Deployment Considerations for HPE Nimble Storage and HPE Synergy with HPE InfoSight
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Support

All documentation and knowledge base articles are available on HPE InfoSight at https://infosight.hpe.com.

To register for HPE InfoSight, click the Create Account link on the main page.

Email: support@nimblestorage.com

For all other general support contact information, go to https://www.nimblestorage.com/customer-support/.
Executive Summary

The solution described in this guide delivers a scalable infrastructure platform that is designed, tested, and documented by Hewlett Packard Enterprise (HPE) to address the business requirements, workloads, and applications required by our customers. It incorporates a wide range of technologies and products into a portfolio of repeatable, scalable, composable, and supportable solutions that are supported by HPE.

The guide describes an architecture that combines industry-leading HPE Synergy 480 Gen10 Compute Modules with HPE Nimble Storage arrays and Mellanox switches to reliably deploy and run a virtualized infrastructure.

HPE Synergy combines storage, compute, and network equipment in one chassis, along with management software that can quickly configure the hardware automatically to provide just the resources needed to run an application. Its unique built-in software intelligence, autodiscovery capabilities, and fluid resource pools enable customers to instantly boot up infrastructure ready to run physical, virtual, and containerized applications.

The solution also harnesses the power of HPE InfoSight to constantly watch over your environment and predict problems, even those outside of storage. When HPE InfoSight uncovers an issue, it proactively resolves it and prevents other systems deployed globally from experiencing the same problem. HPE InfoSight predictive analytics paves the way for autonomous infrastructure, predicting and preventing problems before they can affect your business. HPE InfoSight has fundamentally transformed the way infrastructure is managed and supported. One of its key features is Cross-Stack Analytics for VMware, which helps to identify and resolve performance bottlenecks in the virtualized environment and enables you to correlate performance issues based on a variety of insights into the hypervisor.

Customers can leverage this foundation to support a wide variety of enterprise workloads:

- Datacenter server consolidation or cloud solutions
- Business-critical applications such as Oracle, Microsoft, and SAP databases and applications
- Virtual desktop infrastructure (VDI) solutions such as those from Citrix and VMware Horizon
- Workforce-enablement applications such as Microsoft Exchange Server and SharePoint Server

The architecture is designed to provide a robust, scalable, high-performance, and high-availability solution. Customers can purchase and deploy this solution with the confidence that they are creating an excellent foundation for a wide variety of IT tasks within the enterprise.

Target Audience

The target audience for this deployment guide includes HPE Authorized Partner solution engineers, distributors, and value-added resellers. Readers can use this document to gain insight into the value proposition for the solution. It can help them better understand both the requirements of the solution's components and the recommended software and features that are part of it. Readers can leverage the design guidance to architect a solution to fit a particular set of business cases and to better understand design considerations related to fault tolerance, performance, and scalability when architecting the solution.

The solution is intended for midsize businesses, large enterprises, and IT service providers who are looking for and understand the value from the combination of consolidation, efficiency, and consistency enabled by the solution.

The solution configuration includes the following components:

- **Computing resources.** Industry-leading HPE Synergy Gen10 Compute Modules
- **Storage.** HPE Nimble Storage all-flash storage
- **Ethernet switches.** Mellanox SN2100
- **Hypervisor.** VMware vSphere 6.7

The testing described in this guide was performed in April 2018.
Solution Overview

The HPE Synergy and HPE Nimble Storage solution offers an infrastructure platform that incorporates compute, network, and storage best practices from HPE to deliver a resilient, scalable, and flexible datacenter architecture for enterprise and cloud deployments.

This solution encompasses the following components:

- HPE Synergy 480 Gen10 Compute Modules
- Storage provided by HPE Nimble Storage arrays
- Networking leveraged through Mellanox switches
- VMware ESXi and vSphere 6.7 for hypervisor and management

Figure 1: Components of the HPE Synergy and HPE Nimble Storage solution
Solution Components

HPE Synergy Infrastructure

HPE Synergy is a new category of infrastructure that bridges traditional and cloud native applications through the implementation of composable infrastructure. The HPE Synergy product line delivers a series of key architectural principles, which are described in the following sections.

Composable infrastructure starts with fluid resource pools. Composable pools of compute, storage, and fabric work as a single structure, ready to boot up for any workload. Such pools can also be instantly turned on and flexed to meet the needs of any business application. The fluid nature of this architecture effectively eliminates stranded resources by enabling administrators to build the environment in a way that disaggregates the underlying compute, storage, and fabric resources. In this context, disaggregation basically means that you are able to scale each resource individually. You are not forced to add resources that are not required in order to get the resources you need.

The HPE Synergy 12000 frame is the hardware foundation for the HPE composable vision. It provides a location in which compute, storage, fabric, and management are all aggregated. The HPE Synergy 12000 frame is optimized to include all elements required to run any workload. It includes embedded management, and it is designed to support a wide range of compute modules and storage options.

The back of the frame includes fabric interconnects, enabling flexibility with regard to storage and other interconnectivity needs. The frame is designed to be optimized for longevity. HPE has taken into consideration ongoing requirements for power, cooling, and bandwidth that might occur over the next decade. You will be able to protect your investment even as you go through multiple generations of compute, storage, and fabric resources.

