Hewlett Packard Enterprise

Reference architecture

HPE Reference Architecture for HPE VM Essentials Software 8.0.4

HPE ProLiant Servers and HPE Alletra Storage MP B10000-iSCSI

Contents

Executive summary

HPE VM Essentials (VME) software is a unique software offering which provides highly-available HPE VM Essentials hypervisor clusters based on KVM, while also providing the ability to connect to existing VMware vCenter clusters for unified management of VM workloads. The solution provides per-socket pricing, brownfield VM discovery, and a simple VM-as-a-service provisioning interface into both HPE VM Essentials and VMware hosts. Available as standalone software or as an embedded option within HPE Private Cloud offerings, this enterprise-grade solution is supported by HPE's global support organization.

Built on the same KVM foundation that powers the world's leading hyperscale clouds, the HPE VM Essentials hypervisor extends its capabilities with advanced cluster management features such as intelligent resource-based placement, host-to-host live migration, high availability, hot resize and reconfiguration, security hardening, and integrated data protection. In the event of a host failure within an HPE VM Essentials cluster, virtual machines are automatically restarted on another available host, ensuring continuous availability and minimal service disruption.

To enable flexibility for those continuing to use VMware by Broadcom-based clusters, HPE VM Essentials manager software will also connect to existing VMware vSphere clusters for customers who want to simplify management and provisioning of instances into both VMware ESXi and HPE VM Essentials hosts from one unified solution. In addition to a simple VM provisioning catalog, HPE VM Essentials manager also includes integration into external IPAM and DNS solutions, secure key management, automation execution, built-in data protection, and basic VMware ESXi-to-HPE VM Essentials image format conversion.

Lastly, HPE VM Essentials software offers an upgrade path to the full Morpheus Data software platform for expanded hybrid cloud management including connectivity into dozens of on-prem and public clouds, Kubernetes cluster management, governance policy enforcement, and FinOps capabilities for optimization, metering, and reporting.

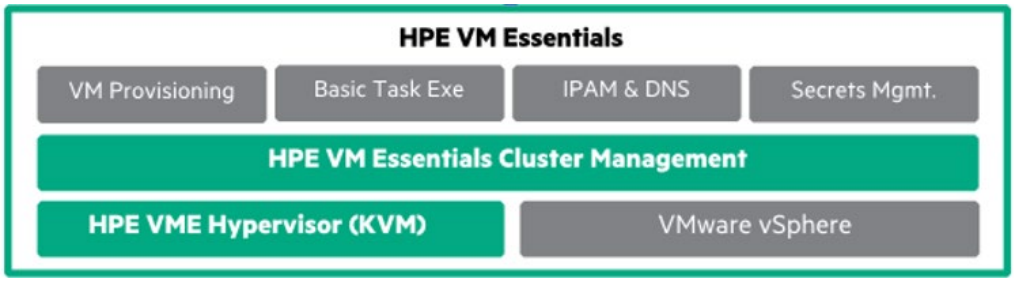

Figure 1. HPE VM Essentials capability diagram

HPE VM Essentials hypervisor features

- **HPE Validated Hardware:** The HPE VM Essentials hypervisor has been validated on HPE ProLiant Gen10 Plus, Gen11, Gen12 and HPE Synergy servers to deliver optimal experience and provide hardware compatibility assurance. Currently, only HPE hardware is supported but support for third-party hardware is planned for the future. All validated hardware and latest compatibility matrix is listed here https://hpevm-docs.morpheusdata.com/en/latest/vme_getting_started/vme_getting_started.html#hpe-vm-essentials-software-compatibility-matrix
- **VM Live Migration:** Migrate a running HPE VM Essentials virtual machine from one host to another within the same cluster with zero downtime.
- **VM High Availability:** Automatically restart HPE VM Essentials virtual machines on another host in the same cluster in the event of an unexpected host failure within the cluster.
- **Dynamic Workload Scheduler:** Dynamically schedule the placement of HPE VM Essentials virtual machines within a cluster based upon optimal workload distribution across the cluster.
- **Storage Migration:** Migrate the virtual disk(s) of a running HPE VM Essentials virtual machine from one storage datastore to another with zero downtime.
- **VMware VM Conversion:** Convert existing VMware virtual machines to the HPE VM Essentials hypervisor using the native conversion feature within the HPE VM Essentials solution.
- **Native Data Protection:** Backup and restore HPE VM Essentials virtual machines using the solution's native data protection feature.

- **Virtual Machine Snapshots:** Create and revert snapshots for HPE VM Essentials virtual machines.
- **External Storage Support:** The HPE VM Essentials hypervisor supports running virtual machines on external storage via iSCSI, NFS, and Fibre Channel. For this release of the Reference Architecture, only external storage with iSCSI has been validated.

Key features of HPE VM Essentials Software for VMware and HPE VME

- **Multi-Hypervisor Support:** HPE VM Essentials enables simple provisioning and management of HPE VM Essentials virtual machines as well as VMware virtual machines.
- **Centralized Identity & Single Sign-On (SSO):** Enable external user authentication using Active Directory (AD) or LDAP. Enable single sign-on with Okta, OneLogin, Azure AD, or SAML.
- **IPAM Integration:** Integrate with external IPAM providers (Infoblox, phpIPAM, BlueCat, SolarWinds) to automate the reservation of an IP address for the virtual machine during the provisioning process.
- **DNS Integration:** Integrate with external DNS providers (Infoblox, Microsoft DNS, BlueCat, SolarWinds) to automate the creation of DNS records for a virtual machine during the provisioning process.
- **Provisioning Automation:** Execute Bash or PowerShell scripts during virtual machine provisioning to automate system bootstrapping operations.
- **Day 2 Automation:** HPE VM Essentials supports the execution of Bash and PowerShell scripts on provisioned and discovered virtual machines.
- **Secrets Management:** Securely store and retrieve secrets from Cypher, the native secrets manager for use with the embedded Bash and Powershell task automation feature.
- **HTML 5 Virtual Machine Console:** Access the console of HPE VM Essentials virtual machines and VMware virtual machines via the HTML5 VM console.

