Hewlett Packard Enterprise

Technical White Paper

HPE Primera storage for VMware Cloud Foundation 3.9.1 workload domain on HPE Synergy

Using HPE Primera 600 Storage as principal storage for VMware Cloud Foundation VI workload domain

CONTENTS

EXECUTIVE SUMMARY

This white paper describes the deployment of HPE Primera 600 series storage as principal storage to a VMware Cloud Foundation™ (VCF) 3.9.1 virtual infrastructure (VI) workload domain on HPE Synergy Composable Infrastructure. Starting from VCF version 3.9, VMware announced the ability to support external fibre channel storage arrays as a principal storage option for VI workload domains in addition to VMware vSAN and NFS.

Customers who run mission-critical workloads are choosing HPE Primera, a Tier-0 enterprise storage solution that delivers extreme resiliency and performance with the agility of the cloud. Customers can now standardize on their choice of HPE Primera storage for virtualized deployments in VCF VI workload domains as well as other Tier-0 workloads.

HPE Primera redefines the experience in mission-critical storage by delivering the agility of the cloud while raising the bar on resiliency and performance. Built upon proven resiliency and powered by HPE InfoSight, HPE Primera delivers instant access to data with storage that sets up in minutes, upgrades transparently, and is delivered as a service. HPE Primera ensures storage for all mission-critical apps, backed by a 100% Availability Guarantee.

HPE Synergy Composable Infrastructure based resource pools with its compute, storage, and network fabric resources are configured with a unified management interface that allows IT to rapidly assemble, disassemble, and re-assemble resources in any configuration. The HPE Synergy architecture eliminates hardware and operational complexity enabling IT to deliver infrastructure to applications faster and with greater precision and flexibility. HPE OneView is the infrastructure automation engine built with software intelligence and streamlines provisioning and lifecycle management across compute, storage, and fabric resources in the HPE Synergy system.

VMware Cloud Foundation is an integrated hybrid cloud platform that delivers a complete set of software-defined services for compute, storage, networking, security and cloud management for the private, hybrid and public cloud. VCF drastically simplifies data center operations by deploying a standardized and validated architecture with built-in lifecycle automation of the SDDC stack.

Target audience: This white paper is for IT Administrators and Solution Architects planning to deploy HPE Primera storage in a VCF deployment and for HPE engineers, VMware engineers and their channel partners. This document is not intended to be a training guide for HPE Synergy, HPE OneView, HPE Primera or VCF. Prior knowledge of these components are expected to understand the content herein. This white paper is based on the testing performed in Hewlett Packard Enterprise Labs in February 2020.

SOLUTION OVERVIEW

HPE Primera is an intelligent storage technology in the form of all-flash or converged flash with mixed flash and spinning media. It provides principal storage as well ancillary storage options for VCF virtual infrastructure (VI) workload domains. The volumes created from HPE Primera storage, connected to an HPE Synergy chassis through fibre channel (FC) connections, can be used to create 'VMFS on FC' datastore for VCF VI workload domain installations. Other volumes created from HPE Primera storage can be presented as ancillary storage options for the workload domain. Figure 1 shows the block diagram for HPE Primera storage options for VI workload domains.

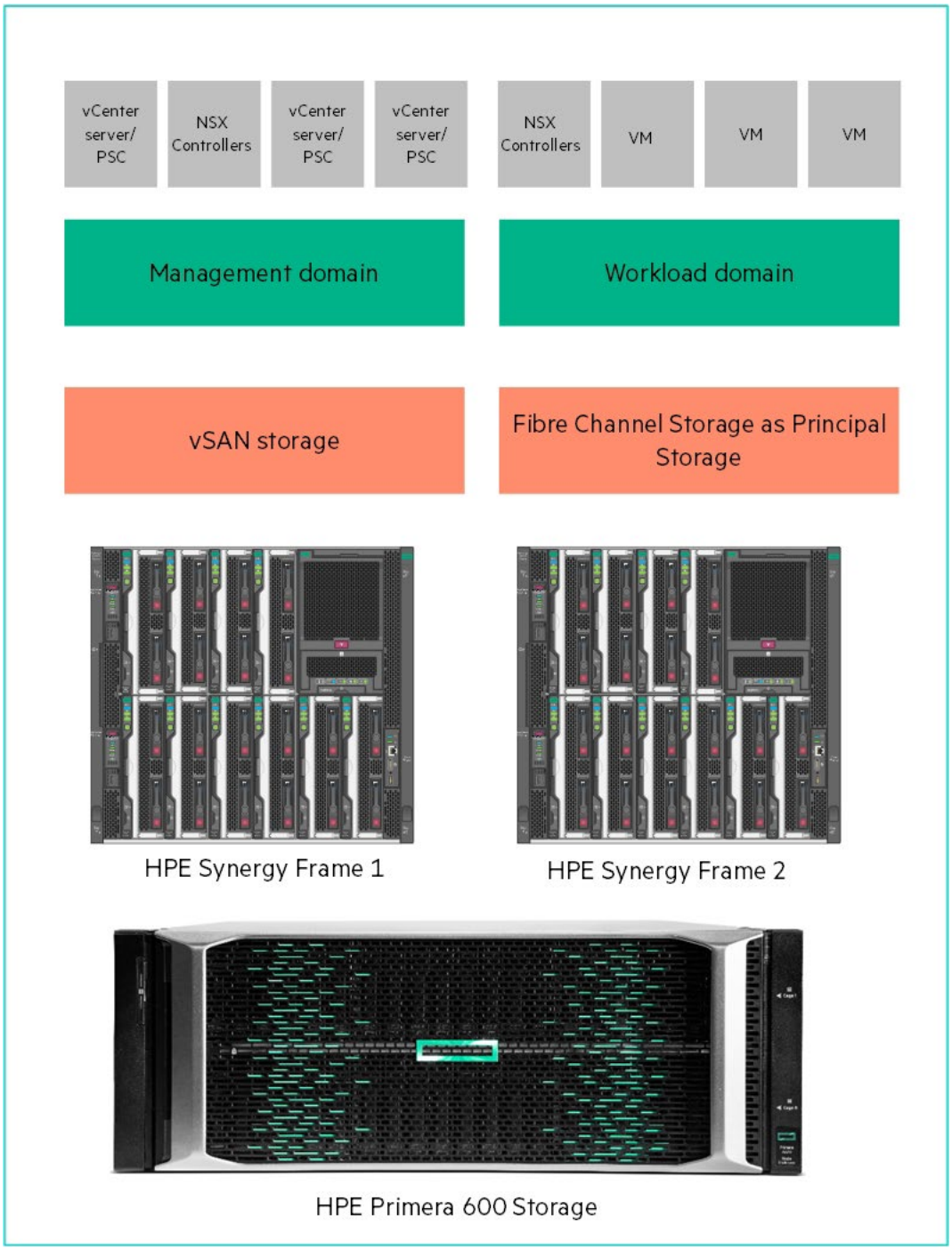

FIGURE 1. HPE Primera storage as principal storage for VMware Cloud Foundation v3.9.1 workload domains

The volumes presented from HPE Primera storage can be configured as principal storage on a "VMFS on FC" datastore for VCF workload domains.

In this white paper, VMware vCenter® integrated HPE OneView is used to provision, manage, and administer HPE Primera, thus providing a single unified management pane for HPE Primera storage operations on the HPE Synergy platform.

This white paper describes the deployment of HPE Primera storage as principal storage for a VMware Cloud Foundation v3.9.1 VI workload domain on the HPE Synergy platform.

HPE Primera storage fabric attach fibre channel (FC) topology

Figure 2 shows a fabric attached SAN networking using SN6600B 32Gb fibre channel switches, HPE Synergy with 32Gb uplinks, and an HPE Primera A630 Storage. For downlink connectivity, HPE Synergy 5830C 32Gb Fibre Channel Host Bus Adapters are used. Hewlett Packard Enterprise recommends cabling the odd numbered Primera ports to one switch and even numbered ports to the partner switch. At the minimum, two ports per component must be used to enable continuous server operation during the failure of a switch, fibre cable, or server fibre port and to enable continuous operation during a firmware updates to SAN switches.

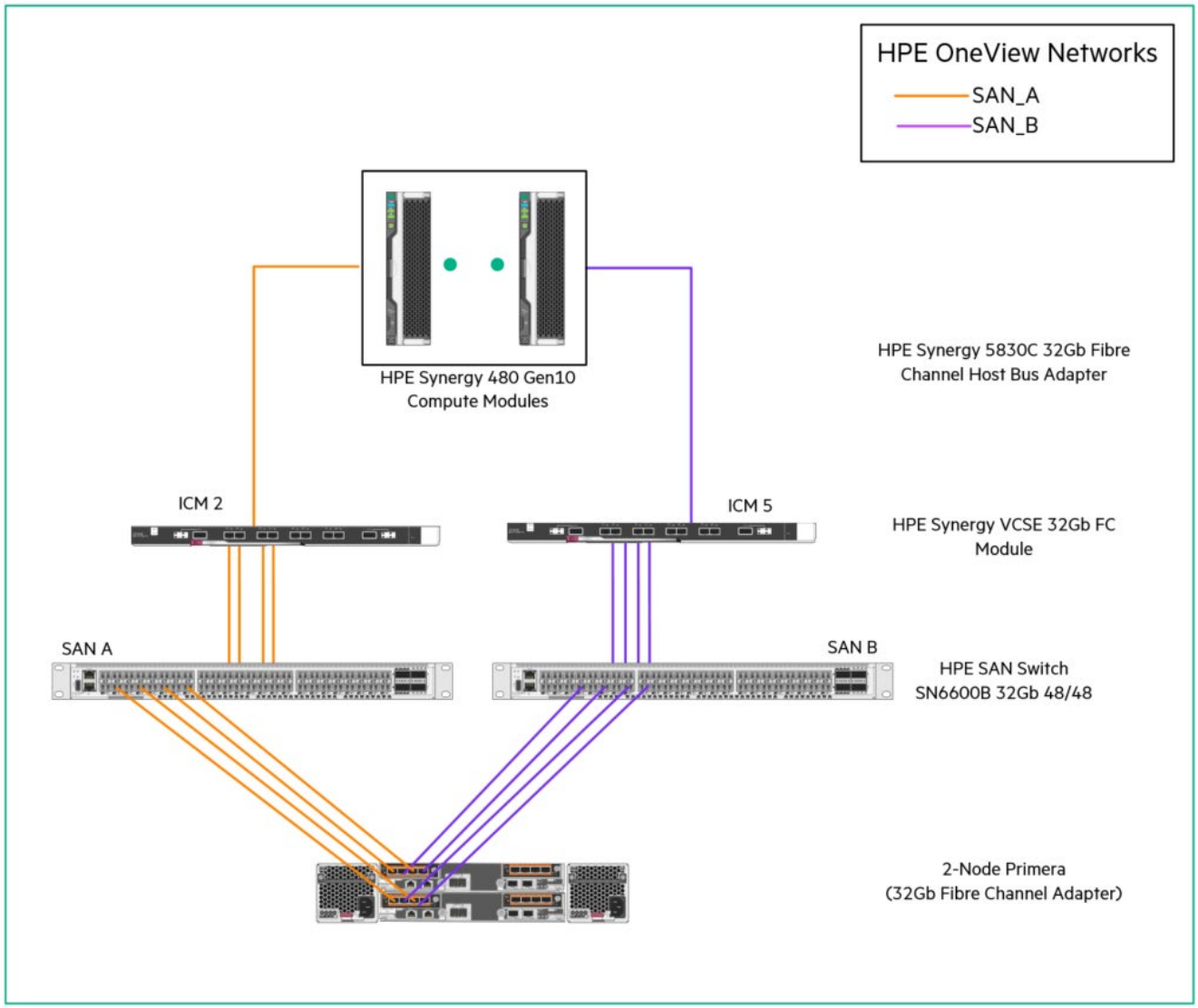

FIGURE 2. An example SAN network topology with HPE Primera storage

SOLUTION COMPONENTS

HPE Synergy 480 Gen10 Compute Module

The HPE Synergy 480 Gen10 Compute Module delivers superior capacity, efficiency, and flexibility in a two-socket, half-height form factor to support demanding workloads. The compute module is powered by the latest Intel® Xeon® Scalable processors, HPE DDR4 SmartMemory supporting up to 3TB, flexible storage controller options, and three I/O connectors. These components create a pool of flexible compute capacity within a composable infrastructure, thus making the compute module an ideal platform for general-purpose enterprise workload.

HPE Virtual Connect SE 32Gb FC Module

The HPE Virtual Connect SE 32Gb FC Module for HPE Synergy is a Storage Area Network (SAN) interconnect with a wire-once change-ready technology. The fibre channel (FC) module in conjunction with HPE Synergy Composer powered by HPE OneView allows workloads to be moved or managed without modifying the network. HPE OneView provides an intuitive management console for seamless connectivity between virtualized HPE Synergy compute modules and 32 GB FC SAN fabrics.

HPE Synergy 5830C 32Gb Fibre Channel Host Bus Adapter

The HPE Synergy 5830C 32 GB Fibre Channel Host Bus Adapter (HBA) provides low latency and flexible connectivity to HPE Synergy Virtual Connect FC modules. The HPE Synergy 5830C 32 GB FC HBA helps minimize CPU utilization for storage I/O and is ideal for environments with greater virtual machine density and bandwidth requirements.

HPE Synergy 3820C 10/20Gb Converged Network Adapter

The HPE Synergy 3820C 10/20Gb Converged Network Adapter is a key element in HPE Composable Fabric connecting pools of compute resources to networks with reliable, high-performing converged 10Gb or 20Gb Ethernet connectivity. With Flex-20 technology, the HPE Synergy 3820C adapter converges Ethernet and FCoE onto a single connection simplifying the hardware and reducing costs. Each port replaces a 10/20 Gb NIC and 8Gb fibre channel HBA simplifying I/O hardware by 50% and reducing costs up to 60%. The HPE Synergy 3820C adapter is an ideal choice for any virtualized or converged data center.

HPE Virtual Connect SE 40Gb F8 Module

The HPE Virtual Connect SE 40Gb F8 Module is designed for composable infrastructure. Its disaggregated, rack-scale design uses a master/satellite architecture to consolidate data center network connections, reduce hardware, and scale network bandwidth across multiple HPE Synergy Frames. The master module contains intelligent networking capabilities that extend connectivity to satellite frames through Interconnect Link Modules. This eliminates top of rack switch need and substantially reduces cost. The reduction in components also simplifies fabric management at scale while consuming fewer ports at the data center aggregation layer.