In addition, as technology moves from copper connectivity to fiber optics, you will be able to upgrade your environment to leverage this paradigm shift. The frame is plumbed to allow you to increase bandwidth, from 10 to 25, 40, and 100 GbE and beyond.
HPE Synergy features two composable management components for administering workloads running in the environment: HPE Synergy Composer and the optional HPE Synergy Image Streamer. HPE Synergy Composer is used in this solution.

**HPE Synergy Composer**

HPE Synergy Composer, powered by HPE OneView, enables you to deploy, monitor, update, and manage infrastructure through its life cycle from a single interface. As the window into HPE Synergy, the Composer uses a template process to provision compute, storage, and fabric resources. The template enables infrastructure to be deployed and consistently updated with the right configuration parameters and firmware versions streamlining the delivery of IT services.
HPE Synergy Storage

For composable storage, HPE Synergy provides support for file, block, and object-based storage systems and supports a variety of both internal and external storage modules and arrays.

HPE Synergy Compute

HPE Synergy supports both two-socket and four-socket compute modules that provide the performance, scalability, density optimization, storage simplicity, and configuration flexibility to power a variety of workloads, including business processing, IT infrastructure, web infrastructure, collaborative, and high-performance computing.

This solution uses the HPE Synergy 480 Gen10 Compute Module.

Figure 4: HPE Synergy 480 Gen10 Compute Module
### Table 1: Technical specifications for the HPE Synergy 480 Gen10 Compute Module

<table>
<thead>
<tr>
<th>Component</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor number</td>
<td>1 or 2</td>
</tr>
<tr>
<td>Processor core available</td>
<td>28 or 26 or 24 or 18 or 16 or 14 or 12 or 10 or 8 or 6 or 4</td>
</tr>
<tr>
<td>Processor cache</td>
<td>38.5 MB, 35.75 MB, 33.00 MB, 30.25 MB, 27.5 MB, 24.75 MB, 22.0 MB, 19.25 MB, 16.5 MB, or 13.75 MB</td>
</tr>
<tr>
<td>Processor speed</td>
<td>3.6 GHz</td>
</tr>
<tr>
<td>Form factor chassis</td>
<td>Compute module</td>
</tr>
<tr>
<td>Power supply type</td>
<td>6, frame-based</td>
</tr>
<tr>
<td>Expansion slots</td>
<td>3, for detailed descriptions, reference the QuickSpecs</td>
</tr>
<tr>
<td>Maximum memory</td>
<td>1.5 TB</td>
</tr>
<tr>
<td>Memory slots</td>
<td>24 DIMM slots</td>
</tr>
<tr>
<td>Memory type</td>
<td>HPE DDR4-2666 smart memory or HPE DDR4-2666 NVDIMM memory available</td>
</tr>
<tr>
<td>Memory protective features</td>
<td>Advanced ECC</td>
</tr>
<tr>
<td></td>
<td>Memory mirroring mode</td>
</tr>
<tr>
<td></td>
<td>Memory online spare mode</td>
</tr>
<tr>
<td>Drive description</td>
<td>2 SFF SAS/SATA or 2 SFF NVMe (optional) or 2 M.2 SATA and 2 dual uFF, hot-plug, depending on model</td>
</tr>
<tr>
<td>System fan features</td>
<td>Frame-based</td>
</tr>
<tr>
<td>Network controller</td>
<td>Synergy 6810C 25/50 Gb converged network adapter (CNA) 2 ports per controller or</td>
</tr>
<tr>
<td></td>
<td>Synergy 3820C 10/20 Gb CNA or</td>
</tr>
<tr>
<td></td>
<td>Synergy 2820C 10 Gb CNA</td>
</tr>
<tr>
<td></td>
<td>There are more options. For all controller options, see the QuickSpecs.</td>
</tr>
<tr>
<td>Warranty</td>
<td>3/3/3 Server Warranty includes three years of parts, three years of labor, three years of onsite support coverage. Additional information regarding worldwide limited warranty and technical support is available at <a href="https://www.hpe.com">HPE Enterprise Support</a>. Additional Hewett Packard Enterprise support and service coverage for your product can be purchased locally. For information about availability of service upgrades and the cost for these service upgrades, refer to <a href="https://www.hpe.com">HPE Enterprise Support</a>.</td>
</tr>
</tbody>
</table>

### HPE Nimble Storage Arrays

The HPE Nimble Storage AF-Series array family starts at the entry level with the AF20Q model and expands through the AF20, AF40, and AF60 models up to the AF80 model at the high end. All-flash arrays can be upgraded nondisruptively from the entry level all the way up to the high-end array model. This is the next generation of the HPE Nimble Storage all-flash arrays, and it offers significant advances in key areas:
• **Storage.** The HPE Store More Guarantee lets you store more data per terabyte of flash storage than any other all-flash arrays.

• **Memory.** The arrays have storage-class memory and are nonvolatile memory express (NVMe) ready.

• **Performance.** The next-generation hardware delivers up to 200% better price-performance.