Target audience: This document is intended for IT decision makers as well as architects, system engineers, partners, and system administrators who want to understand the capabilities of enterprise-ready VMaaS solutions using the HPE ProLiant DL Servers and HPE VM Essentials software. The reader should be well-versed with virtualization, enterprise networking, storage, and HPE ProLiant DL Servers. For assistance with deployment of HPE ProLiant DL Servers with HPE VM Essentials, contact your Hewlett Packard Enterprise Representative or channel partner.

Document purpose: The purpose of this document is to demonstrate the capabilities of HPE VM Essentials (VME) as an enterprise-ready hybrid cloud solution by leveraging the combined value of HPE VM Essentials, HPE ProLiant DL servers, and the HPE Alletra Storage MP B10000. This integrated stack provides a flexible, scalable, and easy-to-deploy infrastructure suitable for both general-purpose and mission-critical workloads. It offers guidance and best practices for deploying HPE VM Essentials on HPE ProLiant DL servers with the HPE Alletra Storage MP B10000 iSCSI array in a greenfield environment. While this document provides a recommended deployment approach, it is not intended to represent the only supported scenario or address all possible customer use cases and environments. This Reference Architecture describes solution testing performed in April 2025.

Introduction

Organizations are increasingly seeking ways to simplify virtualization management, reduce costs, and futureproof their IT infrastructure as they move toward hybrid cloud operating models. Traditional hypervisors like VMware have long dominated the virtualization landscape but come with rising costs and limited flexibility in hybrid environments. There is a growing need for a modern, cost-effective, and integrated platform that can manage existing VMware environments while enabling a seamless transition to open, cloud-ready architectures.

HPE VM Essentials (VME) is designed to address these needs by offering a unified solution that supports both VMware and HPE's native KVM-based virtualization stack. It provides enterprises with a simplified, flexible, and enterprise-grade foundation to manage and scale their virtual workloads—on-premises or across hybrid cloud environments.

HPE VM Essentials empowers organizations to efficiently manage and modernize their virtual infrastructure through four core pillars:

Integrated management of VMware and KVM Workloads

With HPE VM Essentials, customers can continue managing existing VMware workloads while gradually re-platforming to HPE's native KVM-based hypervisor. This dual-stack approach provides a consistent and intuitive management experience, enabling VM provisioning, lifecycle management, and automation across both VMware ESXi and HPE KVM environments—all from a unified interface.

Cost optimization with a Built-in KVM Hypervisor

HPE VM Essentials includes a powerful, built-in KVM-based hypervisor that delivers essential enterprise-grade features such as:

- Support for local, NFS, iSCSI, and Fibre Channel storage
- Distributed workload placement
- VM high availability and live migration
- Integrated data protection
- Image conversion from VMware to KVM

This helps customers significantly reduce licensing costs while maintaining the performance, scalability, and resiliency required for production workloads.

Futureproof architecture with flexible deployment options and Enterprise-Grade support

HPE VM Essentials is offered as both a standalone software solution and as part of HPE Private Cloud offerings, starting with HPE Private Cloud Business Edition. It also provides a seamless upgrade path to the HPE Morpheus Enterprise Software, enabling advanced hybrid cloud management, governance, and FinOps capabilities. By enabling a progressive transition strategy, customers can modernize at their own pace while avoiding vendor lock-in. This flexibility allows customers to scale and evolve their virtualization strategy as their business evolves.

Lower risk with Enterprise-Grade support and ecosystem integration

Built on a proven KVM foundation, HPE VM Essentials is backed by HPE enterprise-class global support to ensure consistent performance and reduce operational risk. HPE is also working closely with its ecosystem of Independent Software Vendors (ISVs) to expand certification and compatibility for key enterprise workloads such as Data Protection, Virtual Desktop Infrastructure (VDI), Enterprise Resource Planning (ERP) systems, and more—ensuring a reliable and supported platform across a wide range of applications. Existing Independent Software Vendors (ISVs) support matrix can be referred in the compatibility matrix https://www.hpe.com/support/VME-Compatibility-Matrix.

HPE VM Essentials solution overview

This Reference Architecture demonstrates best practices and typical deployment for supportability for customers building a cloud solution in an enterprise data center and deploying applications in an automated manner. The solution design is based on HPE VM Essentials on HPE ProLiant DL Servers connected to HPE Alletra Storage MP B10000 iSCSI storage via Aruba switches. HPE VM Essentials provides a unified platform for managing both HPE VM Essentials Clusters and VMware-based environments comprising HPE VM Essentials Hypervisor, and HPE VM Essentials manager.

This Reference Architecture demonstrates the following supported components for HPE VM Essentials Software:

- **HPE Servers** - HPE ProLiant and HPE Synergy servers listed in the compatibility matrix https://www.hpe.com/support/VME-Compatibility-Matrix.
- **HPE Storage** –The HPE Alletra Storage MP B10000 is configured as principal block storage for the HPE ProLiant DL servers over iSCSI.
- **HPE Networking** – HPE Aruba 8325 (Top of Rack) and Aruba 6300 (Management) switches connecting the HPE ProLiant DL servers and HPE Alletra Storage MP B10000.
- **HPE VM Essentials manager** - Enables the HPE VM Essentials administrator to easily manage array storage, datastores, and virtual machines.

Figure 2 shows the Reference Architecture component layout showcasing the solution components validated in this Reference Architecture.