HPE StoreFabric SN6600B Fibre Channel Switch

The HPE SN66x0B Fibre Channel Switch meets the demands of hyper-scale virtualization, larger cloud infrastructures, and growing flash-based storage environments by delivering market-leading 32Gb fibre channel technology and capabilities. It provides a high-density building block for increased scalability, designed to support growth, demanding workloads, and data center consolidation in small to large-scale enterprise infrastructures. It is built for maximum flexibility, scalability, and ease of use. Organizations can scale from 24 to 128 ports, all in an efficient 1U or 2U package. It also provides a simplified deployment process and a point-and-click user interface, making it both powerful and easy to use. With the SN66x0B switch, organizations gain the best of both worlds: high-performance access to industry-leading storage technology and "pay-as-you-grow" scalability to support an evolving storage environment.

FIGURE 3. HPE StoreFabric SN6600B Fibre Channel Switch

Using a fabric attach fibre channel topology requires a minimum of two (2) SAN switches. If more than two switches are needed in the solution, switches of the same vendor/type must be added in pairs, so there is always an even number of switches. It is important to ensure that you select the correct model switch for your future growth plans. Select a bigger switch with only the ports you need licensed to start, if you plan on expanding your HPE Synergy solution in the future.

HPE Primera 600 Storage

HPE Primera storage system features a high-speed, full-mesh passive interconnect that joins multiple controller nodes (the high-performance data movement engines of the HPE Primera architecture) to form an all-active cluster. This low-latency interconnect allows for tight coordination among the controller nodes and a simplified software model.

HPE Primera storage redefines mission-critical storage for Tier-0 applications. Designed for NVMe and Storage Class Memory, HPE Primera delivers remarkable simplicity, app-aware resiliency for mission-critical workloads, and intelligent storage that anticipates and prevents issues across the infrastructure stack.

HPE Primera delivers on the promise of intelligent storage advanced data services and simplicity for your mission-critical applications with a services-centric OS that sets up in minutes, and upgrades seamlessly to minimize risk and be transparent to applications. All of these capabilities add up to enable HPE Primera to provide 100% availability guaranteed.

NOTE

Use of VMware Storage Policy-Based Management is not covered in this paper as the release validated in Table 1 does not support VASA. Hence, vVols support is currently not available.

Use of HPE StoreServ Management Console (SSMC) is not covered in this paper as the Common Provisioning Groups (CPG) are handled automatically in the Primera OS.

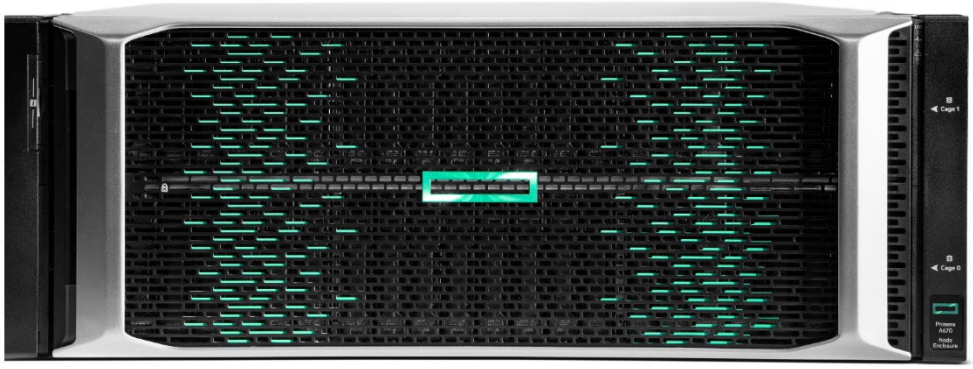

FIGURE 4. HPE Primera A670 Storage

INSTALL AND CONFIGURE HPE PRIMERA STORAGE SYSTEM

Initialize and configure the HPE Primera storage system

Initialize the array with HPE Primera Discovery Tool

NOTE
Locate the system information tag on HPE Primera controller node enclosure and document the serial number as it is required to initialize the array via HPE Primera Discovery Tool.

1. Download the HPE Primera Discovery Tool from https://www.hpe.com/downloads/primera600discoverytool.
2. Unzip, and run the discovery tool application on the installation workstation.
3. Cable the installation workstation to the same switch (or layer 2 broadcast domain) as the HPE Primera array.
4. Enter the serial number of HPE Primera storage system and then click **Search**.

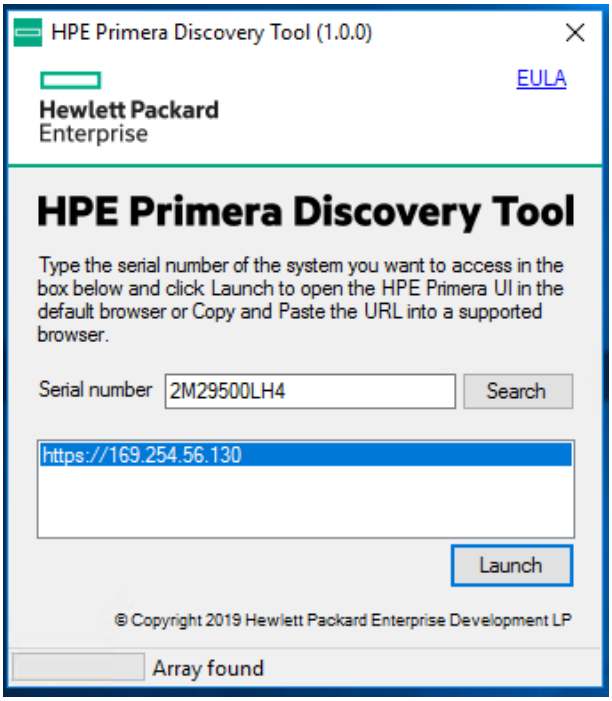

FIGURE 5. HPE Primera Discovery Tool

5. Select the HPE Primera URL and click **Launch**.

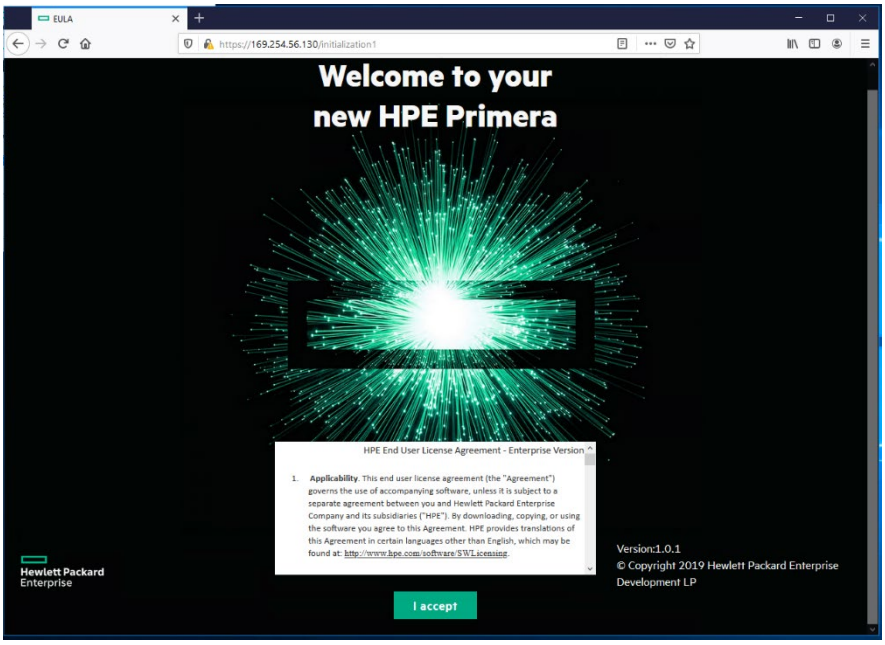

FIGURE 6. HPE Primera Initialize

6. Continue to the next screen accepting the licensing agreements. Log in with no credentials (credentials will be set later in the process), and finally read and review the HPE EULA and click **I accept**.
7. Once you arrive at the Welcome screen, click **Let's get started**.

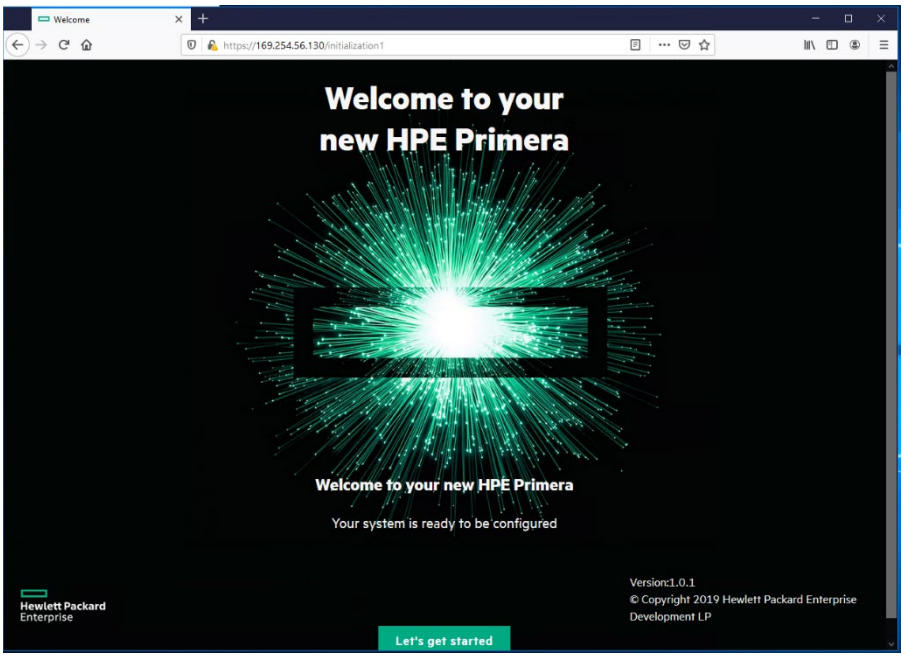

FIGURE 7. HPE Primera welcome screen

8. Review the system configuration summary and ensure that model, serial number, OS version, number of nodes, number of drive enclosures, and number of drives reflect the actual configuration of the HPE Primera storage system and click **Continue**.

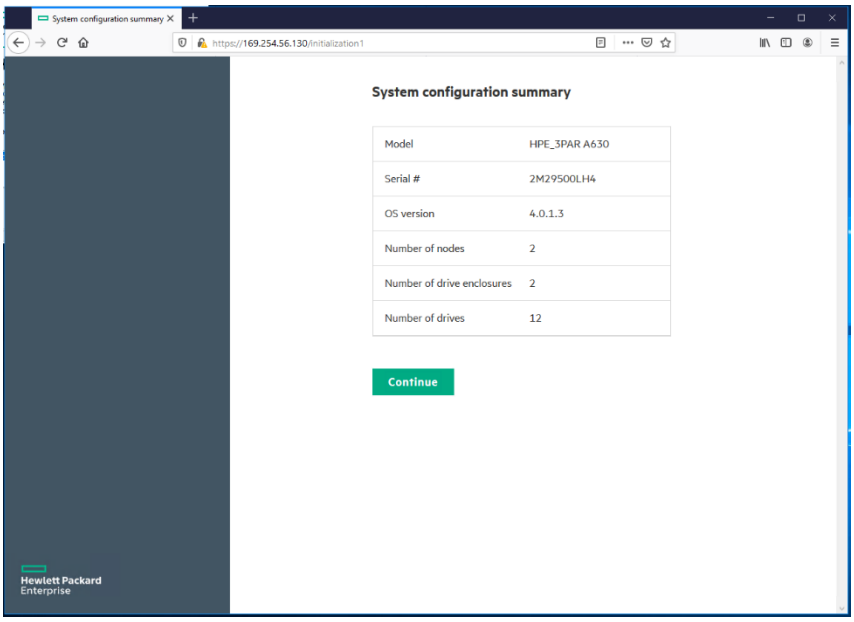

FIGURE 8. Storage configuration summary

9. Complete configuration settings of HPE Primera array on the "Configure Network" screen using the following parameters:
   a. General settings:
      - System name: **<<primera1_system_name>>**
      - 3paradm user and confirm password: **<<primera_adm_pwd>>**

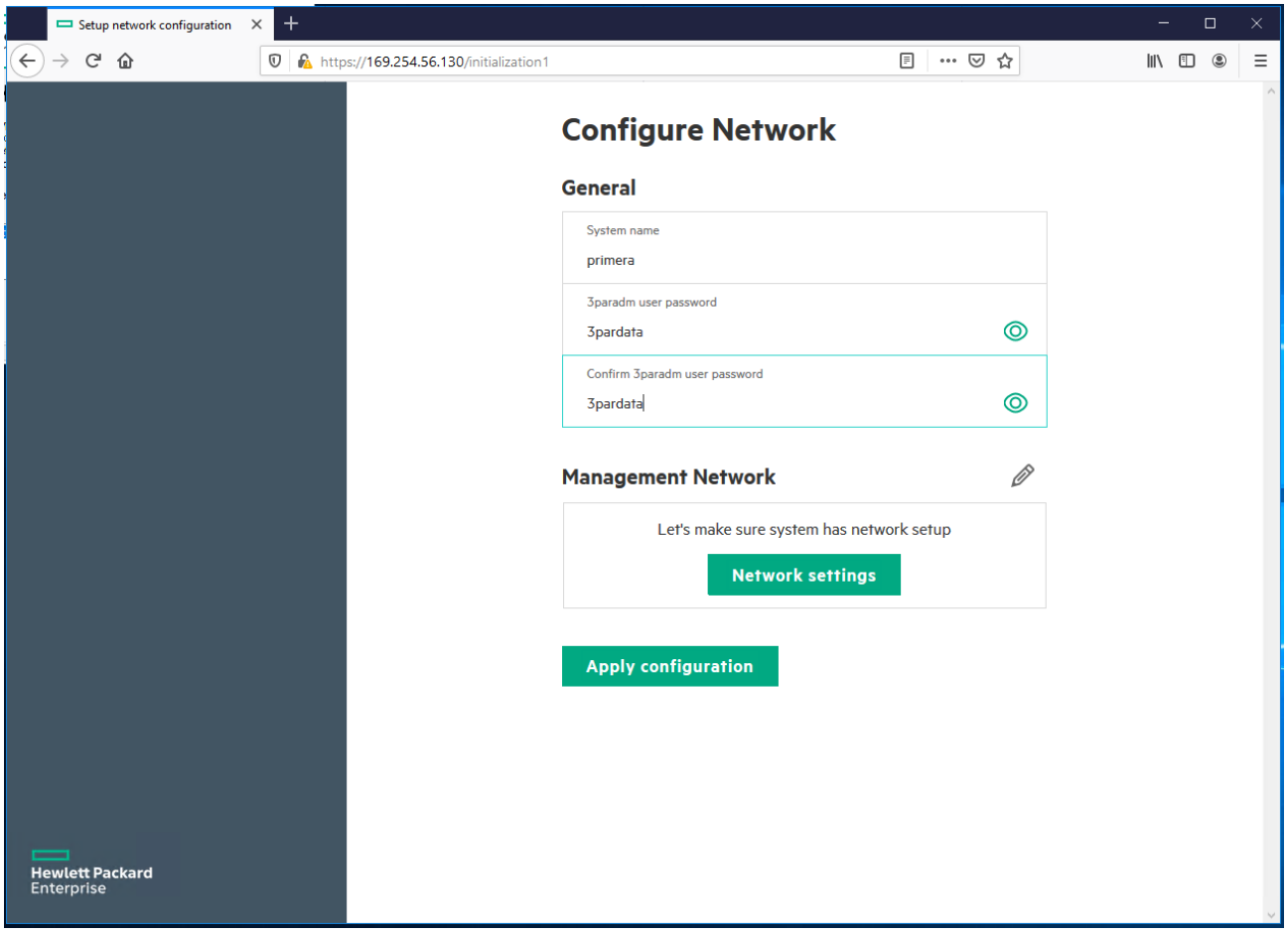

FIGURE 9. Configure the network

b. Management Network. Click **Network settings** and configure the following:

- Network type: **IPv4 only**
- IPv4 address: **<<primera1_mgmt_ip>>**
- IPv4 subnet mask: **<<mgmt_net_mask>>**
- IPv4 gateway: **<<mgmt_net_gw>>**
- DNS servers: **<<mgmt_net_dns1>>**
- Proxy settings

  If a proxy server is not required to establish internet communication, leave it unchecked and proceed to the next step. But, if a proxy server is required, check **Enable proxy** and work with the customer to enter the proxy parameters.

c. Click **Continue.**

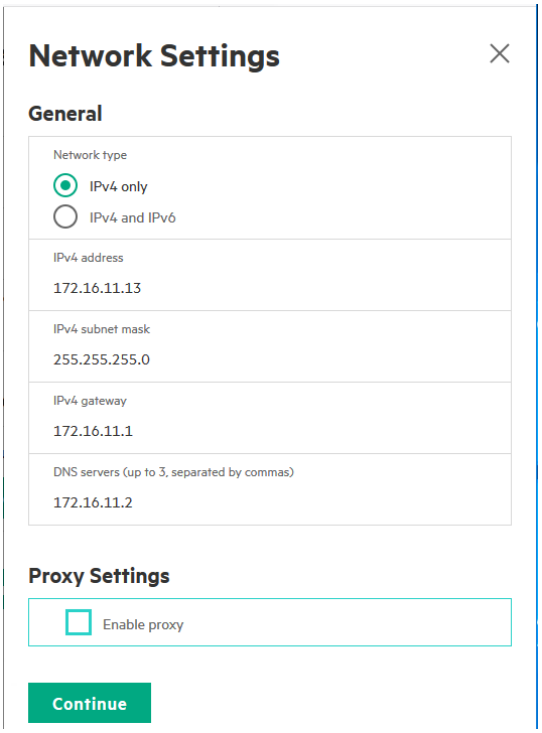

FIGURE 10. Configure the network

d. Review the configuration and click **Apply configuration.**

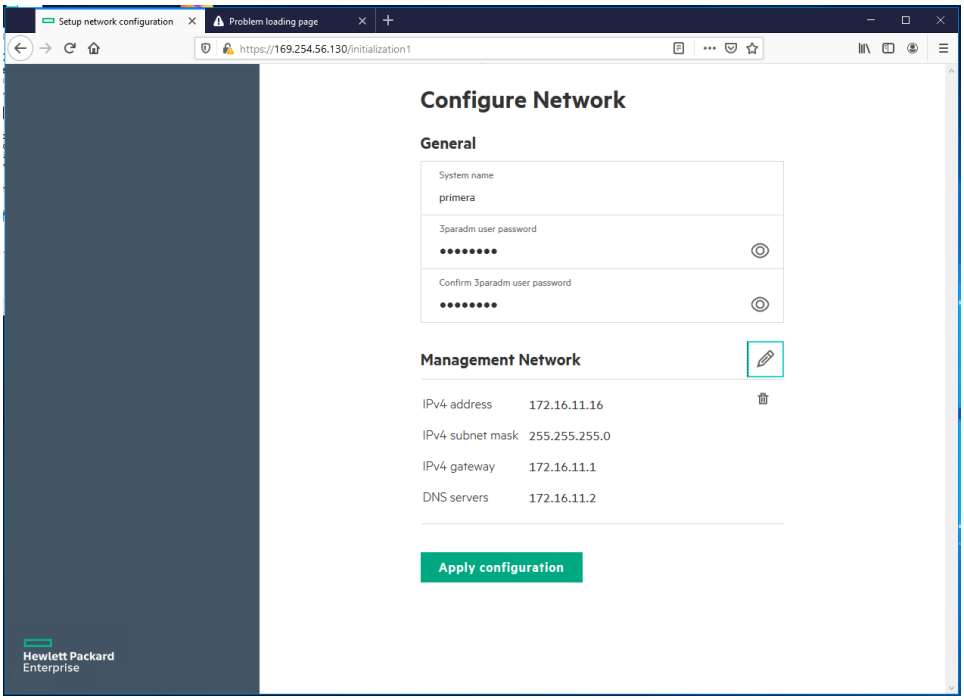

FIGURE 11. Review the network configuration

Update the HPE Primera OS

If required, update the HPE Primera OS to the version outlined in the HPE Synergy firmware and software compatibility matrix for VMware Cloud Foundation 3.9.1 document at https://www.hpe.com/psnow/doc/a50001407enw?jumpid=in_lit-psnow-red.

1. Log in to the HPE Primera UI and select **System > Software**.

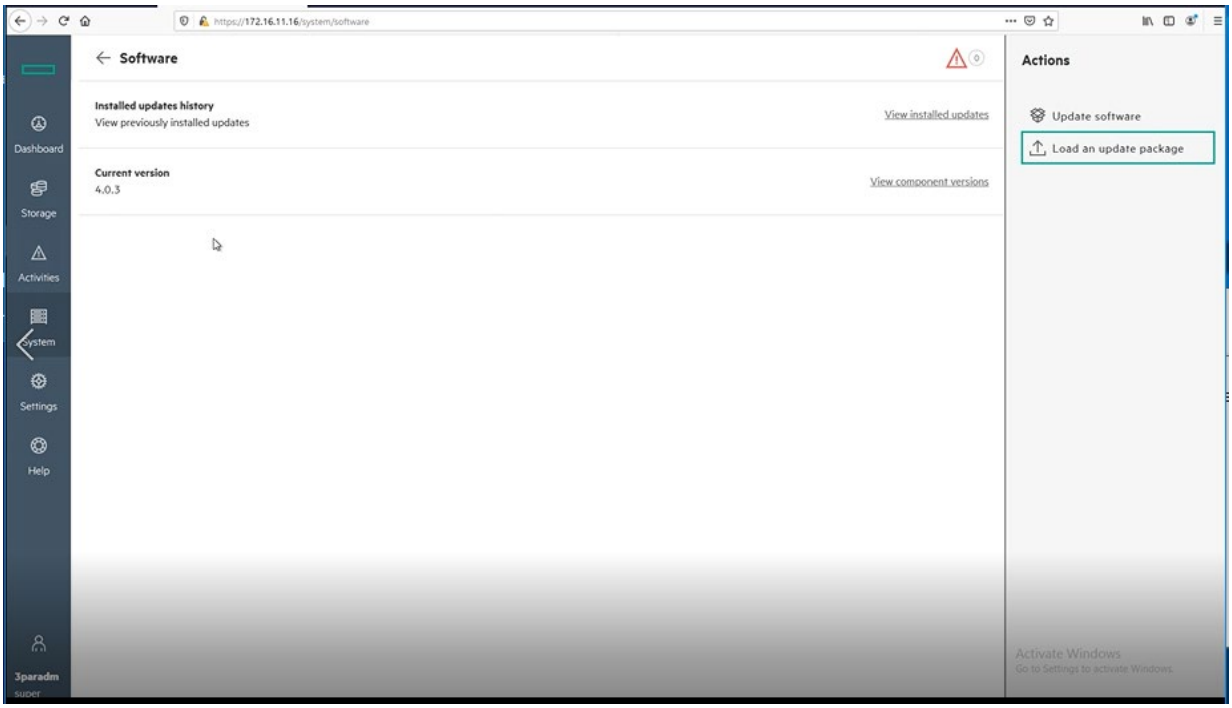

FIGURE 12. Update HPE Primera OS

2. Select **Check for updates** on the **Actions** menu to check if there are any HPE Primera OS update packages for the storage system.
   a. If the HPE Primera OS software package was obtained through another method, click **Load an update package** on the **Actions** menu and follow the instructions on the screen in order to upload the packages to the storage system.

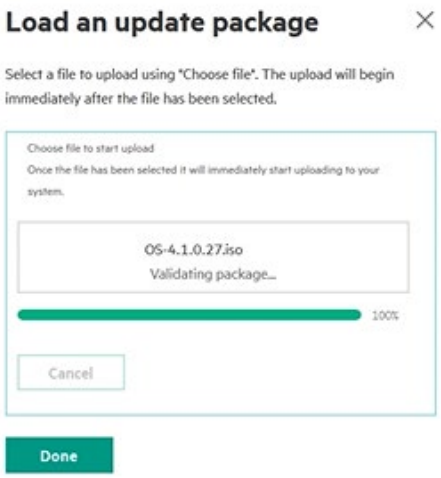

FIGURE 13. Load an HPE Primera OS update package

3. Click **Update software** on the **Actions** menu and follow the instructions on the screen to properly update the software on your storage system.

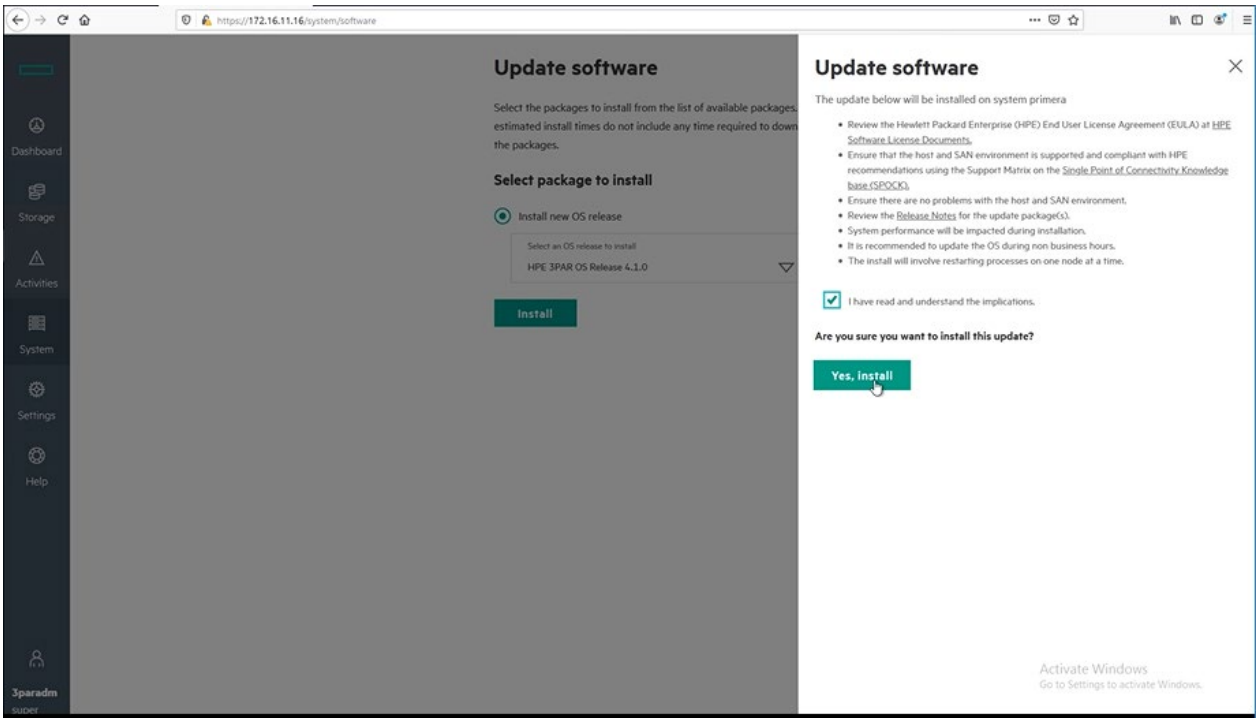

FIGURE 14. Update the software

BEST PRACTICES AND CONFIGURATION GUIDANCE FOR THE SOLUTION

HPE Primera volume provisioning and configuration using HPE OneView for Synergy

In this white paper, HPE OneView is used to provision, manage, and administer the HPE Primera storage, thus providing a single unified management pane for HPE Primera storage operations in the VMware Cloud Foundation environment. Provisioning an HPE Primera requires understanding the customer workload and the characteristics of data that will be stored on the array.

Provisioning HPE Primera fabric attach fibre channel (FC) LUN for management domain nodes

Table 1 shows the details of the firmware and software used in the configuration.

TABLE 1. Firmware and software versions

Name	Versions
VMware Cloud Foundation	3.9.1
HPE OneView	5.00.02
HPE Primera OS	4.1.0
HPE StoreFabric SN6600B Fibre Channel Switch	8.2.2b
VMware vCenter	6.7 Update 3b

1. Create SAN networks as shown in Figure 15 using fibre channel connections:
   a. With HPE OneView integrated into vCenter, navigate to **OneView > Networks > + Create Network**.
   b. Provide a unique name for the first storage network, for example SAN_A.
   c. Under **Type**, select **Fibre Channel**.
   d. Under **Fabric type**, choose **Fabric attach**.