**Figure 5: The AF-Series array family**

![AF-Series array family](image)

**Table 2: AF-Series model transitions**

<table>
<thead>
<tr>
<th>Old Model</th>
<th>New Model</th>
<th>Effective Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>AF9000</td>
<td>AF80</td>
<td>Up to 4 PB</td>
</tr>
<tr>
<td>AF7000</td>
<td>AF60</td>
<td>Up to 2 PB</td>
</tr>
<tr>
<td>AF5000</td>
<td>AF40</td>
<td>Up to 682 TB</td>
</tr>
<tr>
<td>AF3000</td>
<td>AF20</td>
<td>Up to 168 TB</td>
</tr>
<tr>
<td>AF1000</td>
<td>AF20Q</td>
<td>Up to 128 TB</td>
</tr>
</tbody>
</table>

**Radical Simplicity**

Simplicity is one of the key benefits of the next-generation arrays:

• The arrays are simple to deploy, simple to use, and simple to manage.

• They are cloud-ready. You can deploy flash on-premises or in the cloud with common data services and mobility between all-flash, adaptive flash, and HPE Cloud Volumes.

• Timeless storage means no worries today or tomorrow. Flash arrays are future-proofed for NVMe and SCM and come with a satisfaction guarantee, all-inclusive software licensing, flat support pricing, no forklift upgrades, and an option to receive a free faster controller upgrade after three years.

• They are radically easy to integrate with many ecosystems. Deep integration is possible with VMware, MS applications, Oracle, Veeam, and others.

**HPE InfoSight Predictive Analytics**

The HPE InfoSight predictive analytics capability makes the difference:

• Automatically predicts and resolves 86% of problems before you even know there is an issue.

• Transforms the support experience through cloud-based predictive analytics and level 3-only support.

• Sees across the infrastructure stack and resolves problems beyond storage.

• Simplifies planning with prescriptive forecasts into capacity, performance, and bandwidth needs.
• Makes infrastructure smarter and more reliable by learning from the installed base.

Cross-Stack Analytics for VMware Based Hypervisors
The Cross-Stack Analytics for VMware feature provides a granular view of the resources used by each VM. It enables you to correlate performance issues based on a variety of insights into the hypervisor.

Fast and Reliable Performance
Outstanding performance is a key benefit:
• Scale-to-fit: Scale-up performance and capacity independently and nondisruptively. Scale out to four arrays managed as one.
• Up to 5X or greater data reduction from variable block inline deduplication and compression.
• Backup and DR from all-flash to adaptive flash arrays at one-third the cost.
• Data reduction, snapshots, and Triple+ Parity RAID with no performance impact.
• Sub-millisecond response time for performance-sensitive enterprise workloads.

Absolute Resiliency
Multiple features make HPE Nimble Storage arrays resilient:
• Guaranteed availability is at 99.9999% (six-nines).
• Triple+ Parity RAID tolerates three simultaneous drive failures and provides additional protection through intra-drive parity.
• App-granular, FIPS-certified encryption provides data at rest and over-the-wire protection, with secure data shredding built in.
• The arrays offer native application-consistent snapshots and replication plus integration with leading backup software.

NimbleOS Architecture
The HPE Nimble Storage operating system, NimbleOS, is based on the patented Cache Accelerated Sequential Layout (CASL) architecture. CASL leverages the unique properties of flash and disk to deliver high performance and capacity—all within a dramatically small footprint. CASL and HPE InfoSight form the foundation of the predictive flash platform, which enables the dynamic and intelligent deployment of storage resources to meet the growing demands of business-critical applications.

Universal Hardware Architecture
All HPE Nimble Storage arrays are built on a universal hardware platform. All array components are modular, and components, including controllers, can be nondisruptively upgraded easily by the customer or an HPE Nimble Storage representative. The universal hardware architecture spans both all-flash and adaptive flash arrays, giving customers maximum flexibility and reuse with array hardware.
Figure 6: HPE Nimble Storage hardware components

Networking Components

Mellanox SN2100 Switch

Mellanox Spectrum based 1U switch systems are an ideal spine and top-of-rack (ToR) solution. They enable maximum flexibility, with port speeds spanning from 10 Gbps to 100 Gbps per port, and port density that enables full rack connectivity to any server at any speed. The uplink ports allow a variety of blocking ratios that suit any application requirement. Powered by the Spectrum ASIC, the systems carry exceptional switching and processing capacities in a compact 1U form factor.

In keeping with the Mellanox tradition of setting performance record switch systems, the Spectrum based systems introduce the world’s lowest latency for 100 GbE switching and routing elements, and do so while maintaining the lowest power consumption in the market. They enable the use of 10, 25, 40, 50, and 100 GbE on a large scale without changing power infrastructure facilities. The Spectrum based 1U switch systems are a part of the Mellanox complete end-to-end solution, which provides 10 GbE through 100 GbE interconnectivity within the datacenter.