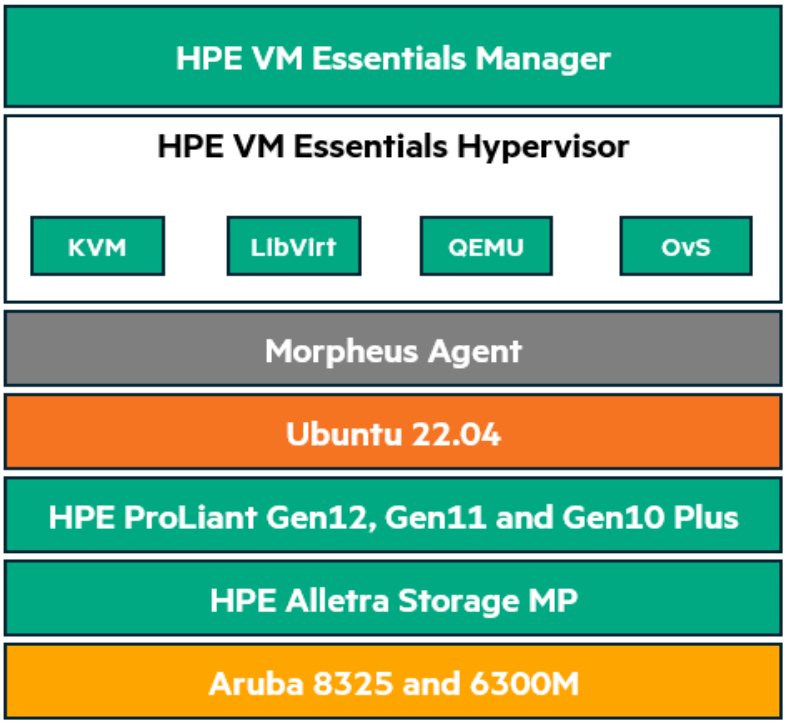

Figure 2. Diagram layout showcasing the solution components

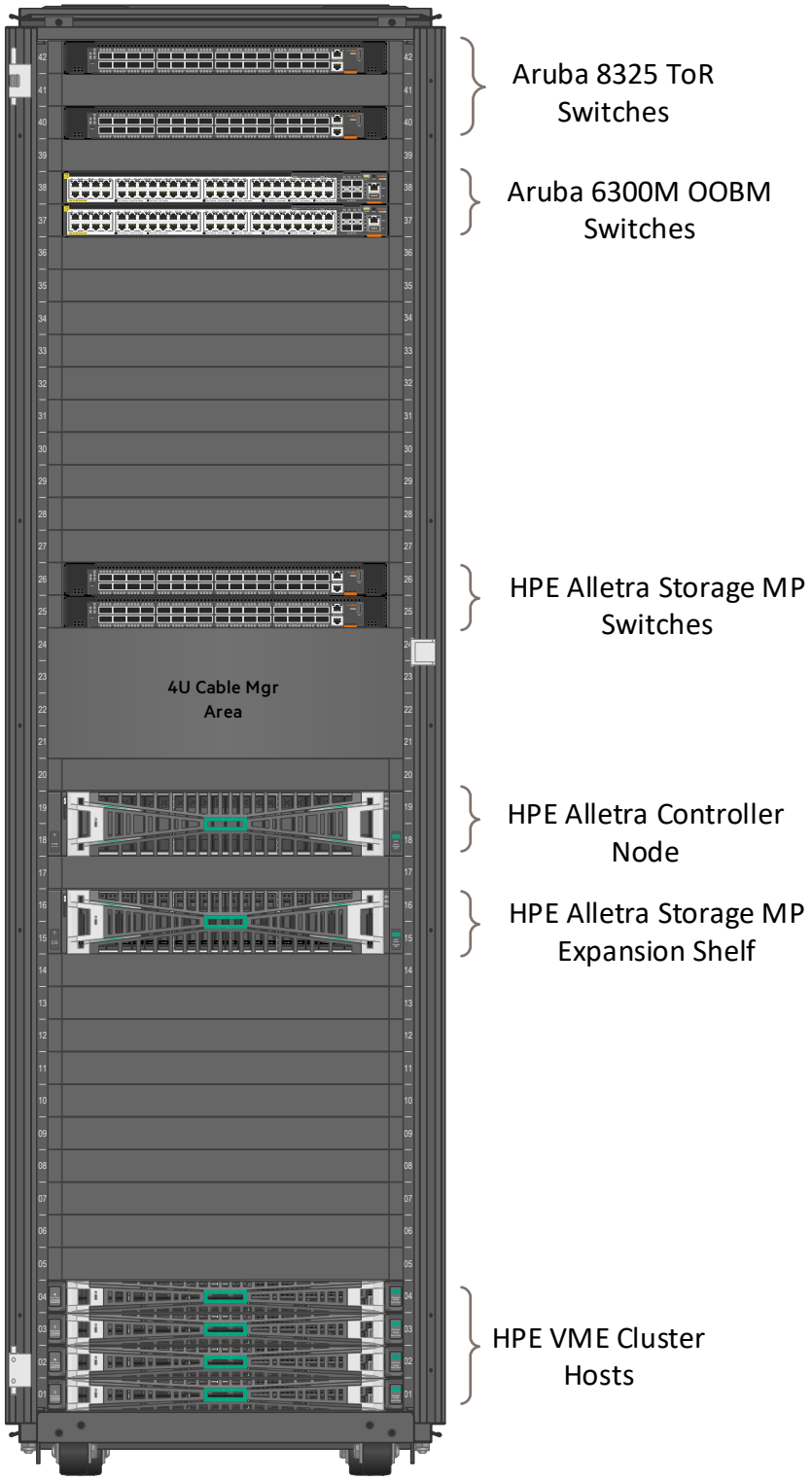

Figure 3. Example Reference Architecture showing Hewlett Packard Enterprise VM Essentials Rack Overview

HPE VM Essentials solution components

HPE VM Essentials Solution and HPE Virtualization hypervisor is validated on the HPE ProLiant DL Servers solution and is tested with the following hardware and software components.

Collateral documentation can be found at https://www.hpe.com/us/en/hpe-vm-essentials.html.

Software

The logical architecture of the validated HPE VM Essentials (VME) stack compromises the following components.

HPE VM Essentials Manager

The management server provides KVM clustering, identity management, virtual machine provisioning, monitoring, and logging. The HPE VM Essentials Manager will be downloaded from the HPE Software center and installed as a pre-packaged virtual appliance. It is installed as a KVM-based virtual machine on any single host which will be part of the cluster. The manager itself is running on an Ubuntu 22.04 VM and can be installed in one of three pre-defined sizes which are described in the following figure.