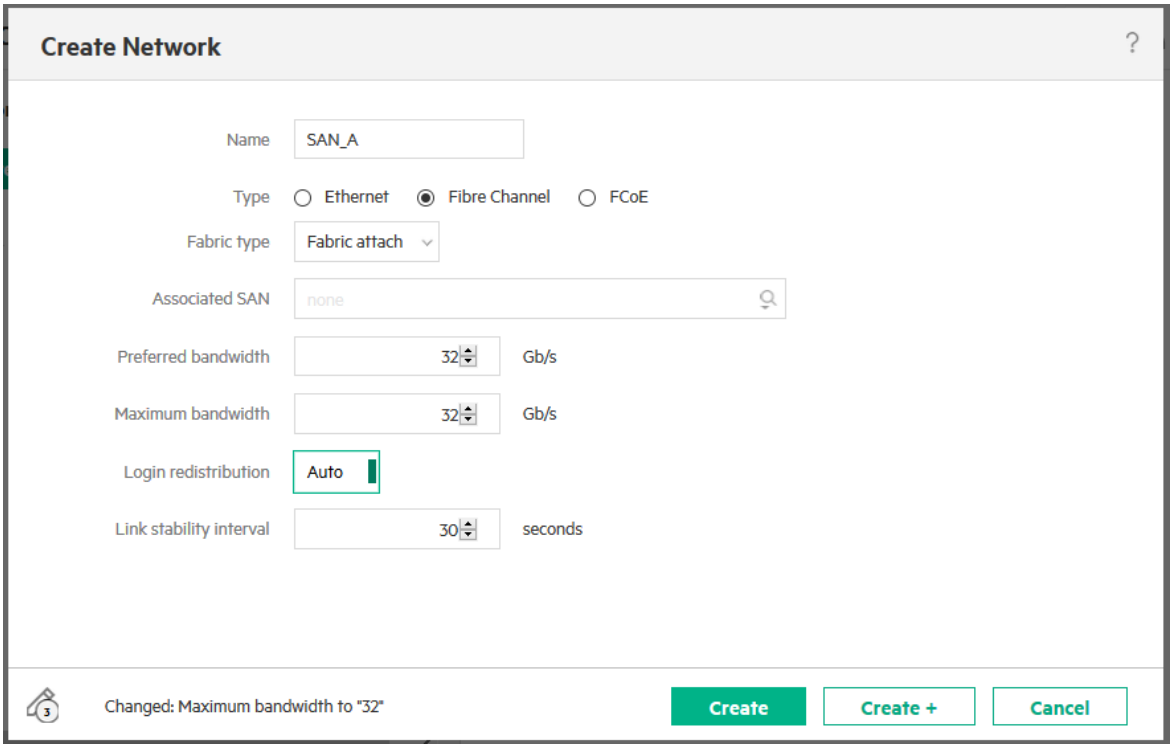

FIGURE 15. Create networks for SAN

2. Similarly, create a second SAN storage network SAN_B by clicking **Create +**.

3. Create a Logical Interconnect Group (LIG) as shown in Figure 16:
   a. Click **Create Logical Interconnect Group** in the **Logical Interconnect Group** screen to create an LIG for the FC connectivity.
   b. Provide a unique name for the LIG, for example "EG1_VCSE_32GBFC_LIG1".
   c. Under **Interconnect type**, select "Virtual Connect SE 32Gb FC Module for Synergy".
   d. Select **Enclosure count** as 1 (no user selection).
   e. Choose **Interconnect bay set** as 2.
   f. Choose **Redundancy** as "Redundant".
   g. Click **Select interconnects** and select **Virtual Connect SE 32Gb FC Module for Synergy for Bays 2 and 5**.

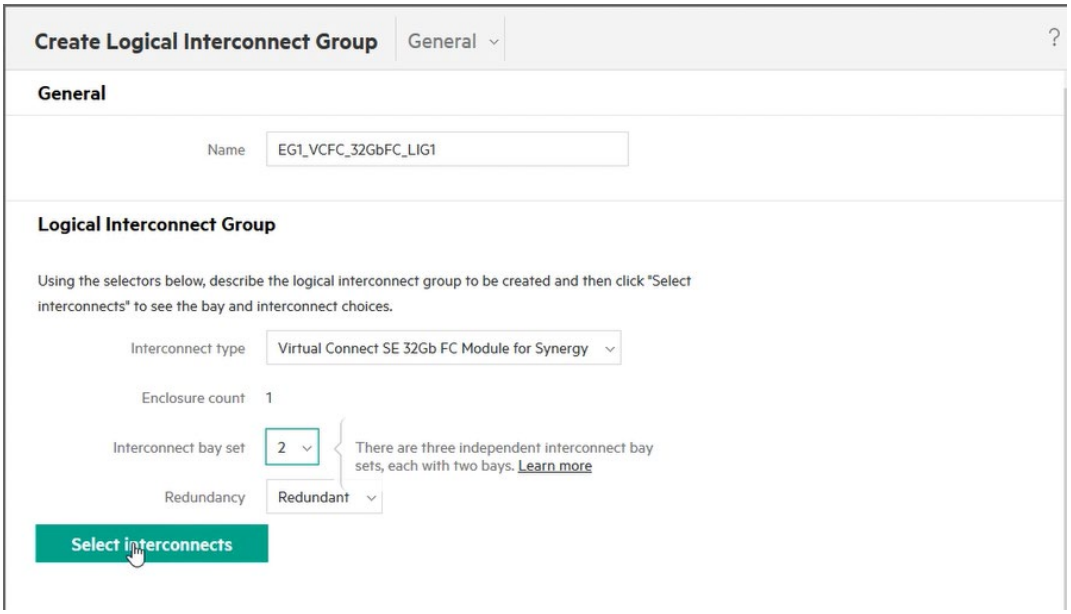

FIGURE 16. Create a Logical Interconnect Group

   h. In the **Logical Interconnect Group** section, click **Add uplink set**:
      I. Under **General** section, in the **Name** field, enter a unique name, for example "Uplinkset_SAN_A".
      II. Under **Type**, select "Fibre Channel".
      III. Under **Networks**, select "SAN_A".
      IV. Under **Uplink Ports** section, click **Add uplink ports**.
      V. Select the appropriate uplink ports and click **Add**.
      VI. Click **Create** in the **Create Uplink Set** screen.
      VII. Similarly, add an uplink port "Uplinkset_SAN_B" by clicking **Create +**.
      VIII. Click **Create +** in Logical Interconnect Group to create the LIG.

4. Add a SAN Manager to HPE OneView for Synergy:
   a. Click **OneView** > **SAN Managers**.
   b. Click **Add SAN Manager**.

      HPE OneView 5.0 provides a new SAN Manager type which utilizes the Brocade FOS switch REST API to manage Brocade SANs. Follow the requirements for setting up the fibre channel switch to support operation with the HPE OneView SAN Manager.

      I. The switch must be running in the "Native" switch mode.
      II. The switch must be running Brocade switch FOS version 8.0.2b or later.
      III. The HPE OneView software version should be 5.0 or later.
      IV. The FOS REST API is enabled by default. If it is disabled, it must be enabled using the following command:

      ```
      mgmtapp -enable REST
      ```

      V. Update the maximum session per switch from default 3 to 4 for integration with HPE OneView:

      ```
      mgmtapp -config -maxrestsession 4
      ```

5. Configure SAN Manager with Brocade FOS switch as shown in Figure 17.
   a. In the Add SAN Manager screen, select the **SAN Manager type** as "Brocade FOS Switch".
   b. Provide the FQDN/IP address of a native mode switch in the SAN, and REST API login credentials to authenticate.
   c. Click the **Add** button, or **Add +** button to add another Brocade FOS switch as SAN Manager.

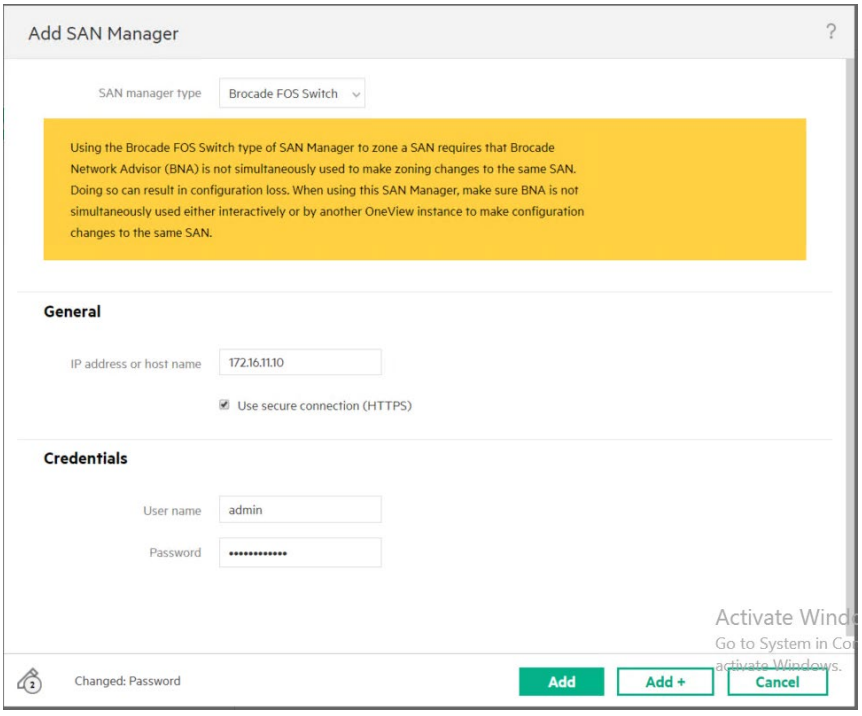

FIGURE 17. Add SAN Manager with Brocade FOS switch

6. Associate SAN networks with SAN fabrics:
   a. From the top left corner, click **OneView** > **Networks**.
   b. Select **SAN_A** and then click **Actions > Edit.**

c. In the **Associated SAN** field, select **<<san_switch1_hostname>>.**

d. Click **OK**.

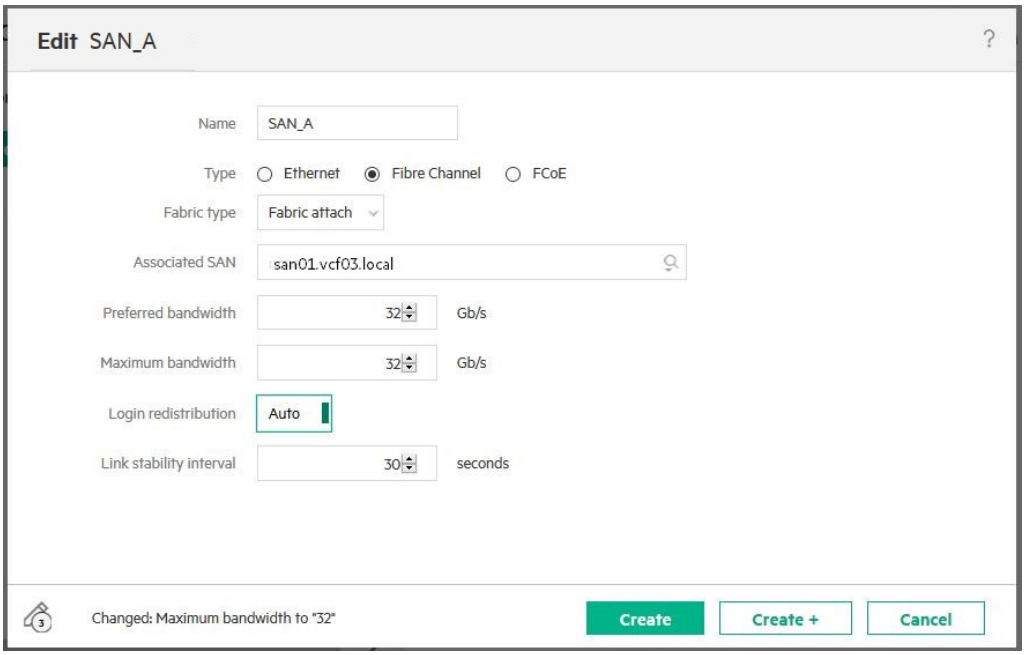

FIGURE 18. Associate the SAN_A with SAN fabric

e. Repeat step 6 to associate **SAN_B** with **<<san_switch2_hostname>>.**

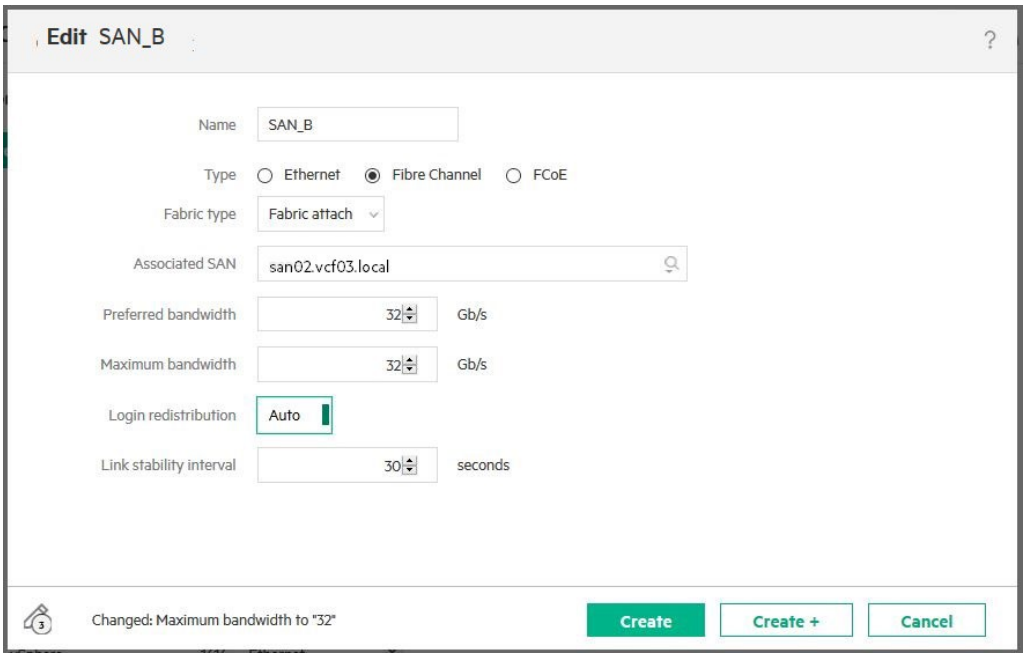

FIGURE 19. Associate the SAN_B with SAN fabric

7. Update enclosure groups:
   a. From the top left corner, click **OneView** > **Enclosure Groups**.
   b. Select **Enclosure Group** and then click **Actions > Edit.**