The solution leverages the SN2100 switch, which carries a unique design to accommodate the highest rack performance. Its design allows side-by-side placement of two switches in a single 1RU slot of a 19-inch rack, delivering high availability to the hosts. The SN2100 accommodates 16 ports.
HPE Virtual Connect SE 40 Gb F8 Compute Module for Synergy

The HPE Virtual Connect SE 40 Gb F8 Compute Module for Synergy consolidates datacenter network connections and reduces hardware and scale network bandwidth across multiple frames. It uses the innovative HPE Synergy disaggregated rack-scale design to deliver key benefits:

- Efficiently extend flexible pools of network resources from each HPE Virtual Connect SE 40Gb F8 Module for Synergy to scale bandwidth across multiple frames.
- Improve network reliability with resilient fabric connectivity to upstream switches by using Hewlett Packard Enterprise Synergy Multi-module LAG (MLAG) technology.
- Provide simple, reliable, and fast provisioning of Virtual Connect SE 40Gb F8 Modules by using the HPE Synergy software-defined intelligence with template-driven programming.
- Orchestrate frictionless Virtual Connect SE firmware updates in concert with an entire Synergy infrastructure by using one-tool, one-step template-based operations from HPE Synergy Composer.

HPE Virtual Connect SE 40GB F8 Compute Modules are leveraged in this solution to connect the Mellanox switches to the Synergy frame.

VMware vSphere 6.7 Software

VMware vSphere 6.7 is the latest release of the VMware hypervisor. vSphere 6.7 is an efficient and secure platform for hybrid clouds, fueling digital transformation by delivering simple and efficient management at scale, comprehensive built-in security, a universal application platform, and seamless hybrid cloud experience.

The new release comes with several new features and enhancements, some of which are highlighted here.
vSphere Client (HTML5)
vSphere 6.7 adds functionalities to the previous version. In this release, the HTML5 client is not yet fully working, but the feature is 95% complete. The vSphere Client performance has been improved to provide a more intuitive look. The Web Client now includes the Platform Services Controller (PSC) for easier management.

Figure 9: HTML5 client

The following figure shows the HTML5 view of the host and clusters.

Figure 10: Host and clusters view

Various menu options are available, including the HPE Nimble Storage HTML5 plugin.
The HTML5 client includes several useful enhancements. In addition to its existing capabilities, it can now also manage the following functions:

- vSphere Update Manager
- Content library
- vSAN
- Storage policies
- Host profiles
- vDS topology diagram
- Licensing

**Enhanced vCenter Server Appliance**

With the new APIs introduced in vSphere 6.7, you can now create a template for deploying multiple vCenters, which simplifies the management of the VMware vCenter Server Appliance (vCSA). In addition, the embedded PSC topology supports the enhanced linked mode, enabling administrators to link multiple vCenters. The result is seamless visibility across the environment without the need for an external PSC or load balancers.

Performances in the vCSA 6.7 are dramatically improved:

- 2X faster performance in vCenter operations per second
- 3X reduction in memory usage
- 3X faster DRS-related operations
ESXi Single Reboot

In vSphere 6.7, the upgrade process of ESXi hosts has been improved by eliminating one of two reboots that are normally required for major version upgrades reducing maintenance time. The upgrade from version 6.5 to 6.7 provides the benefit of the new feature.

ESXi Quick Boot

For the hardware that supports this new feature, the hypervisor can be restarted without going through the physical hardware reboot process. Currently, only a limited number of servers are supported, but the number will be increased.

This feature works not only for reboots but also for upgrades. The system creates a second ESXi memory image. When the host is rebooted, it does not perform a full reboot but switches over to the latest image instead.
Figure 13: Enabling quick boot

Configurable Automatic UNMAP

When automatic UNMAP was released with vSphere 6.5, it had a selectable priority with two options: low or none. Storage vendors and customers requested higher, configurable rates rather than a fixed 25 MBps. vSphere 6.7 adds a new method, “fixed,” which allows you to configure an automatic UNMAP rate between 100 MBps and 2000 MBps. You can configure the rate in both the UI and the CLI.

The following example of CLI-based UNMAP configuration shows how to check the current configuration:

```
esxcli storage vmfs reclaim config get --volume-label <volume-name>
```

This example shows how to set the rate to 100 MBps:

```
esxcli storage vmfs reclaim config set --volume-label <volume-name> --reclaimmethod fixed -b 100
```

Additional vSphere 6.7 Features

Other significant features of vSphere 6.7 include improved DRS initial placement, vSphere Persistent Memory, and so on. For more information about vSphere 6.7, visit the VMware website.
Detailed Solution Architecture

The HPE Synergy chassis leverages the HPE Virtual Connect SE 40Gb F8 modules to connect into the Mellanox switches.

The solution uses three HPE Synergy 480 Gen10 Compute Modules. The HPE Synergy 480 Gen10 Compute Module delivers an efficient and flexible two-socket workhorse to support the most demanding workloads. It is powered by the Intel Xeon Scalable Family processors (Skylake), up to 3 TB DDR4, and a variety of GPU options within a composable architecture.

The HPE Nimble Storage array used in this solution is an all-flash AF20. The AF20 can scale up to 168 TB of effective capacity. The HPE Nimble Storage array is connected through a 10 GB Ethernet link to the Mellanox switch.

Figure 14: Detailed solution architecture
Configuring the System

Install and Configure the HPE Synergy Framework

For information about connecting and initializing the HPE Synergy system, see the documents listed in HPE Synergy Document Map on page 55. After the system is connected and initialized, you can log in to HPE OneView to build and manage the environment.