- Runs Ubuntu 22.04 as the base operating system.
- Available in multiple hardware configuration sizes.
  - **Small**: 2 vCPUs and 12 GB RAM (Manages a maximum of 1 HPE VM Essentials cluster)
  - **Medium**: 4 vCPUs and 16 GB RAM (Manages a maximum of 3 HPE VM Essentials clusters)
  - **Large**: 4 vCPUs and 32 GB RAM (Manages a maximum of 10 HPE VM Essentials clusters)

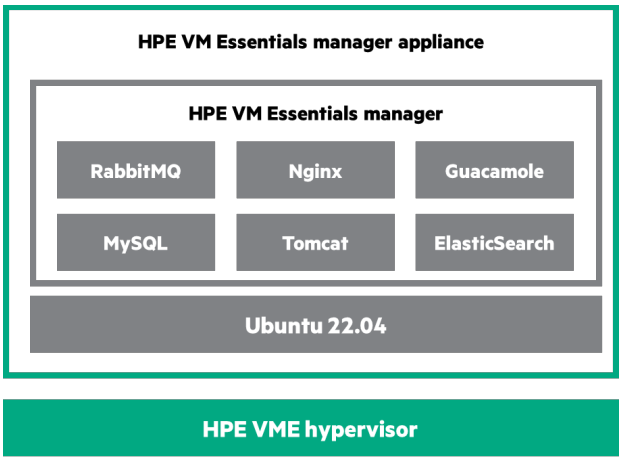

Figure 4. HPE VM Essentials Manager layout diagram

HPE VM Essentials Hypervisor

KVM-based hypervisor hosting virtual machines being managed by the HPE VM Essentials Manager.

- **CPU**: One or more 64-bit x86 CPUs, 1.5 GHz minimum with Intel VT or AMD-V enabled.
- **Memory**: 8 GB minimum.
- **Disk Space**: 50 GB minimum for the Ubuntu 22.04 operating system. An operating system disk of 15 GB is also required. Clusters utilizing non-converged Layouts can configure external storage (iSCSI). Virtual Image datastores need to have 20% usable capacity, or the oldest images may be deleted to create capacity. It's recommended to select a minimum of 2 shared disks for HA failover quorum per cluster (this is manual selection).
- **Network Connectivity**: HPE VM Essentials Hypervisor hosts must be assigned static IP addresses. They also need DNS resolution for HPE VM Essentials Manager and Internet access to download and install system packages for HPE VM Essentials dependencies, such as KVM, Open vSwitch (OVS), and more.

- HPE VM Essentials clusters require a minimum of three hypervisor hosts when using iSCSI as the primary storage protocol. In this solution, each host is provisioned with block storage via LUNs from the HPE Alletra Storage MP B10000 array over iSCSI connectivity.

The following network ports are being used for communication in the HPE VM Essentials solution between components.

Table 1. HPE VM Essentials Software Network Communication Ports

Description	Source	Destination	Port	Protocol
Morpheus Agent communication with the Morpheus appliance	HPE VM Essentials Hypervisor Host	HPE VM Essentials Manager	443	TCP
HPE VM Essentials Hypervisor host configuration and management	HPE VM Essentials Manager	HPE VM Essentials Hypervisor Host	22, 5900	TCP
HPE VM Essentials Hypervisor interhost communication for clustered deployment	HPE VM Essentials Hypervisor Host	HPE VM Essentials Hypervisor Host	22, 2224,3121, 5403, 5404, 9929, 21064	TCP
HPE VM Essentials Hypervisor interhost communication for clustered deployment	HPE VM Essentials Hypervisor Host	HPE VM Essentials Hypervisor Host	5405, 9929	UDP
Morpheus server SSH access for deployed virtual machines	HPE VM Essentials Manager	HPE VM Essentials Hypervisor-hosted virtual machines	22	TCP
Morpheus server WinRM (HTTP) access for deployed virtual machines	HPE VM Essentials Manager	HPE VM Essentials Hypervisor-hosted virtual machines	5985	TCP
Morpheus server WinRM (HTTPS) access for deployed virtual machines	HPE VM Essentials Manager	HPE VM Essentials Hypervisor-hosted virtual machines	5986	TCP

Morpheus Agent

The software that runs on each Hypervisor host that collects system stats, logs, and executes operations received from the HPE VM Essentials Manager.

Ubuntu 22.04

The installation of the base Ubuntu 22.04 operating system is a prerequisite for deploying the VME hypervisor. Ubuntu 22.04 can be installed either on a local disk in the HPE ProLiant servers or via boot from SAN using the HPE Alletra Storage MP B10000. A minimum of 250 GB disk space is required for the installation. During the Ubuntu 22.04 installation with LVM (Logical Volume Manager), the installer does not automatically allocate all available disk space. Ensure that the full disk space is manually allocated during the partitioning step.

Note

Support for Ubuntu 24.04 is in beta and will be available with the next version of HPE VM Essentials 8.0.5.

HPE Service Pack for ProLiant

The HPE Service Pack for ProLiant (SPP) is a collection of software, firmware, and drivers for HPE ProLiant servers. It's delivered as an ISO image that can be used to update the firmware and systems software on HPE ProLiant servers.

Hardware

This section will discuss the hardware components used in the Reference Architecture.

- **HPE Servers** - HPE ProLiant DL365 Gen11 server with 10/25Gb 2-port ethernet network adapters as HPE VM Essentials Hypervisor hosts.
- **HPE Storage** – The HPE Alletra Storage MP B10000 is configured as principal block storage for the HPE ProLiant DL servers over iSCSI.
- **HPE Networking** – HPE Aruba 8325 and Aruba 6300 switches connecting the HPE ProLiant DL servers and HPE Alletra Storage MP B10000 storage for production traffic and management traffic respectively.

HPE ProLiant DL365 Gen11 server

The new HPE ProLiant DL365 Gen11 server is a rack-optimized 1U 2P dense solution that delivers exceptional compute performance, upgraded high-speed data transfer rate and memory depth at 2P compute capability. Powered by 5th Generation AMD EPYC™ Processors with up to 160 cores, increased memory bandwidth (up to 6 TB), and high-speed PCIe Gen5 I/O. The HPE ProLiant DL365 Gen11 server is one of the capable and reliable choice to deploy HPE VM Essentials hypervisor.