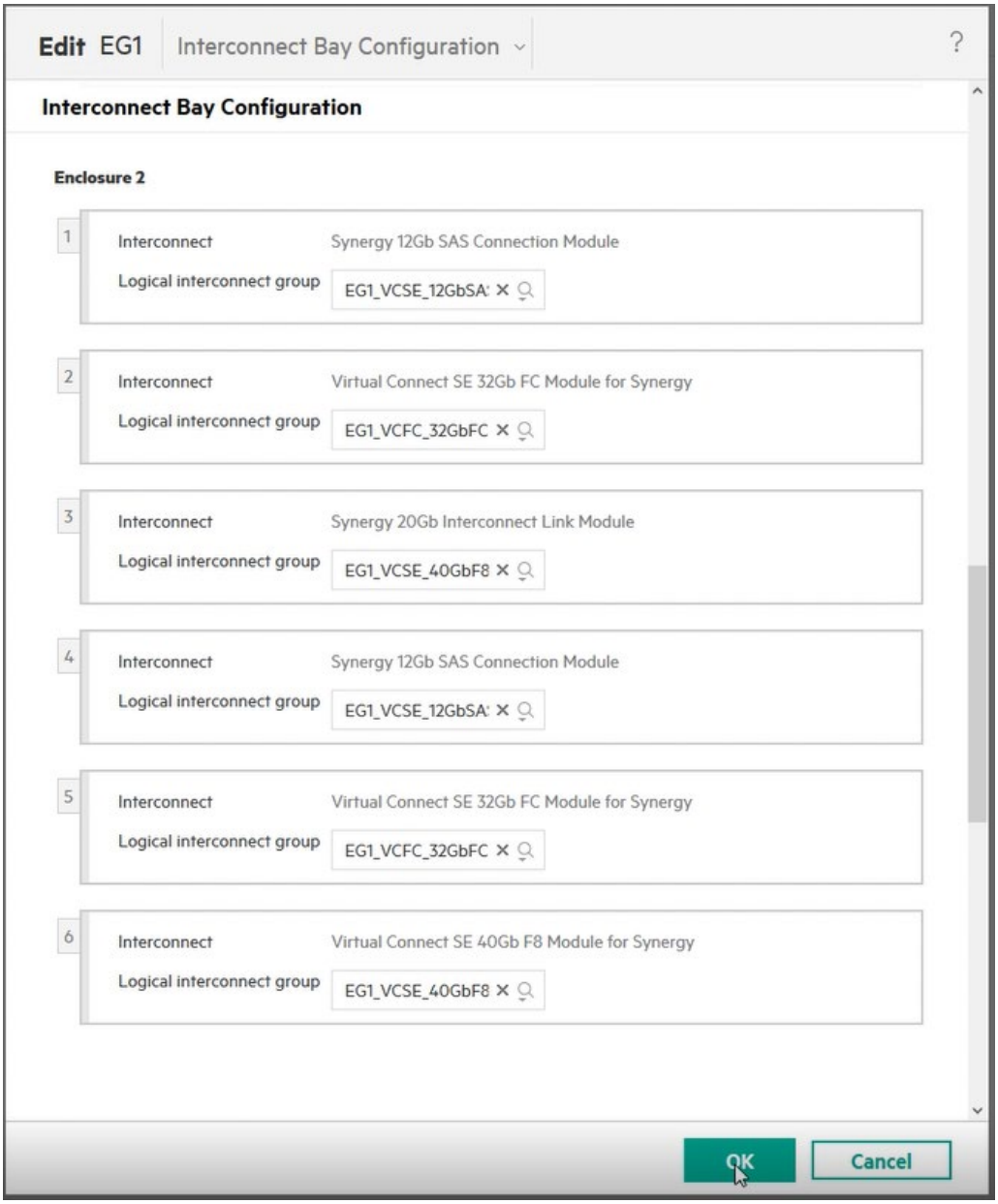

FIGURE 20. Update the enclosure group

8. Update Logical Enclosure (LE)
   a. From the top left corner, click **OneView** > **Logical Enclosures**.
   b. Select **Logical Enclosure** and then click **Actions > Update from group.**

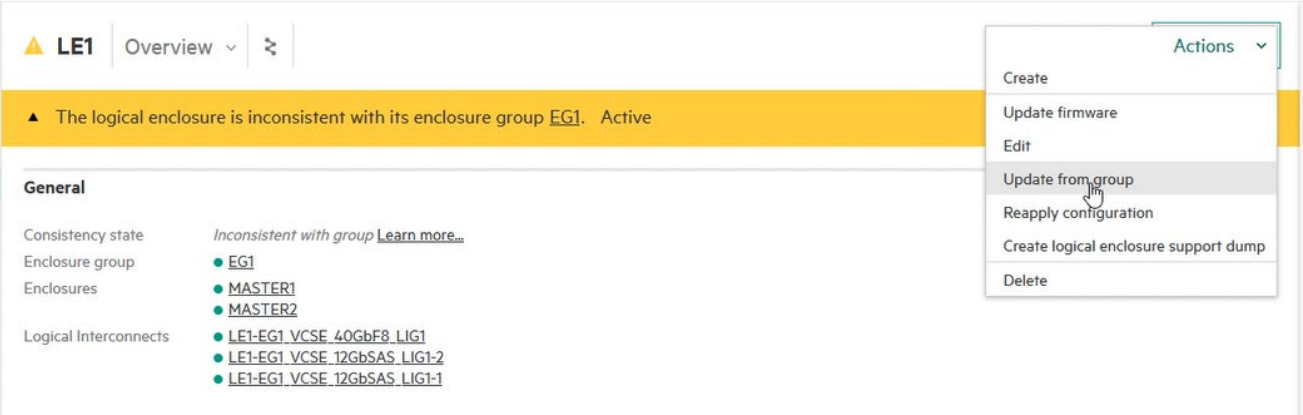

FIGURE 21. Update the logical enclosure

9. Import HPE Primera storage as shown in Figure 22:
   a. Click **OneView > Storage Systems and then c**lick **Add Storage Systems**.
   b. Select **Storage system type** as "Primera" and provide **IP address or hostname**: **<<Primera_fqdn>>.**
   c. Enter the User name: **3paradm**
   d. Password: **<<primera_adm_pwd>>**
   e. Click **Connect.**

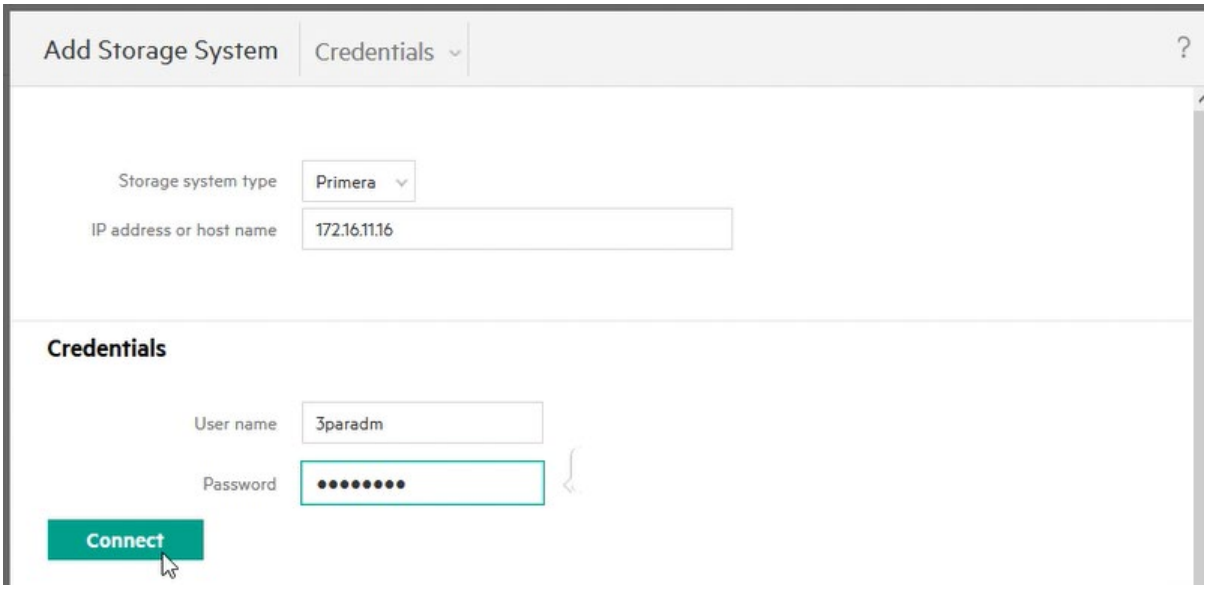

FIGURE 22. Add storage system

   f. Click **Add.**

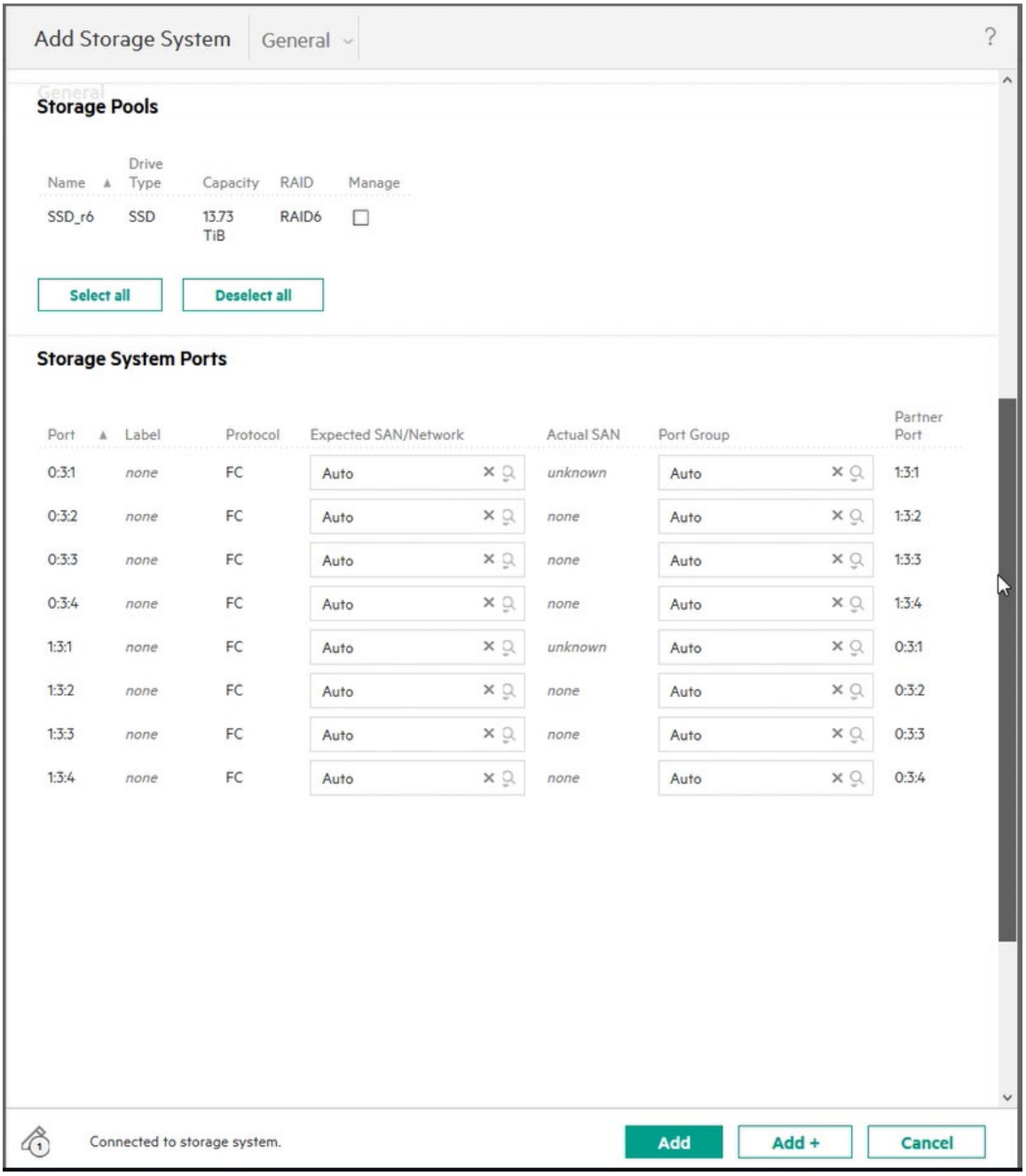

FIGURE 23. Add storage system

10. Change the storage pool state:

    a. From the top left corner, click **OneView** > **Storage Pools**.

    b. Select **Storage Pool** and then click **Actions > Edit**.

    c. Select the **State** check box > **Managed**.