Procedure

1. Select a method for building the server profiles for the individual compute modules to boot ESXi 6.7.

   There are two ways to create server profiles. To maintain uniformity, you can create a server profile template and then create multiple server profiles from it for the individual servers. In this way, the server profiles remain consistent. The second method is to create separate server profiles for each server. In this solution, a service profile template was created and three separate server profiles were created from the template.

2. Create a server profile, beginning with the General section:
   a. Enter a name for the profile.
   b. Enter a name for the server profile template, if using a template.
   c. For the server hardware, select the bay on which the server resides.
   d. Select the server hardware type (in this example, SY 480 Gen10 1).
   e. Select the corresponding enclosure group.
   f. Select the affinity (in this example, the Device Bay affinity).
3 Choose the firmware levels:
   a Select the firmware base line from the dropdown menu.
   b Select **Firmware only** as the installation method.

4 Set the network connections.
   The solution uses two networks: management and data.
5 Select **Local Storage** if the individual compute modules will boot locally.

In the example, internal drives are selected to boot the ESXi server.

**Note** Ensure that each server contains a Smart Array Controller to leverage local boot.

6 Select the boot and BIOS settings:

   a Select the boot mode (in this example, **UEFI optimized**).
   b Select the boot order (in this example, **Hard disk**).
   c Select the BIOS setting (in this example, **Virtualization – Max Performance**).
7 Under **Advanced**, leave all of the default options (Virtual).

**Advanced**

- **iSCSI initiator name**: Virtual, User-specified
- **MAC addresses**: Virtual, Physical
- **WWN addresses**: Virtual, Physical
- **Serial number/UUID**: Virtual, Physical, User-specified

8 After the settings are applied and the profile is created, log in to the ILO of the server and map the latest HPE-compatible version of the ESXi 6.7 ISO to the virtual devices in ILO.
9 When the server starts to install ESXi, select the local boot disk and complete the ESXi setup.
10 After ESXi is installed, you can go into the network setting and change the IP address and the DNS names as required.
11 Complete the build of the remaining servers by using the same procedure.

Configure the VMware vSphere Software

*VMware vSphere 6.7* was used in this solution, and the vSphere appliance was leveraged to manage the ESXi hosts and datastores.

**Procedure**

1. Run the setup from the vSphere appliance folder, and then click **Install** to start a new vCenter Server Appliance installation process.

2. Note the two stages of installation. The appliance is deployed in the first stage and configured in the second stage.
3 Select the appropriate deployment type.

4 Enter the information needed to identify the ESXi host that will host the vCenter appliance.
Configure the VMware vSphere Software

5 Enter a name for the vCenter appliance.
6 Enter the information required to configure the network settings for the vCenter appliance.

7 Verify that the provided information matches and click **Finish** to complete the deployment.
The system displays the progress of deployment.

After deployment is complete, move to stage 2, setting up the appliance.
The introduction page shows stage 1 as complete and stage 2 as next.

9 Provide an SSO domain for the vCenter login.
10 Verify the summary screen before you finish setting up the appliance.

With the vCenter Server appliance configured, log in to the vSphere client and add the three hosts to a cluster.

The next task is to register the HPE Nimble Storage array to the vCenter instance and start presenting volumes to vCenter and provisioning VMs.
Configuring HPE Nimble Storage Arrays

The solution uses HPE Nimble Storage AF20, an entry-level all-flash array that can produce up to 22,500 IOPS and scale up to 168 TB. For information about how to initially set up and configure an HPE Nimble Storage array, refer to the HPE Nimble Storage product user guides listed on HPE InfoSight.

The HPE Nimble Storage plugin for vCenter helps VM admins to manage certain storage functionalities right from the vCenter console. The vCenter plugin greatly simplifies storage workflows, especially for VMFS datastores.

HPE supports both vSphere Web Client and HTML5. In NimbleOS 5.x, the HTML plugin has been enhanced with a landing page and several VVol-related workflows.

With the vCenter plugin, you can create and manage datastores (volumes) on the HPE Nimble Storage array, directly from vCenter. You can create, grow, and clone datastores. You can also delete datastores and create snapshots of them. In addition, you can see detailed information about the current level of performance and use of space.

The HPE Nimble Storage plugin for vCenter also offers array-level monitoring in the vCenter console. IOPS, latency, and bandwidth details are displayed on the Performance tab in the Datastore view.

Figure 15: Array-level performance information

The plugin also provides a summary view of all HPE Nimble Storage specific attributes and any active alerts.
Figure 16: Summarized volume information

Note The HTML version of the plugin does not currently support VMFS workflows.

Register the HPE Nimble Storage Plugin for vCenter

After the HPE Nimble Storage is configured and set up, you must register the vCenter instance that you created earlier.

Procedure

1. Log in to the HPE Nimble Storage array GUI and select VMware Integration from the Administration menu.
2 Select Add a new vCenter and enter the required vCenter information.

3 After the vCenter is registered, log out and log in to the vCenter to see the new HPE Nimble Storage plugin.

Create a New Datastore

Procedure

1 To use the HPE Nimble Storage plugin to create a new datatcenter, navigate to the Storage view in vCenter and right-click the datacenter to display the Nimble Storage Actions menu.
This is where new HPE Nimble Storage volumes can be provisioned from the vCenter.