Front view

Figure 5. Front view of HPE ProLiant DL365 Gen11 Server

Rear view

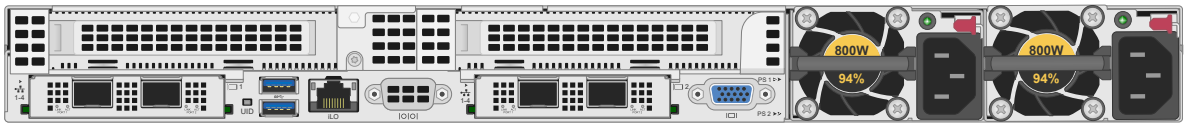

Figure 6. Rear view of HPE ProLiant DL365 Gen11 Server

HPE Alletra Storage MP B10000

HPE Alletra Storage MP B10000 is a unique, software-defined, scale-out data system that consolidates a high-performance all-flash object storage service, exabyte-scale capacity, and easy management for data intensive initiatives like data lakes, digital repositories, and backup with flash-accelerated recovery. The HPE Alletra Storage MP takes advantage of the industry's first disaggregated multi-protocol architecture, which makes it possible for you to scale from terabytes to exabytes on the same hardware. Cost savings are provided through the ability to efficiently scale capacity and performance independently.

It is a software-defined, multi-protocol storage platform that provides flexibility and high performance for both structured and unstructured data storage needs. It consists of standardized, composable building blocks — compute (node), capacity (JBOF), and switches — that can be configured for different software-defined storage personas and use cases. This enables you to uniquely deploy block, file or object workloads on common hardware and manage everything with a unified cloud experience through the HPE GreenLake cloud.

Figure 7 shows the HPE Alletra Storage MP B10000.

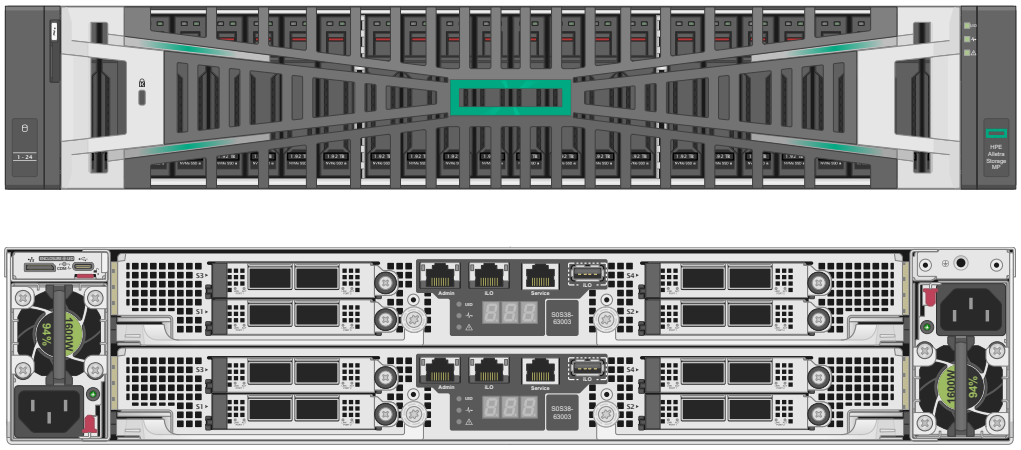

Figure 7. HPE Alletra Storage MP B10000 Storage Front and Rear

HPE Alletra Storage MP B10000 Drive Enclosure

HPE Alletra Storage MP B10000 Drive Enclosures help extend the storage capacity of the storage array. Each enclosure contains multiple slots for either small or large form factor drives. Drive enclosures also contain Input/Output modules (cards), and a pair of PCMs (power-cooling modules) for redundant power and cooling of the enclosure.

Front View

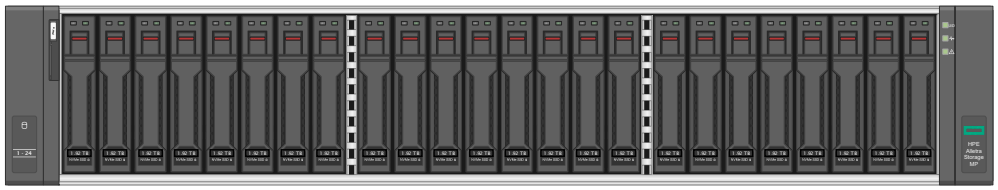

Figure 8. Front View-HPE Alletra Storage MP

Rear View

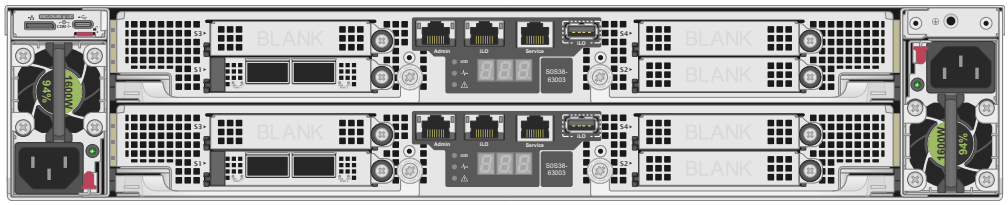

Figure 9. Rear view –HPE Alletra Storage MP

HPE Alletra Storage MP Switches

HPE Alletra Storage MP B10000 family of storage arrays support both switched and switchless architecture. For the purpose of this reference architecture, a switched storage array was used which is supported by HPE Alletra Storage MP Switches. These switches are used to connect HPE Alletra Storage MP B10000 controller nodes with disk enclosures and help with easy expansion of the storage capacity.

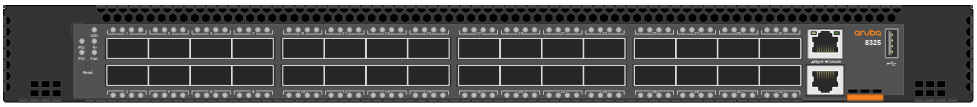

Figure 10. HPE Alletra Storage MP Switches

Software and firmware compatibility matrix

The following table outlines the software and firmware components used in the solution. While it provides a reference matrix, it does not represent the only supported versions. The goal of the Reference Architecture is to utilize the latest firmware and operating system versions available at the time of building the solution.

Additionally, the HPE VM Essentials Software Compatibility matrix for HPE VME can be found here https://hpevm-docs.morpheusdata.com/en/8.0.4-vme/vme_getting_started/vme_getting_started.html#hpe-vm-essentials-software-compatibility-matrix.