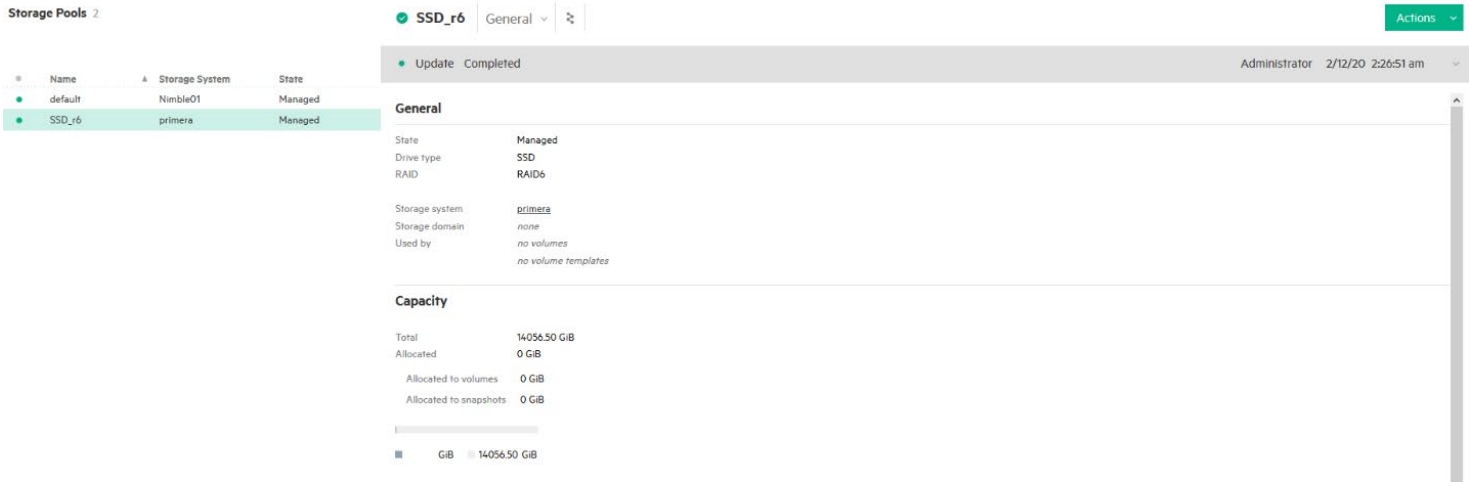

FIGURE 24. Update the storage pool state

11. Create and attach storage volumes to the HPE Synergy management and compute host profiles:
    a. Click **OneView > Storage Systems.**
    b. Click **Create volume template.**
    c. Enter the required details in the **Name, Description, Storage pool, and Capacity, Sharing, and Provisioning** fields as shown in Figure 25.

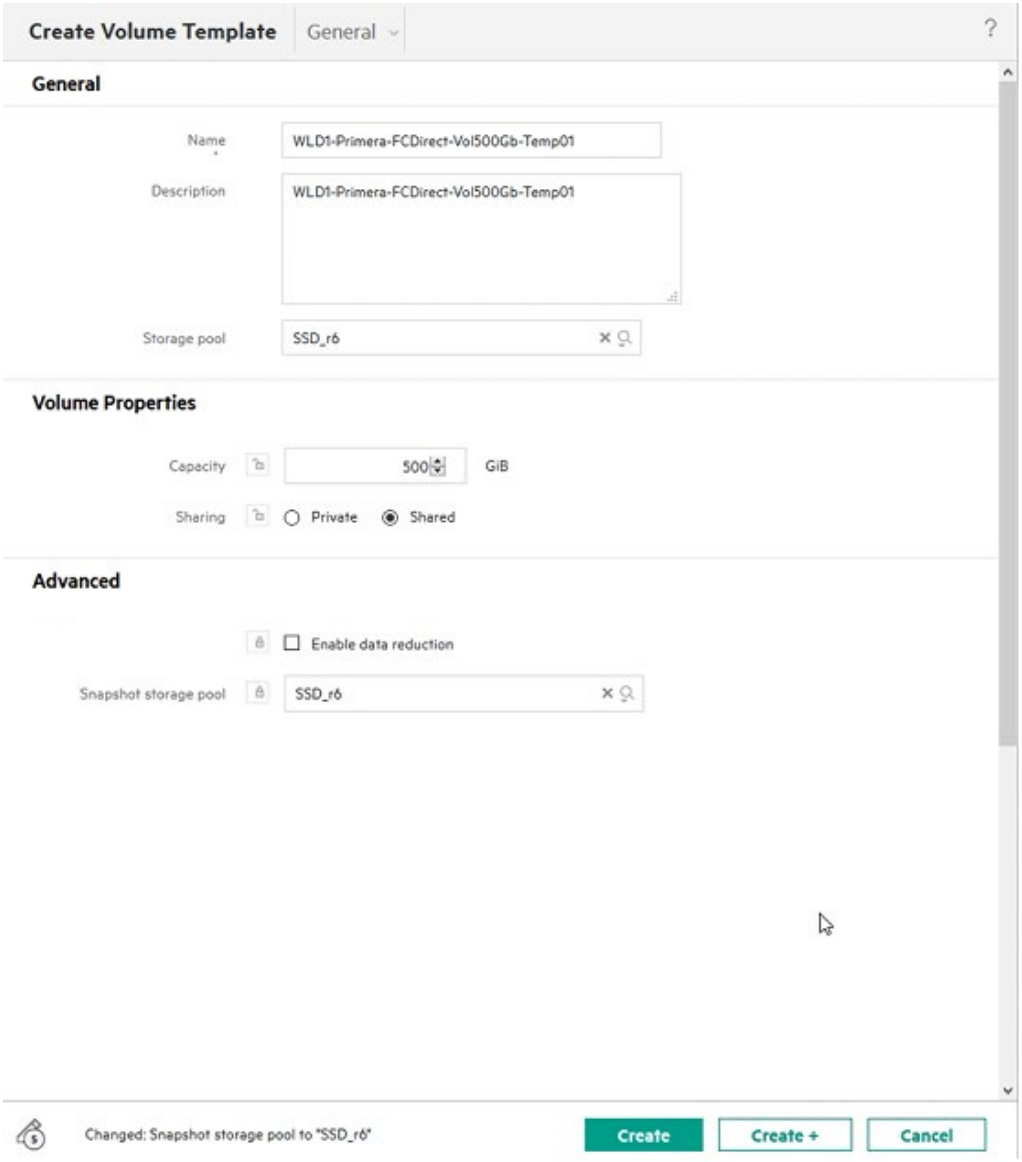

FIGURE 25. Create Volume Template

    d. Click **Create**.
    e. Click **OneView > Storage Systems**.
    f. Click **Create volume**.
    g. Enter the required details in the Name, Description, and Volume template fields as shown in Figure 26.

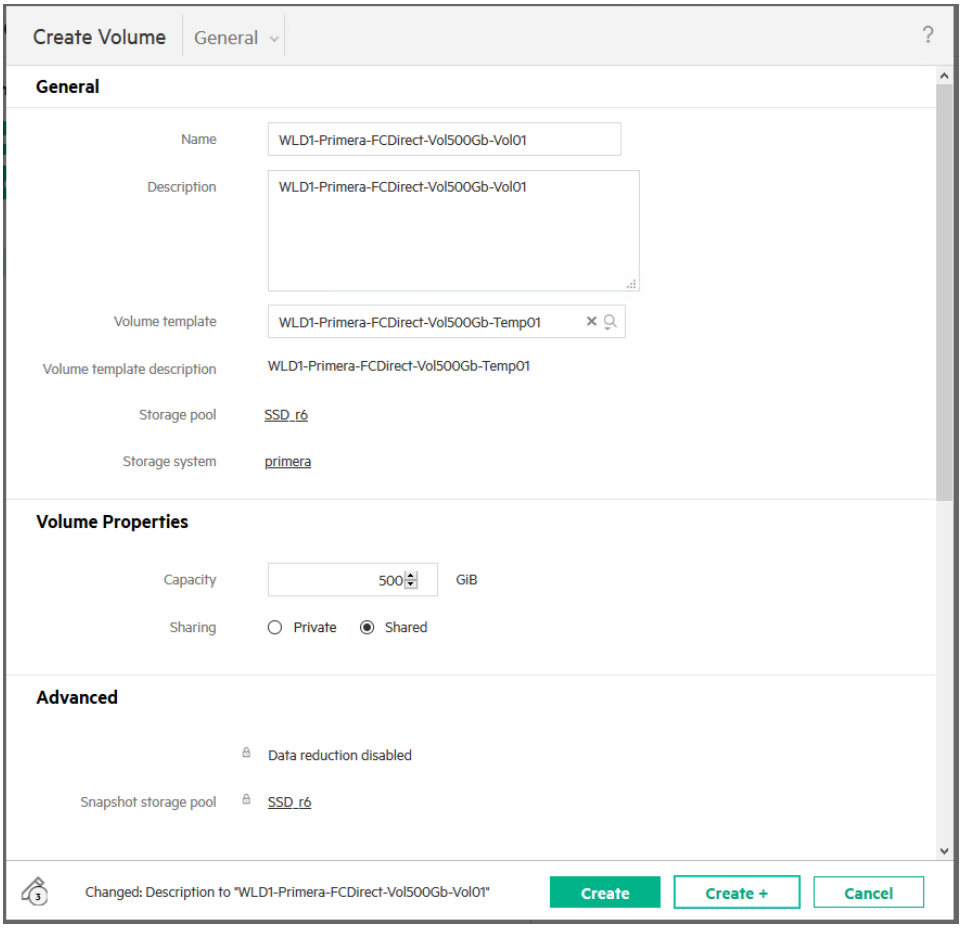

FIGURE 26. Create volume

h. Click **Create**.

12. Update the HPE Synergy Gen10 server profile template for SAN connections and SAN storage:
    a. Click **OneView** > **Server Profile Templates**.
    b. Select the appropriate server profile template.
    c. Click **Actions** > **Edit.**
    d. Update for SAN connections, scroll down to **connections**.
    e. Click **Add connections,** provide the details for **Name, Function type, Network, Requested bandwidth** and **boot**, as shown in Figure 27.

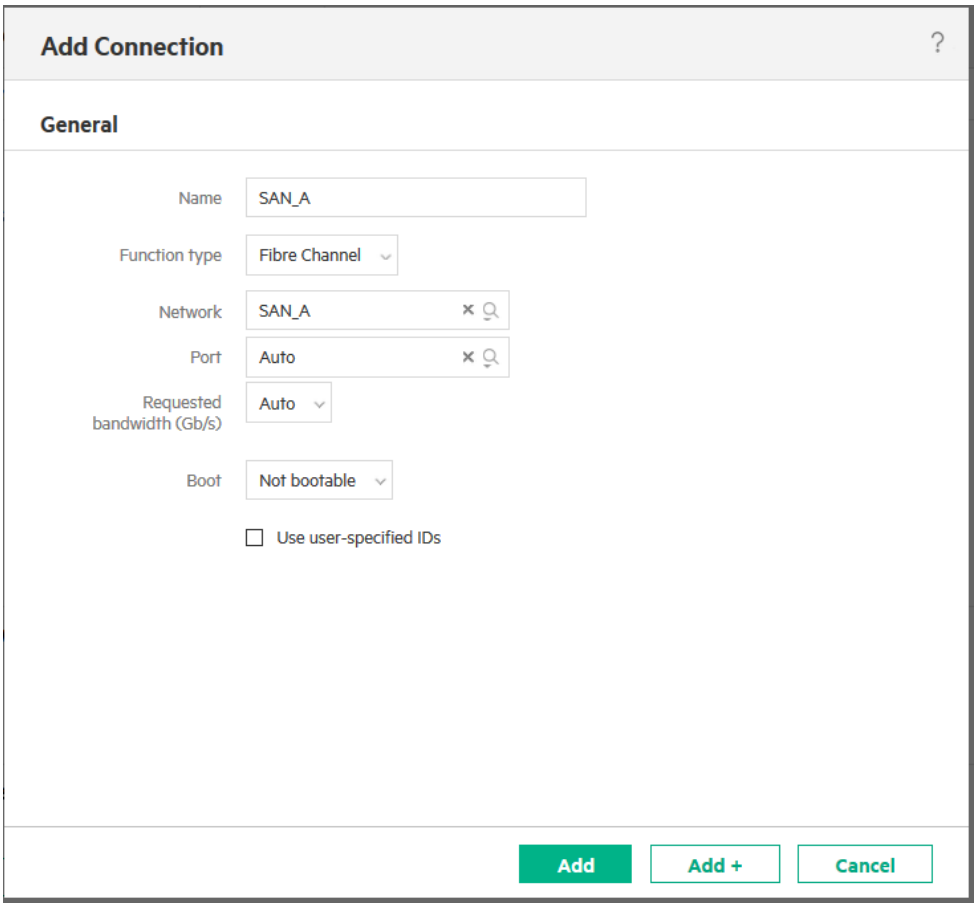

FIGURE 27. Add connections

    f. Similarly, click Add+ to add connection SAN_B.
    g. Attach volume, scroll down to SAN Storage to check Manage SAN Storage, and select the Host OS type as VMware (ESXi).

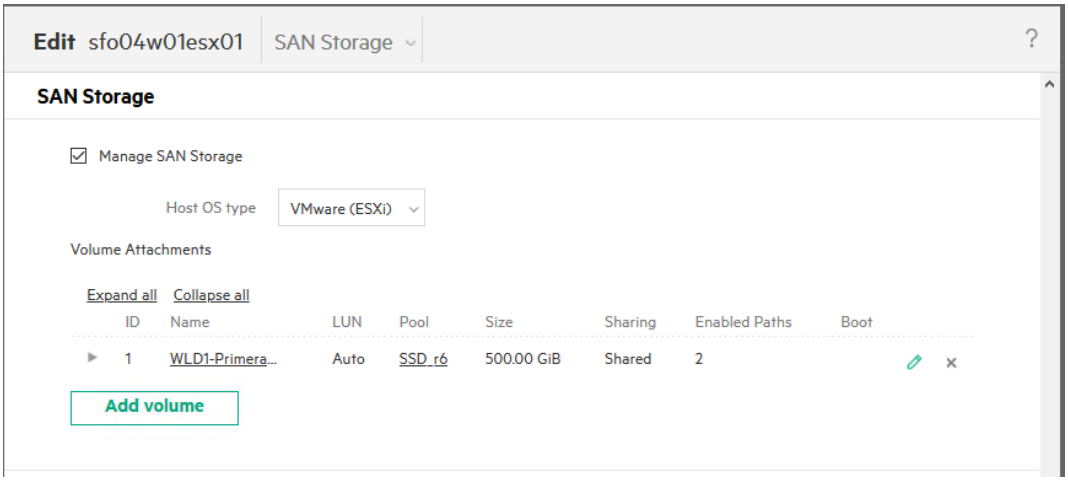

FIGURE 28. Add connection

h. Click Add volume and enter the required details.