2 In the Create Datastore wizard, select the array on which you want the datastore to be configured.

3 Enter a name for the volume and select the hosts on which it will be mounted.
4 Enter the required datastore capacity and choose the appropriate storage pool and HPE Nimble Storage folder for the volume to reside in.

If required, you can also set space reserves and usage threshold warnings here.

5 You can create a new HPE Nimble Storage volume collection or add the volume to an existing volume collection for data protection.

You can also configure application-consistent snapshots here.
6 Use the performance options to set specific limits on IOPS and bandwidth.

7 Verify that the information on the summary page is accurate and click **Finish** to create the datastore.

**Note** If the environment contains VMs that are based on VMware VVols, those VMs can be managed by the HPE Nimble Storage HTML5 plugin.
HPE InfoSight is an artificial intelligence (AI) platform that is built on a unique approach to data collection and analysis, an approach that goes well beyond depending on the logs and obvious metrics that are used in traditional infrastructure. Every second, for almost a decade now, HPE InfoSight has been collecting and analyzing millions of sensors from our globally connected installed base. It collects thousands of embedded sensors built into every storage system and pulls in data from VMware for full-stack visibility.

But this data is not analyzed in isolation. It is sent to the cloud, where we apply advanced machine learning to drive our predictive analytics and recommendation engines. Our predictive analytics capabilities extend across the lifecycle from planning, to managing, to expanding. Our recommendation engine tells IT how to avoid issues, how to improve their environment, and how to get more out of their resources. The ability of HPE InfoSight to learn from every system enables it to identify ideal operating environments and recognize abnormal patterns in infrastructure, configurations, and workloads.

This platform then drives predictive support automation, which goes far beyond proactive support. HPE InfoSight transforms the support experience by not only predicting problems but also preventing them from happening. The AI-driven approach to managing infrastructure through the HPE InfoSight cloud portal tells IT exactly how to improve their environment and make it better. In addition, it offers a unique product experience in which the infrastructure supported by HPE InfoSight continues to get smarter and more reliable.

**Figure 17: HPE InfoSight AI**

**Architecting the AI Recommendation Engine**

The architecture of the new AI recommendation engine has at its core the ability to predict complex problems by using hybrid machine learning.
Predictive Models

HPE offers two types of predictive models:

- **Expert-trained models** are developed by HPE data scientists and support engineers based on known variables and values that indicate potential problems.
- **Globally trained models** are used for problems that are much more nebulous, lacking the specificity that would be needed to code the problem signature.

The globally trained model is where HPE leverages multivariate machine-learning. It uses classification, correlations, and regression, as well as using telemetry data to train the models so that it can identify causation (recognize patterns) to predict future problems. It also uses these techniques to identify anomalies in order to classify new issues.

The machine-learning approach improves the system's accuracy and its breadth of coverage. It also improves the system's extensibility, future-proofing it for new types of problems. New plugins will be added as HPE continues to extend the system's reach.

Prioritization Matrix

The predictive models feed the prioritization matrix to provide customers preemptive recommendations based on real-time telemetry.

Enabling Streaming for HPE InfoSight and Cross-Stack Analytics

For data to be streamed over to HPE InfoSight, you must log in to the HPE InfoSight portal and click Telemetry Settings under Settings.
Figure 19: Telemetry settings

Then, under **Telemetry Settings**, you can enable the streaming and VMware options.

Figure 20: Enable streaming

After the sensors are enabled for the arrays you want, the data from the sensors is sent to HPE InfoSight for predictive analysis.

**Overview of HPE InfoSight**

HPE InfoSight dashboards provide four types of views into the HPE Nimble Storage environment:

- Operational
- Executive
- Wellness
- Capacity

**The Operational Dashboard**

The Operational Dashboard shows an overview of the environment. It offers views of the number of arrays and shows which VMs are top-performing in terms of latency and IOPS. It also provides insights into system health and capacity issues. This is the ideal place to look for a quick health check across the environment.
**Figure 21: Operational Dashboard**

The Executive Dashboard provides an overview of the state of your arrays. Its graphs offer quick summaries of information such as operational efficiencies, data protection, upgrade needs, and overall space savings achieved through various data-savings techniques.

**Figure 22: Space-savings graph**

Other Executive Dashboard graphs provide details about operation efficiencies, showing, for example, how many manual and auto tickets have been created and closed.
The Executive Dashboard offers views into the status of data protection, disaster recovery, and retention configurations based on the application performance policies selected.

Finally, the Executive Dashboard provides graphs that predict upgrade needs based on the CPU and capacity consumption of the array. It takes the guesswork out of planning and accurately predicts future capacity and performance needs.
The Wellness Dashboard

The Wellness Dashboard summarizes any issues related to the array, or to pools, volumes, and so forth.

**Figure 26: The Wellness Dashboard**

It also provides details about the type of problem and its associated conditions.
The Capacity Dashboard

The Capacity Dashboard report displays the capacity of all pools or of a particular pool based on a timeframe that you select. The information is presented as a summary in the headline bar or in graph format with the details listed at the bottom.