Table 2. Software and firmware version of components used in the solution

Component	Version
HPE VM Essentials	8.0.4
SPP for HPE VM Essentials nodes	Version: P76091_001_gen11spp-2024.11.00.00-Gen11SPP2024110000.2024_1113.24.iso.
Ubuntu OS	22.04.5
Aruba CX 8325 Switch (R9F67A)	10.13.1020 {ArubaOS-CX_8325_10.13.1020}
Aruba 6300M Switch (R9F63A)	10.13.1020 {ArubaOS-CX_6400-6300_10.13.1020}
Aruba Fabric Composer (AFC)	7.0.1 {ArubaFabricComposer-7}
HPE Alletra Storage MP B10000 OS	10.4.2

Network architecture and requirements

This section outlines the different network connectivity options supported for deploying an HPE VM Essentials cluster on HPE ProLiant Gen11 servers with various network adapter configurations.

Aggregated network connectivity

With aggregated network connectivity, all types of network traffic including management, compute (workload), and storage—share the same set of network adapters bonded together through LACP. The following diagram depicts the aggregated network connectivity on a server with two 100Gbps network adapter. The two adapters are bonded together to host management, compute, and storage traffic. This aggregated design optimizes the use of two available ports by enabling efficient bandwidth utilization, providing redundancy in case of a single link failure, and simplifying network configuration and management.

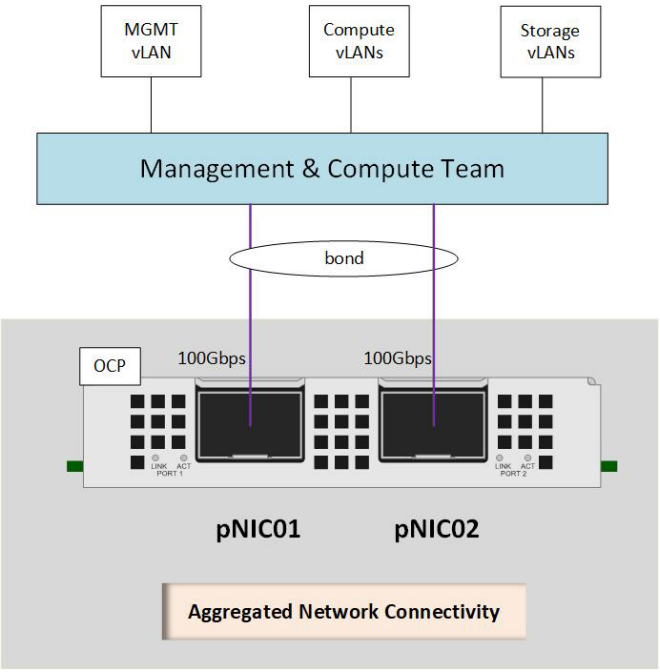

Figure 11. Aggregated Network Connectivity

Converged network connectivity

With converged network connectivity, management and compute (workload) traffic is carried over a set of network adapters bonded using LACP. In contrast, iSCSI storage traffic is isolated and transmitted over two separate, dedicated networks—iSCSI VLAN A and iSCSI VLAN B—each mapped to individual network adapters.

The following diagram illustrates this configuration on a server equipped with four 25 Gbps network adapters:

- **pNIC01** and **pNIC03** are bonded (LACP) to handle management and compute traffic.
- **pNIC02** is dedicated to **iSCSI VLAN A**, connected to **Switch A in access mode.**
- **pNIC04** is dedicated to **iSCSI VLAN B**, connected to **Switch B in access mode.**

This design ensures optimal throughput, path redundancy, and fault isolation across both compute/management and storage traffic.

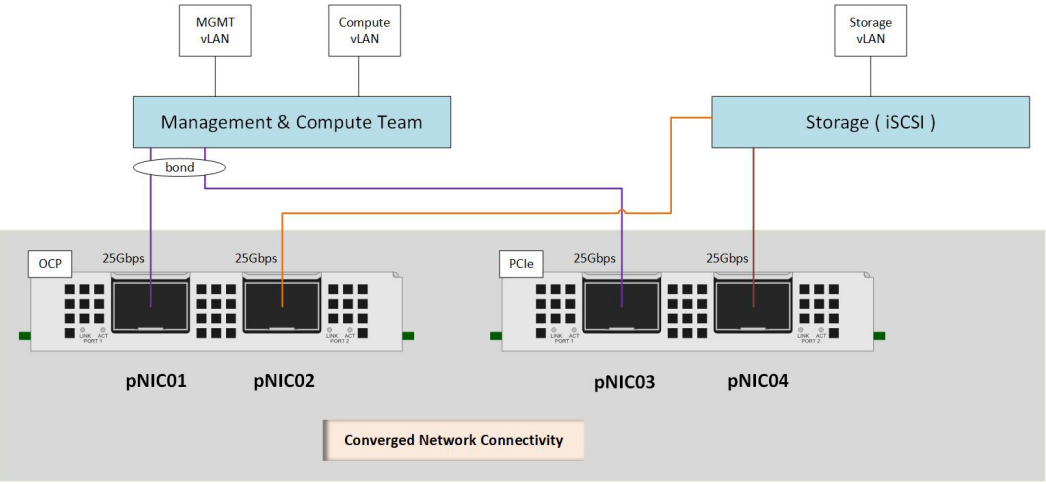

Figure 12. Converged network connectivity

Diverged network connectivity

With diverged network connectivity, each type of traffic—management, compute, and storage—is allocated to a dedicated set of physical network adapters. Management and compute traffic are handled over separate bonded interfaces using LACP, while iSCSI storage traffic is isolated across two individual network adapters.

The following diagram illustrates this setup on a server equipped with six 25 Gbps network adapters:

- **pNIC01** and **pNIC03** are bonded to handle **management traffic.**
- **pNIC02** and **pNIC05** are bonded to handle **compute (workload) traffic**.
- **pNIC04** is dedicated to **iSCSI VLAN A**, connected to **Switch A.**
- **pNIC06** is dedicated to **iSCSI VLAN B**, connected to **Switch B.**

This diverged design ensures strict traffic separation, enhanced performance tuning per traffic type, and increased fault isolation across the network fabric.