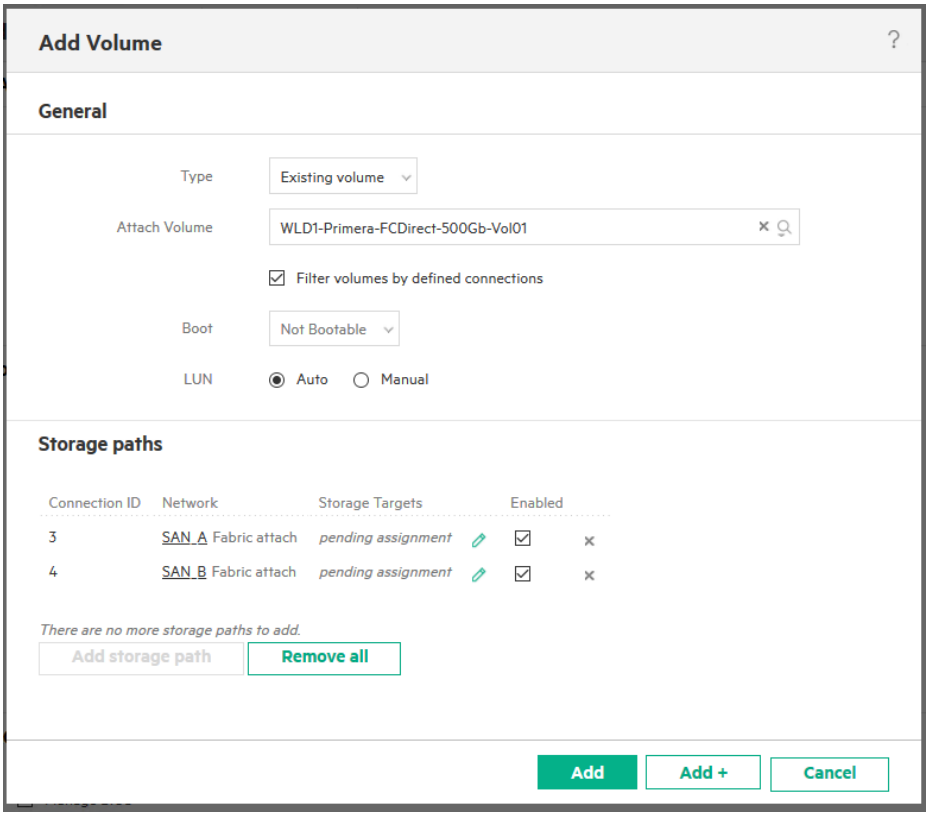

FIGURE 29. Add volume

i. Click **Add**.

j. Click **OK** to update the server profile template.

13. Apply the server profile template changes to the hosts:

    a. Click **OneView > Server Profiles**.

    b. Click **Update** from template then click **Yes, update**.

    c. Repeat for each server profile that is inconsistent with its respective server profile template.

Compose servers using SDDC Manager for VCF workload domains

Starting with VCF 3.9.x, workload domain can deployed on block storages (VMFS on FC). However, if the solution has D3940 storage system (vSAN) as part of the workload domains, HPE OneView connector for VCF 0.3.3 enables composability feature to provide a pure cloud experience in provisioning and deprovisioning of composable resources (compute, storage and networking resources of HPE Synergy). The HPE OneView connector for VCF is based on a Linux instance (virtual or physical) and Hewlett Packard Enterprise recommends to install the connector in the management domain of VMware Cloud Foundation.

1. Choose the available server profile template from the **Available Resources** section on the Composable Infrastructure page as shown in Figure 30 and click **Compose**.

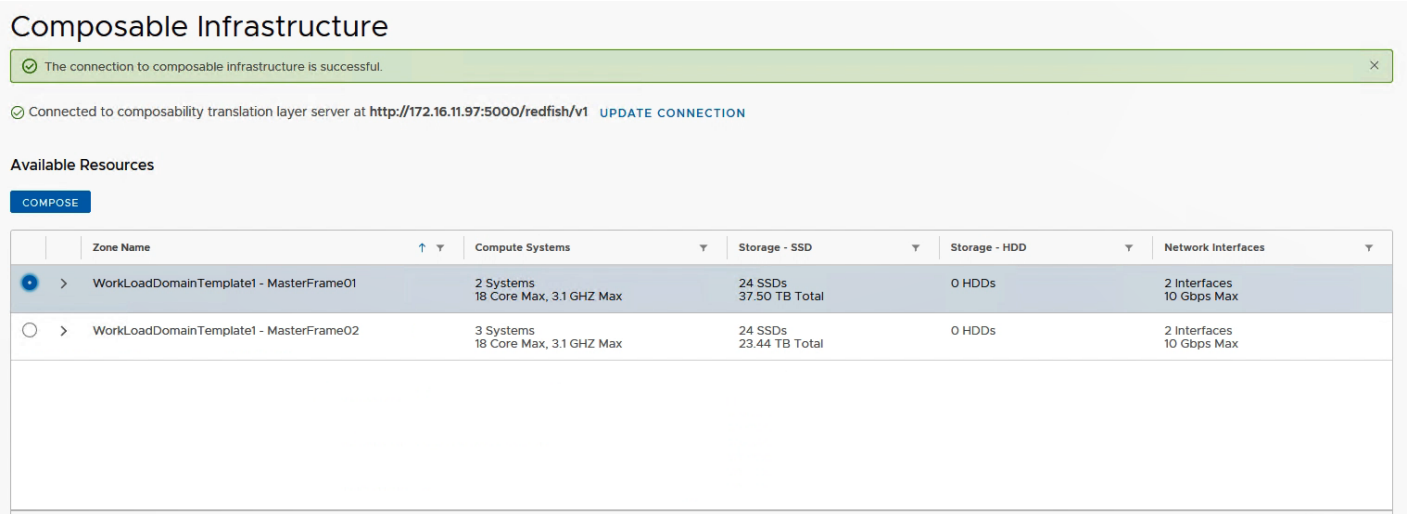

FIGURE 30. Select server profile template

2. Allocate the resources per server, storage, network interfaces, and number of servers. Review the same and click **Next**. Figure 31 shows an example for the composing of compute resource.

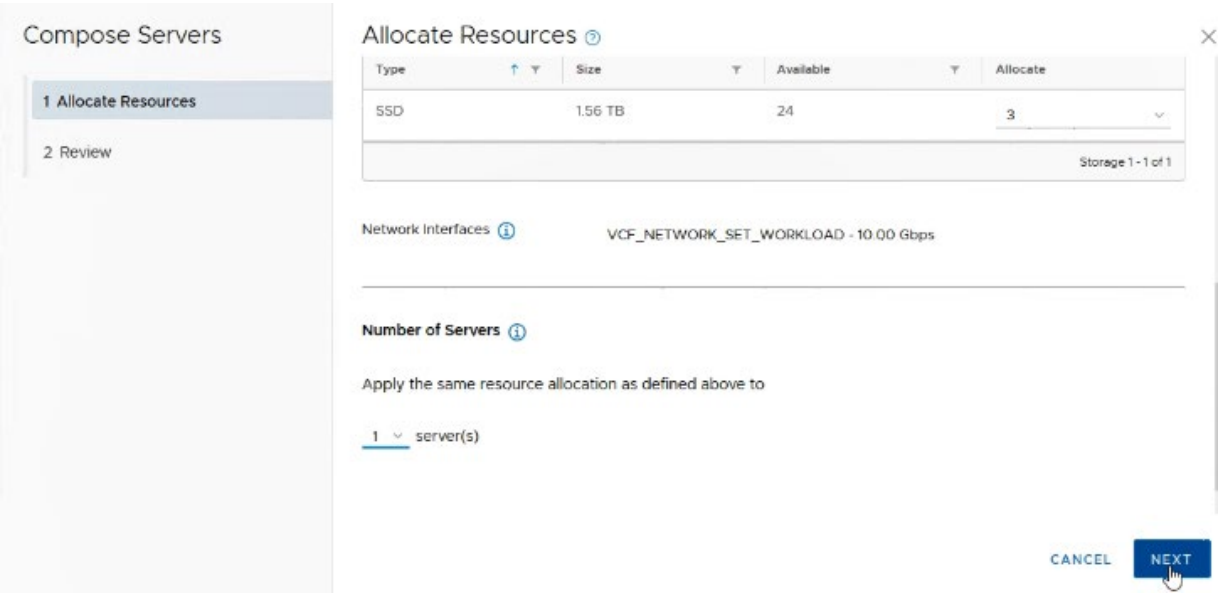

FIGURE 31. Allocate Resources for Compose Servers

3. Review the Compose Servers configuration and Click **Compose**.

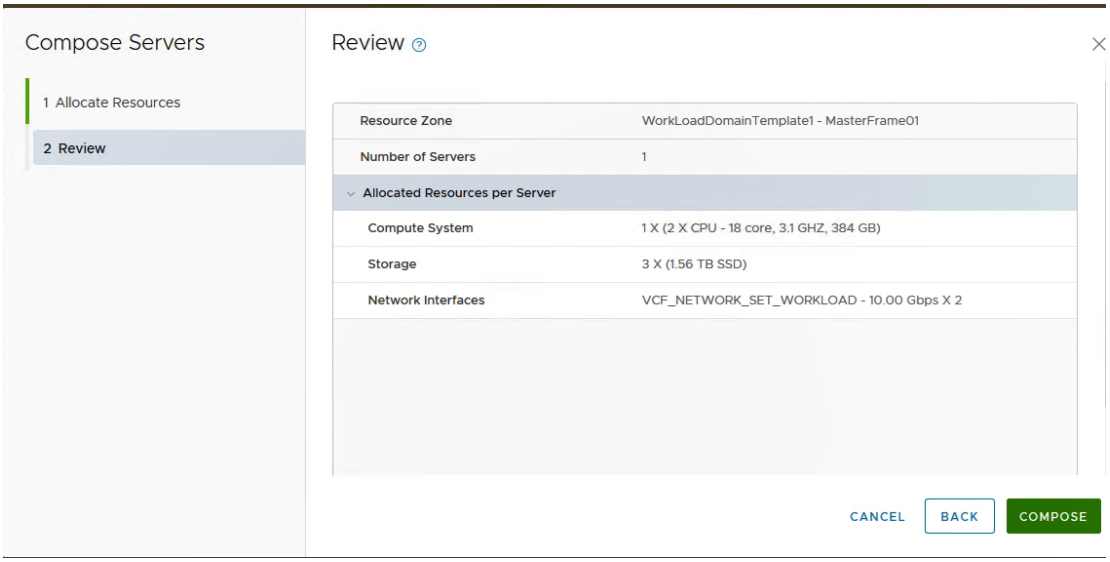

FIGURE 32. Compose the Servers

NOTE

When composing servers via HPE OneView connector for VCF when the server does not have internal hard disk drives (HPE Primera is the only choice of storage for workload domain), compose the servers using HPE OneView and not using HPE OneView connector for VCF. If you choose to configure your workload domain with HPE Synergy D3940 using vSAN along with Primera, compose/decompose of servers should be performed using HPE OneView connector for VCF via SDDC Manager.

VCF workload domain deployment using HPE Primera as principal storage

The SDDC manager allows VMFS datastores over fibre channel storage. This white paper uses HPE Primera as principal storage for the VCF workload domain. Before commissioning the workload domain hosts on SDDC Manager, the VMFS datastore LUN should be presented to workload domain hosts and VMFS datastore should be created.

Once all the workload domain hosts are deployed and configured with ESXi and HPE Primera LUN presented to all workload domain ESXi hosts, do the following:

1. Log in to one of the ESXi hosts web client.
2. Rescan the storage adapters for new storage devices.
3. Create a new VMFS-6 datastore and note the datastore name for the creation of workload domain.
4. Log in to the remaining ESXi hosts web client to verify that the hosts can see the newly created datastore, as shown in Figure 33.

