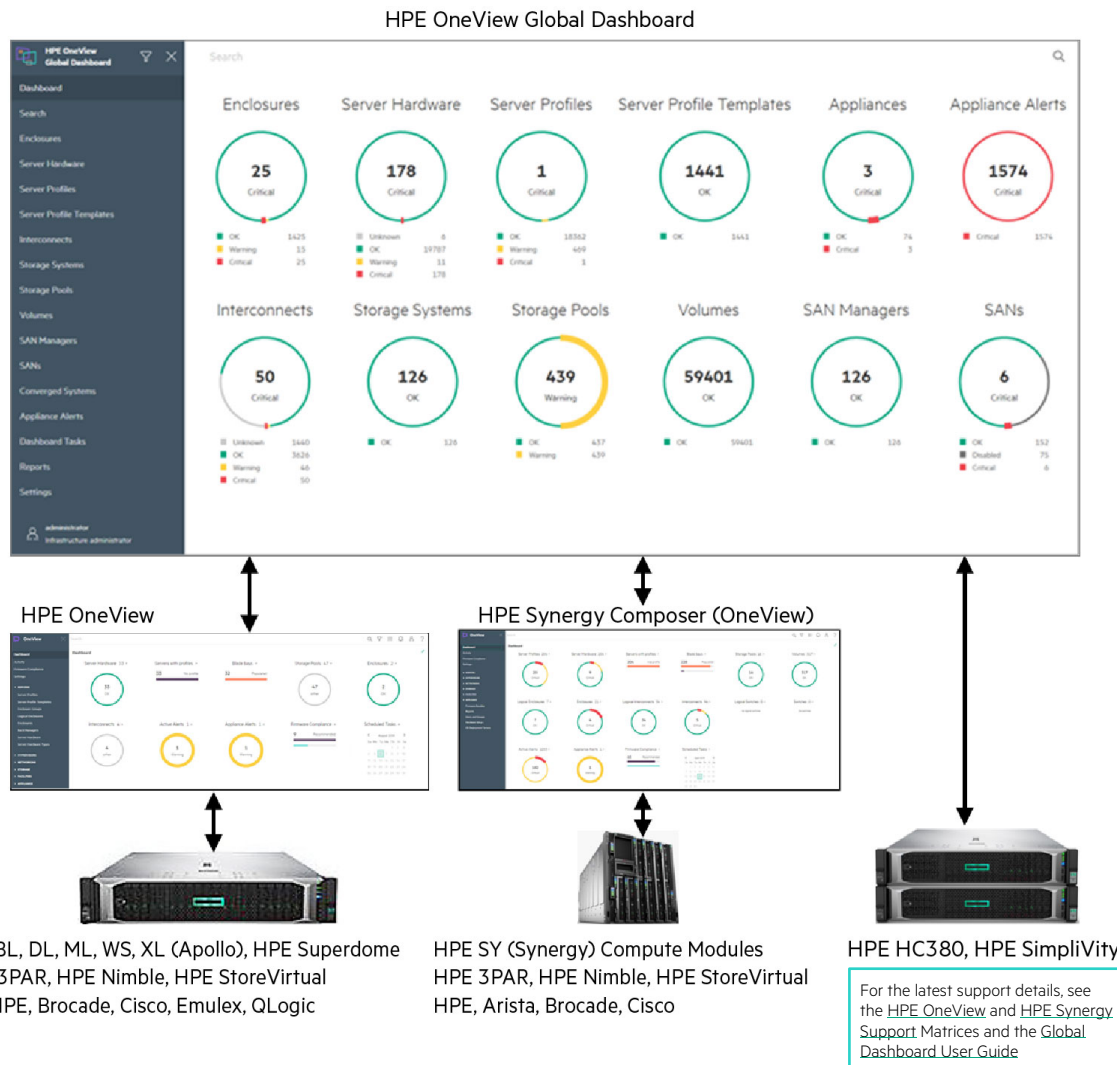


FIGURE 30. HPE OneView Global Dashboard enterprise-wide resource consolidation

Global Dashboard summary

HPE OneView Global Dashboard aggregates multiple instances of the HPE OneView management appliances into a single-pain-of-glass for a unified view and consolidated reporting of your global infrastructure. Alerts propagate up from the HPE OneView appliances to Global Dashboard where they can be viewed and acted on through context sensitive drilldown to the source management appliance. This unified view of your HPE OneView managed infrastructure facilitates a better understanding of your IT environment and where attention may be required to avoid future problems.

CONCLUSION

HPE OneView is a secure IT monitoring and management appliance that is designed to scale from a data center with a few servers to a global operation with multiple data centers, remote sites, and thousands of servers. HPE OneView will be around for the long-term with support for your legacy systems and at the same time for cutting edge technologies like composable, hyper-converged, and cloud. HPE OneView's regular product enhancement releases ensures it continues as a platform for the future. This platform is further enhanced with a robust and active partner ecosystem that supports integrations with partner management tools and technologies. You can rest comfortable knowing that your HPE OneView software-defined data center investment is secure as the HPE OneView capabilities continue to expand to incorporate the latest technologies.

Resources

- [HPE Glossary](#)



HPE OneView resources

- [HPE Software-Defined Infrastructure home page](#)
- [HPE Software-Defined Infrastructure Community home page](#)
- [Shifting to Software-Defined blog](#)
- [HPE Integrated Lights Out home page](#)
- [HPE Video Gallery](#)
 - Search on “oneview”, “synergy”, “image streamer”, or whatever you wish
- [HPE Demonstration Portal home page](#)
 - Contains live demos, documents, and recorded demos
 - Search on “oneview”, “synergy”, “image streamer”, or whatever you wish
- [HPE OneView home page](#)
- [HPE OneView Discussion Board](#)
- [HPE OneView Information Library documentation](#)
- [HPE OneView Trial](#) (appliance download 60-day advanced license)
- [HPE OneView downloads](#)
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 - [HPE software licensing page](#)
 - [HPE privacy statement](#)
- [HPE Developer site home page](#)
- [HPE OneView Developer Hub](#)
- [HPE OneView Slack channel](#)
- RabbitMQ message broker: [RabbitMQ](#), [Features](#), and [Libraries](#)
- Advanced Messaging Queuing Protocol: [AMQP](#)

HPE Composable resources

- [HPE Composable Infrastructure home page](#)
- [HPE Composable Ecosystem Partners](#)
- [HPE Synergy home page](#)
- [HPE Synergy Information Library documentation](#)
- [HPE Synergy Discussion Board](#)
- [HPE Synergy Image Streamer Blog](#)
- [HPE Synergy Image Streamer Information Library documentation](#)
- [HPE Synergy Image Streamer Community Project](#)
- [HPE Synergy Image Streamer GitHub repository for Image Streamer tools and artifact bundles](#)

HPE OneView Global Dashboard resources

- [HPE OneView Global Dashboard home page](#)
- [HPE OneView Global Dashboard Information Library documentation](#)



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