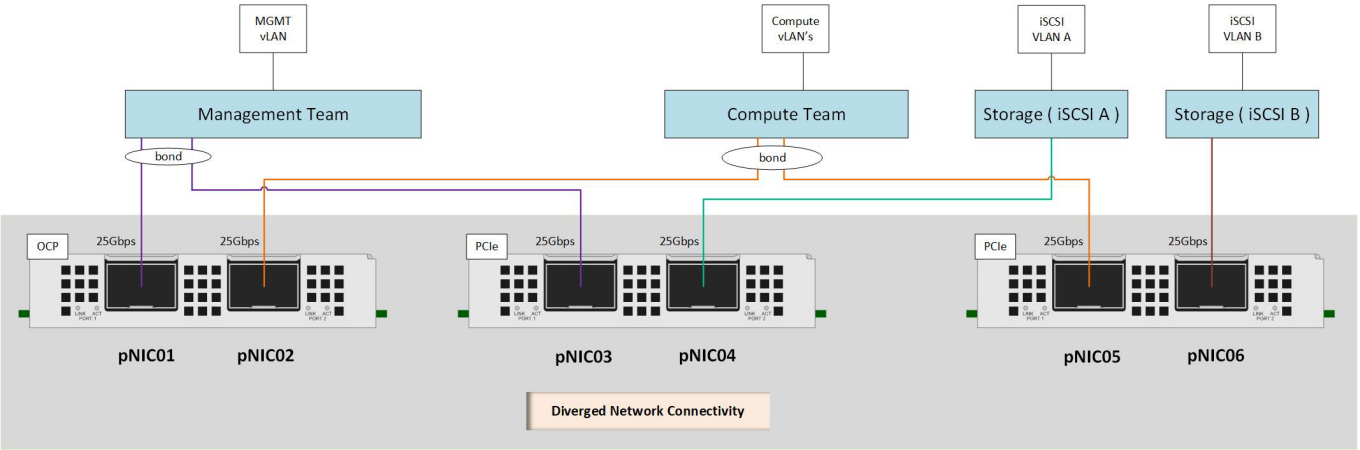

Figure 13. Diverged Network Connectivity

Network connectivity recommendation

A minimum of four 10/25 GbE network ports per server is recommended to ensure high availability and adequate throughput. For this reference architecture, a **converged network connectivity** utilizing four (4) network ports per server has been selected to optimize performance and resilience.

Link Aggregation (LACP 802.3ad)

Link Aggregation Control Protocol (LACP) in 802.3ad mode is employed to bond network ports carrying management and compute (workload) traffic. This approach enhances throughput and provides network path redundancy—making it particularly effective for virtualization environments like HPE VM Essentials.

Dedicated iSCSI Networks for Storage Traffic

iSCSI traffic is isolated across two separate networks:

- iSCSI VLAN A is mapped to one network adapter connected to Switch A
- iSCSI VLAN B is mapped to a second network adapter connected to Switch B

This dual-network setup is recommended to prevent issues such as broadcast storms, network loops, or unknown unicast floods.
If iSCSI traffic is instead carried over a single bonded network, or if both VLANs share the same physical switch or path, such events could simultaneously impact both iSCSI paths—resulting in total loss of storage connectivity.

Storage architecture and requirements

HPE Alletra Storage MP B10000 is a disaggregated, scale-out block storage solution designed to deliver 100% data availability while ensuring mission-critical storage at midrange economics. It is built on the HPE Alletra Storage MP hardware platform and is managed via HPE GreenLake cloud, bringing cloud agility, performance, and resiliency to mission-critical workloads.

Architecture overview

Disaggregated, Scale-Out Design: The architecture allows for independent scaling of performance and capacity, enabling organizations to tailor their storage infrastructure to specific workload requirements.

Composable Building Blocks: The system is built using a chassis that can house compute nodes and storage media. For instance, Just a Bunch of Flash (JBOF) expansion shelf includes storage media and two controllers, each equipped with an operating system RAM, and CPU. This design ensures flexibility in configuring storage solutions.

Multi-Protocol Support: HPE Alletra Storage MP B10000 supports various storage protocols, making it suitable for diverse application needs.

With Switch (Enterprise Deployment)

- Uses storage switches (Ethernet/Fibre Channel) for scalability & redundancy.
- Hosts connect via a redundant switch fabric for high availability.
- Best for large-scale, mission-critical workloads.

Without Switch (Direct-Attached Deployment)

- Storage nodes connect directly to hosts (NVMe, iSCSI, FC).
- Simpler setup, lower cost, but limited scalability.
- Best for edge/small-scale deployments.

Note

For the purpose of this reference architecture switched storage array was used which are supported by HPE Alletra Storage MP Switches. These switches are used to connect HPE Alletra Storage MP B10000 controller nodes with disk enclosures and help with easy expansion of the storage capacity.

Configuration guidance for the solution

Prerequisites

HPE ProLiant servers

Qualified HPE ProLiant servers are listed in the HPE VM Essentials Software Compatibility Matrix https://www.hpe.com/support/VME-Compatibility-Matrix.

Network

- **Out of Band Management Switch:** A pair of Aruba 6300M OOBM switches to support management traffic
- **Top of Rack Switch:** A pair of Aruba 8325 Top of Rack switches to support compute traffic.
- **Management VLAN:** One dedicated network (VLAN) created on OOBM and ToR switches for server iLO management and host(ubuntu) management traffic.
  - **Compute VLAN:** One network (VLAN) created on ToR switches for workload traffic. If the user needs isolation for workloads, more compute VLANs can be created as required.
  - **ISCSI VLANS:** Two VLANs created on ToR switches, one for iSCSI VLAN A and another for iSCSI VLAN B

Software

HPE Gen11 SPP: HPE Gen 11 SPP (P76091_001_gen11spp-2024.11.00.00-Gen11SPP2024110000.2024_1113.24.iso) available at https://support.hpe.com/hpesc/public/swd/detail?swCollectionId=MTX-a2a2747055284d4e. Active contract is required to download the HPE Service pack for ProLiant (SPP).

Ubuntu Server: Ubuntu Server version 22.04 available at https://releases.ubuntu.com/jammy/ubuntu-22.04.5-live-server-amd64.iso.

HPE VM Essentials Software and HPE VM Essentials Manager: HPE VM Essentials software version 8.0.4 and HPE Manager comes bundled in a single package file HPE_VM_Essentials_SW_image_8.0.4_S5Q83-11007.iso. For customer or partner access to HPE VM Essentials software, contact your Hewlett Packard Enterprise Sales Representative.