The following example graph shows total usage, free space, and savings for various arrays in the pool.

The capacity report can be further filtered by pools, applications, or volumes. Each of these views can include volume usage, past growth, and savings based on the category selected, as the following examples show.
HPE InfoSight Cross-Stack Analytics for VMware

HPE InfoSight Cross-Stack Analytics for VMware environments provides performance correlation analytics to help you identify the leading factors affecting performance, while avoiding significant manual data collection and analysis. The Cross-Stack Analytics for VMware agentless per-VM monitoring feature gives enterprise IT staff clear visibility into latency and performance across host, network, and storage layers of the stack through intuitive graphical representations.
Cross-Stack Analytics provides a granular view of the resources that are used by every VM connected to an HPE Nimble Storage array. This feature makes it possible to correlate the performance of VMs in a datastore with insights into hypervisor and host resource constraints such as vCPU, memory, and network.

Cross-Stack Analytics helps in determining VM latency factors, whether from the storage, the host, or the network. It also helps in taking corrective action on noisy-neighbor VMs and reclaiming space from underused VMs. Every hour, through the heartbeat mechanism, the correlated statistics are sent to HPE InfoSight for processing. No additional host-side agents, tools, or licenses are necessary for the feature to work.

Before data is populated into Cross-Stack Analytics for VMware, the VMware streaming option must be enabled for the array, as described in *HPE Infosight AI for the Datacenter* on page 37.
To view detailed metrics on VMware Virtualization, click the **Infrastructure** view and select one of the items in the **Virtualization** menu.

**Figure 32: Virtualization menu**

Selecting an item from the menu brings up the Cross-Stack Analytics view for VMware. There are five views in this console:

- Datacenter
- Clusters
- ESXi hosts
- Datastores
- VMs

**Datacenter View**

The datacenter view provides an overview of all VMware vCenter infrastructures and all datacenters that are enabled for monitoring. It also shows a summary of the total number of clusters, hosts, datastores, and VMs in each datacenter.

**Figure 33: Datacenter view**

**Cluster View**

This view provides visibility into all vSphere clusters that have been created.
ESXi Host View

Figure 34: Cluster view

This view provides an overview of all hosts in the environment across the vSphere deployment. It provides insight into the CPU and memory usage within the last six hours.

Figure 35: ESXi host view

Under the ESXi Hosts tab, there is also a sub-view that shows performance trends for the hosts. This view provides a detailed heatmap that graphically displays how well the host has performed in its use of CPU and memory resources.
Datastores View

The datastores view provides visibility into how the capacity utilization, block size, and storage I/O are set for each of the individual HPE Nimble Storage arrays.

Figure 37: Datastores view
VMs View

The VMs view is the core of the Cross-Stack Analytics view. Here is where you can start troubleshooting performance, capacity, host, network, or storage issues for a particular VM.

The VMs view contains further sub-views:

- Capacity trend
- I/O contention treemap
- I/O contention trend
- Memory contention trend
- CPU contention trend

Figure 38: Sub-views under the VMs view

The following VM I/O contention treemap offers an example illustration. The datastore treemap is a visualization tool that shows the I/O and latency of datastores and VMs. This view shows datastores. The larger the rectangle, the greater the I/O over the last 24 hours. The darker the color, the higher the latency.

Figure 39: VM I/O contention treemap
You can click a particular datastore to display the list of VMs in that datastore. The display follows a heatmap pattern similar to the one at the datastore level.

**Figure 40: VM I/O and latency grouped by datastore**

You can click a particular VM to display a detailed performance metrics view. The detailed view enables you to correlate a performance issue with a latency, IOPS, or bandwidth problem on a host, on the network, or on the storage. All locations are color coded, making the results easy to understand at a glance.
In the example report, the host appears to be causing increased latency. As this example shows, you can click the host that is associated with the problem to further triage the issue. Then, in the host view, you can look at either the CPU or the memory utilization to exactly pinpoint the source of the issue.

In addition, you can view the VMs that are using a high amount of CPU resources and the VMs that are starving (CPU ready) because of the other bully VMs (noisy neighbours).
Figure 42: VM CPU contention trend report
Configuration Guidelines

Use the information provided in the following sections to simplify the administration and management workflows later in this guide. At a high level, make sure that the hardware and software versions meet minimum requirements.

SAN and iSCSI Boot

Currently, Synergy compute modules can boot from SAN by using Fibre Channel (FC). HPE Nimble Storage interoperability has qualified boot from SAN by using FC adapters (3830 and 3530 FC adapters).

Boot from iSCSI is still being qualified (as of June 11 2018).

Compatibility Guide

Always consult the Compatibility Matrix in the HPE Information Library and the guides to verify interoperability of the components.

HPE Nimble Storage Connection Manager for VMware

The HPE Nimble Storage Connection Manager (NCM) manages connections from the host to volumes on HPE Nimble Storage systems. To simplify the process of configuring multiple connections and MPIO, NimbleOS requires only one IP address (the iSCSI discovery IP address) be advertised, instead of requiring the full set of iSCSI network interfaces to be advertised at the time of discovery.