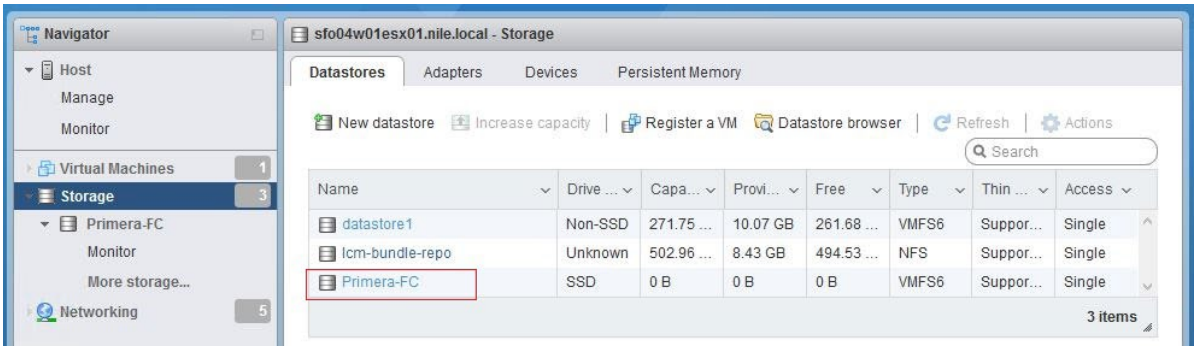

FIGURE 33. VMFS on FC datastore

Create a new workload domain in SDDC Manager

1. Create a network pool.

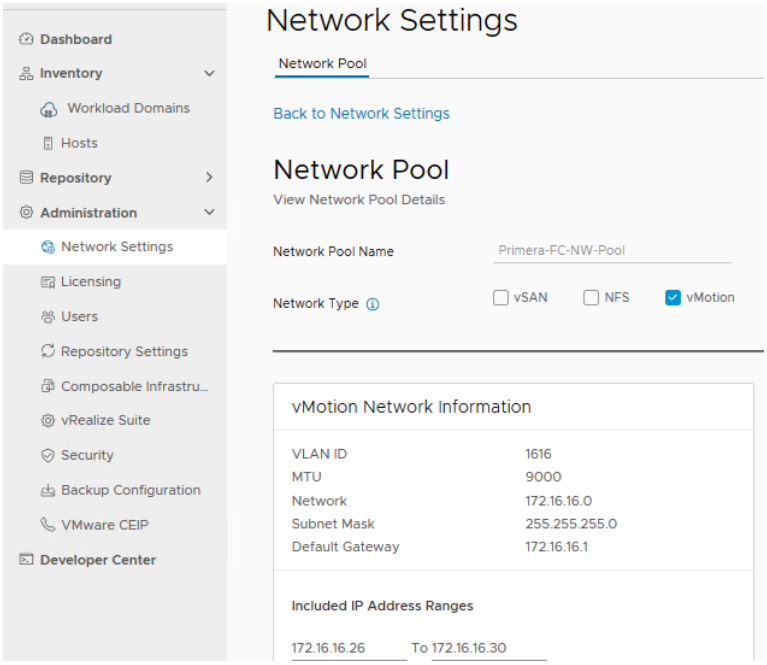

FIGURE 34. Create a network pool

2. Commission the workload domain nodes.

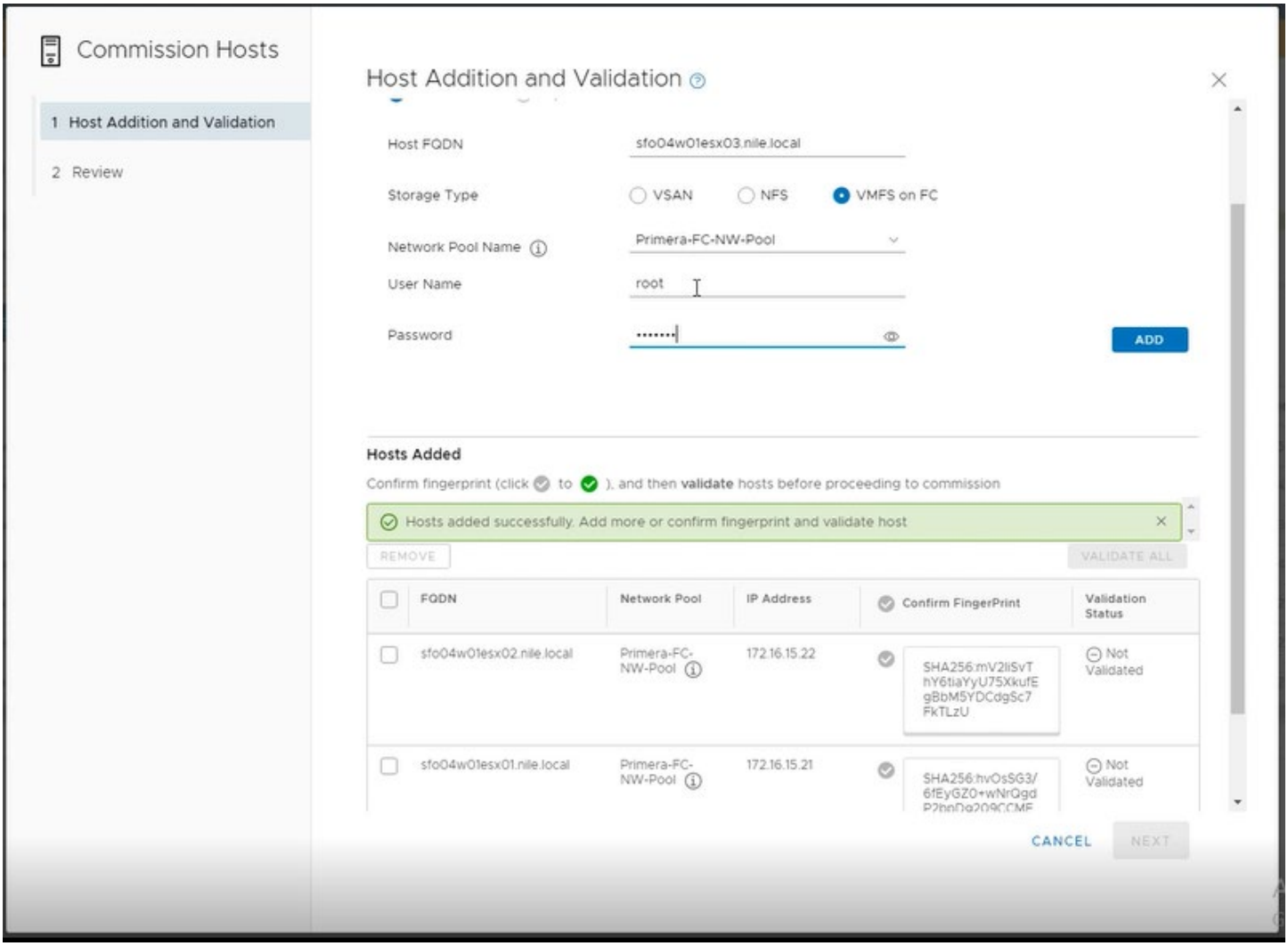

FIGURE 35. Commission the hosts

3. Create a new workload domain from the commissioned hosts:

   a. From the SDDC Manager Dashboard, select **+Workload Domain > VI – Virtual Infrastructure**.

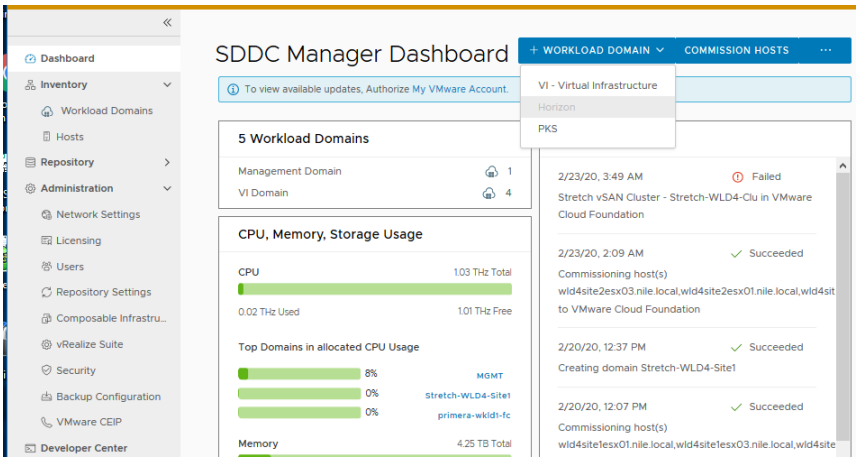

FIGURE 36. SDDC Manager Dashboard

   b. Select **VMFS on FC** as the storage and click **Begin**.

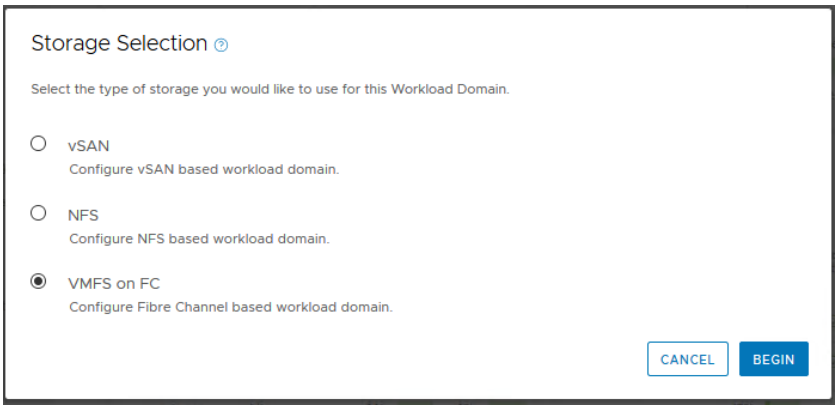

FIGURE 37. Select VMFS on FC as the Storage

c. When the **VI Configuration** wizard begins, enter the environment-specific details into the **Name**, **Compute**, **Networking**, **vSAN Storage**, **Host Selection, License,** and **Object Names** pages.

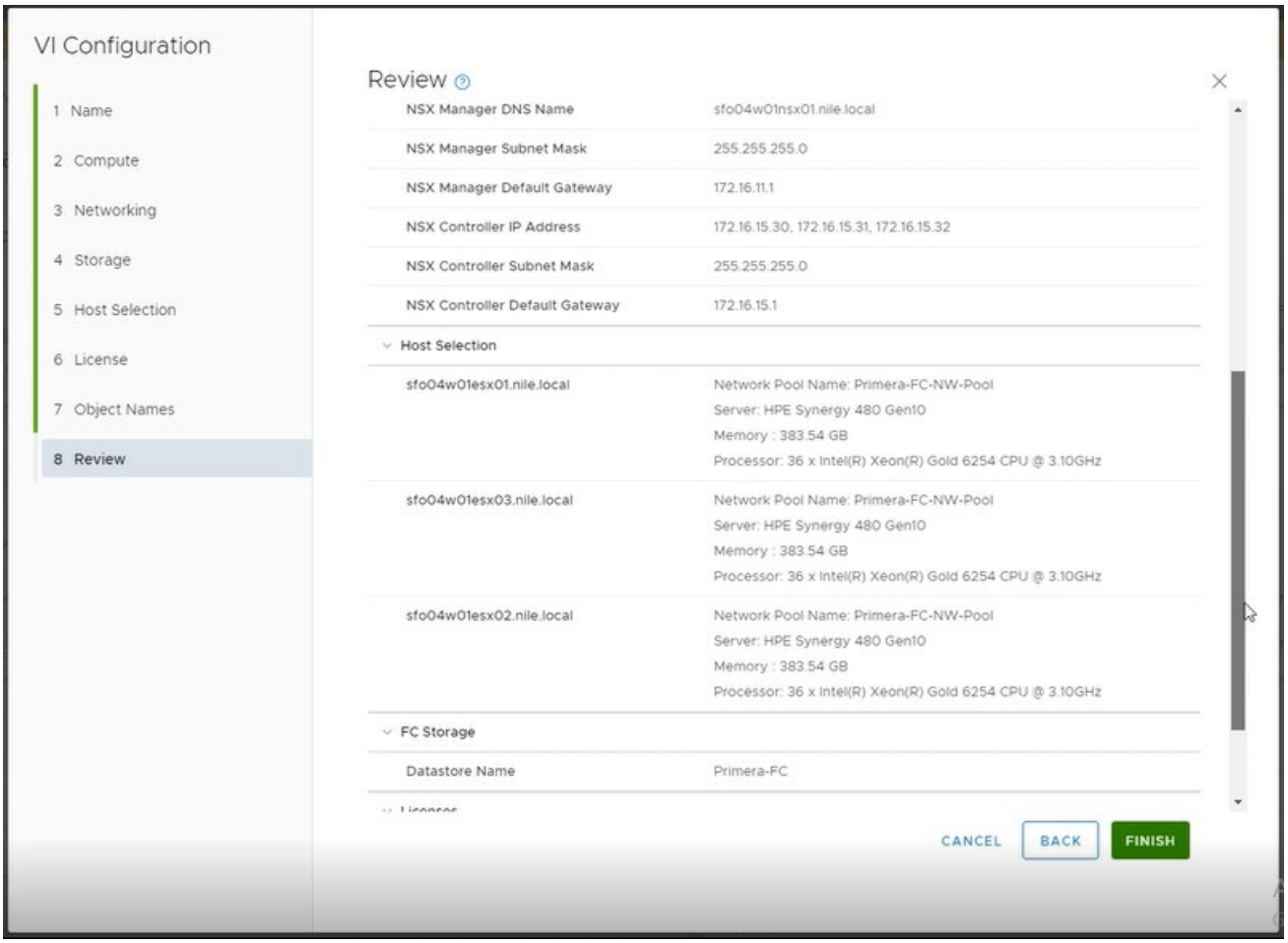

FIGURE 38. SDDC VI Configuration

d. Once the workload domain installation is complete, the new VI workload domain appears.

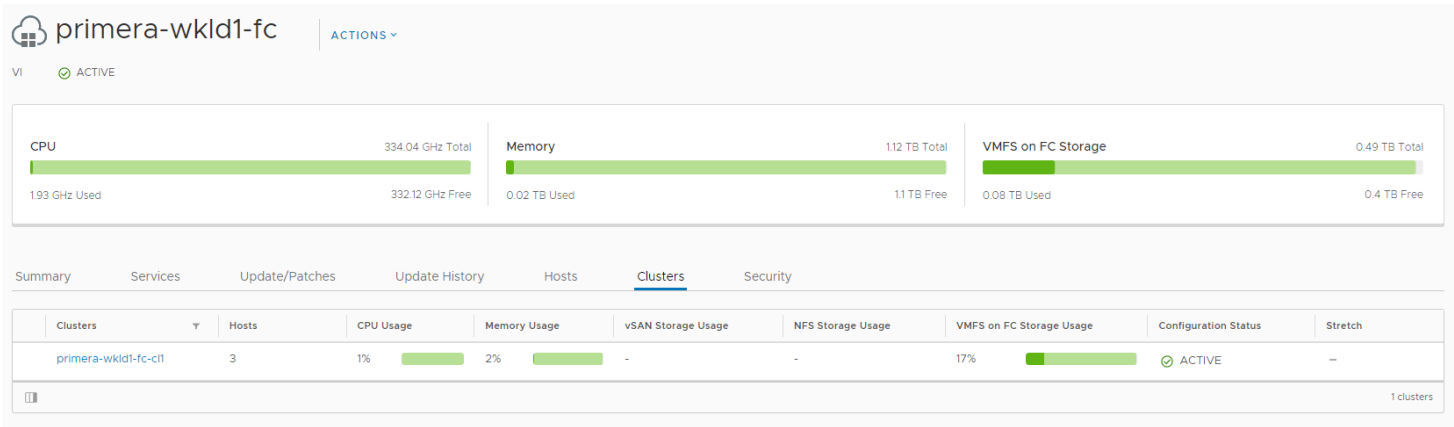

FIGURE 39. HPE Primera as a principal storage for workload domain

SUMMARY

HPE Synergy combined with VMware Cloud Foundation delivers a secure enterprise-ready private cloud that is flexible, simple to deploy, and cost efficient. This technical white paper demonstrates the configuration of HPE Primera storage as principal storage for VMware Cloud Foundation VI workload domain.

RESOURCES AND ADDITIONAL LINKS

HPE Synergy, hpe.com/in/en/integrated-systems/synergy.html

VMware Cloud Foundation, https://docs.vmware.com/en/VMware-Cloud-Foundation/3.9.1/rn/VMware-Cloud-Foundation-391-Release-Notes.html

HPE Synergy firmware and software compatibility matrix for VMware Cloud Foundation 3.9.1, https://www.hpe.com/psnow/doc/a50001407enw?jumpid=in_lit-psnow-red

HPE Primera 600 Storage Documentation, https://support.hpe.com/hpesc/public/km/product/1011658395/hpe-primera-600-storage#t=Documents&sort=relevancy&layout=table&numberOfResults=50&f:@kmdoctype=[cv60000005]&f:@kmdoclanguagecode=[cv1871440]&hpe=1

HPE Servers, hpe.com/servers

HPE Storage, hpe.com/storage

HPE Networking, hpe.com/networking

HPE GreenLake Advisory and Professional Services, https://www.hpe.com/us/en/services/consulting.html

To help us improve our documents, please provide feedback at hpe.com/contact/feedback.

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