This means that you do not need to manually make specific connections to the appropriate interfaces, or worry about how many connections there are to a volume. As connections are made to the same address (group target portal), the connections are redirected to the appropriate distribution of actual iSCSI network interfaces. Before installing the NCM, refer to the VMware Integration Guide for detailed information and requirements.

The NCM is installed on ESXi hosts through the vSphere Installation Bundle (VIB). The HPE Nimble Storage connection service (NCS) calculates and maintains the optimal number of iSCSI sessions from host to storage group, balanced across the host's NICs. The HPE Nimble Storage path selection plugin (PSP) automatically directs the I/O request for an HPE Nimble Storage device to the most favourable route. It autoconfigures and tunes the storage array type plugin (SATP) and MPIO to conform to best practices.

Install NCM on an ESXi Host

You must enable SSH access on the ESXi host on which NCM will be installed.

Procedure

1 Open the Internet browser on your installation system.
2 Locate the NCM software by going to https://infosight.hpe.com/ and navigating to the software download section.
3 Find the HPE Nimble Storage VMware Integration table and click the Download link for the NCM software.
   Version 5.1.0 of the NCM for VMware is supported for ESXi versions 6.0, 6.5, and 6.7.
4 SCP the file to the ESXi server on which the NCM is to be installed and place the file in /tmp location.
5 SSH to the system, using the user name root, the password <<mgmt_server_root_password>>, and the IP address <<mgmt_server_1_ip>>.
6 To install the NCM, execute the command `esxcli software vib install -d /tmp/nimble-ncm-for-esx6-x.x.x-xxxxxx.zip`, where `x.x.x-xxxxxx` is the version number that you downloaded.

7 After NCM is installed, exit the SSH session and reboot the server for the installation to complete.

8 On the SSH console of the server, verify the success of the installation by running this command from the root directory: `esxcli software vib list | grep nimble`.

If `nimble-ncs` and `nimble-psp` appear in the list, the installation was successful. The installation is also displayed on the vCenter client.

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**Infrastructure Components and Versions**

The following table summarizes all of the components used in the solution and shows which versions were used.

**Table 3: Infrastructure components and versions**

<table>
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<tr>
<th>Component</th>
<th>Version</th>
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<tbody>
<tr>
<td>HPE Synergy frame</td>
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<td>HPE Synergy compute modules</td>
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<td>VMware vSphere and ESXi</td>
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HPE Synergy Document Map

The complete set of HPE Synergy documentation is available at the Hewlett Packard Enterprise Information Library. You can find documents in the following categories.

Planning
- HPE Synergy 12000 Frame Site Planning Guide
- HPE Synergy Configuration and Compatibility Guide
- HPE OneView Support Matrix for HPE Synergy
- HPE Synergy Image Streamer Support Matrix
- Setup Overview for HPE Synergy
- HPE Synergy Software Overview Guide

Installing Hardware
- HPE Synergy Start Here Poster (included with frame)
- HPE Synergy 12000 Frame Setup and Installation Guide
- Rack Rails Installation Instructions for the HPE Synergy 12000 Frame (included with frame)
- HPE Synergy 12000 Frame Rack Template (included with frame)
- Hood labels
- User guides
- HPE Synergy Cabling Interactive Guide
- HPE OneView Help for HPE Synergy — Hardware setup

Configuring for Managing and Monitoring
- HPE OneView Help for HPE Synergy
- HPE OneView User Guide for HPE Synergy
- HPE OneView API Reference for HPE Synergy
- HPE OneView REST API Scripting Help for HPE Synergy
- User Guides

Managing
- HPE OneView User Guide for HPE Synergy
- HPE Synergy Image Streamer Help
- HPE Synergy Image Streamer User Guide
- HPE Synergy Image Streamer API Reference
- HPE Synergy Image Streamer deployment workflow
- HPE Synergy Frame Link Module User Guide

Monitoring
- HPE OneView User Guide for HPE Synergy
- HPE OneView Global Dashboard User Guide Maintaining
- Product maintenance and service guides
- Best Practices for HPE Synergy Firmware and Driver Updates
- HPE OneView Help for HPE Synergy
- HPE OneView User Guide for HPE Synergy
• HPE Synergy Appliances Maintenance and Service Guide for HPE Synergy Composer and HPE Synergy Image Streamer

Troubleshooting
• HPE OneView alert details
• HPE Synergy Troubleshooting Guide
• Error Message Guide for HPE ProLiant Gen10 servers and HPE Synergy
• Integrated Management Log Messages and Troubleshooting Guide for HPE ProLiant Gen10 and HPE Synergy
• HPE OneView API Reference for HPE Synergy
• HPE Synergy Image Streamer API Reference
About the Author

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Bharath Ram specializes in virtualization technologies for servers and desktops and in storage solutions for data centers. He has extensive experience with the VMware and Citrix product portfolios, and he has worked on numerous projects to integrate these products with HPE Nimble Storage offerings. Before joining HPE, Bharath was a solution architect for other storage companies where he implemented virtual desktop and application solutions for the healthcare and insurance domains.
## Version History

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<th>Release Date</th>
<th>Description</th>
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<td>Initial release</td>
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