Storage

The storage provisioning process requires that physical connectivity is correctly established between the HPE VM Essentials nodes, the HPE Alletra MP B10000 storage array, and the HPE network switches. It also requires storage array to be initialized and accessible via HPE DSCC (Data Services Cloud Console) for configuration management and iSCSi ports configured.

License

License is priced per CPU socket for HPE VM Essentials hypervisor nodes and service is made available in 1, 3 and 5-year terms. For licensing questions and trial licenses contact your Hewlett Packard Enterprise Sales Representative.

Server BIOS

Boot drives present on Gen11 servers need to be configured in RAID 1 mode. Workload profile in Gen11 server BIOS should be set to Virtualization – Max Performance.

Other requirements

- Internet Connectivity required on the management network to download and install the required packages and dependencies on Ubuntu HPE-VME servers.
- NTP server to enable time sync on all Ubuntu HPE VM Essentials servers.
- HPE Alletra Storage MP B10000 array should have been activated and ready to be consumed and the scope of this reference architecture does not cover Cloud enablement, discovery setup and initialization.

Workflow

The following figure describes the high-level workflow for the HPE VM Essentials deployment:

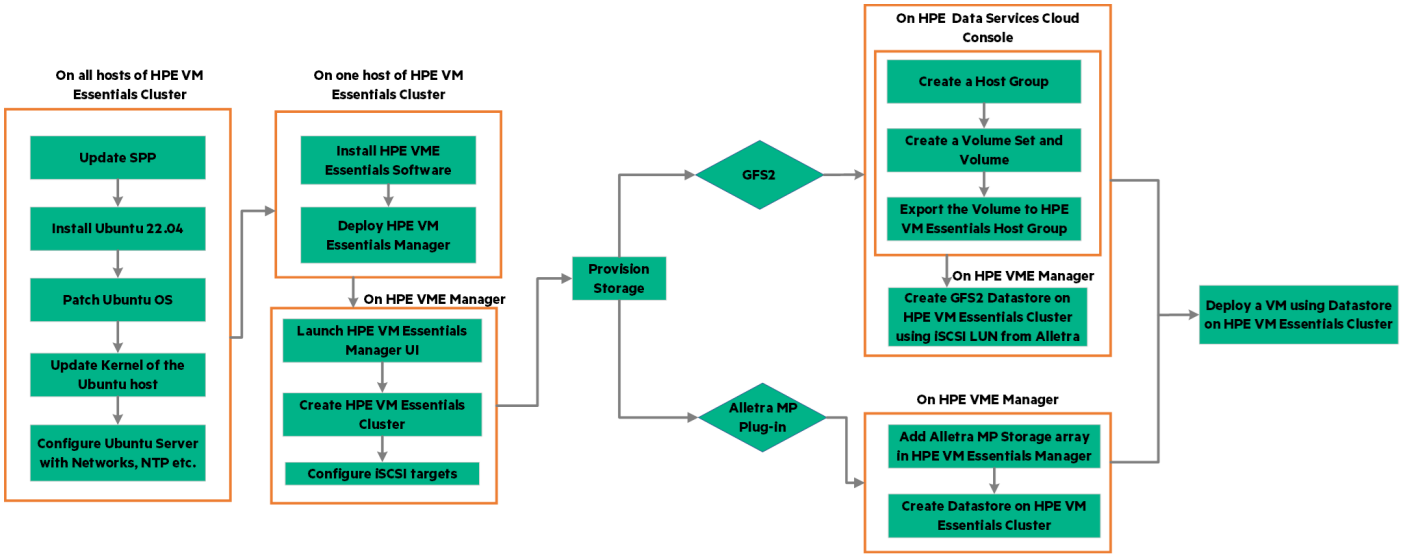

Figure 14. Workflow

Install and configure Ubuntu 22.04

This section discusses installation and configuration of Ubuntu 22.04 on HPE ProLiant Gen11 Servers.

To install Ubuntu on the HPE ProLiant Gen11 server, perform the following steps:

1. Log into the iLO of the Server and launch the iLO console.
2. Click **Virtual Media** and select Local *.iso file under option CD/DVD
3. Select the downloaded Ubuntu Server 22.04.5 image.
4. Under **Menu**, select **Reset server**.
5. Select **F11** (Boot Menu) during reset and click 'iLO Virtual USB: iLO Virtual CD/DVD' option to start the installation.
6. Under GRUB GNU screen, select **Try and install Ubuntu**.
7. Select the type of installation as Ubuntu Server.

Ubuntu network setup

During the networking setup portion of the Ubuntu installation, bonding must be created for management and compute traffic.

1. Select the first port of first network adapter (connects to first Aruba switch) and the second port of the second network adapter (connects to second Aruba switch) to create a bond (Ex: bond0).
2. Select 803.2ad as the bond mode. Link Aggregation Group (LAG) needs to be configured for the same set of ports on Aruba switches.

   The following are the sample VLANs used in this solution validation:

Table 3. Sample VLANs

VLANs	Subnets	Purpose
101	172.28.1.0/24	ILO, Alletra, and VME Node Mgmt.
102	172.28.2.0/24	Compute (workloads)
301	172.30.1.0/24	iSCSI A
302	172.30.2.0/24	iSCSI B

3. After the bond is created, add a VLAN tag with management VLAN (Ex: 101) to create management virtual network adapter.
4. Add another VLAN tag with compute VLAN (Ex: 102) to create compute virtual network adapter.
5. Select the virtual adapter named bond0.<mgmt.-vlan-id> (Ex: bond0.101), choose **Edit** to activate the management network by selecting 'IPV4 Method' as 'Manual' and add the static IP address, DNS server, and DNS search domain for management network.
6. Select the virtual adapters named bond0.<compute-vlan-id> (Ex: bond0.102), choose **Edit** to activate the compute network by selecting 'IPV4 Method' as 'Manual' and add the static IP address for the compute network.
7. Select the first port of second network adapter (connects to first Aruba switch) and configure the static IP address for the iSCSI VLAN A network.
8. Select the second port of first network adapter (connects to second Aruba switch) configure the static IP address for the iSCSI VLAN B network.
9. The following figure shows the bonding created for management and compute networks, and individual adapters hosting iSCSI A and iSCSI B traffic.

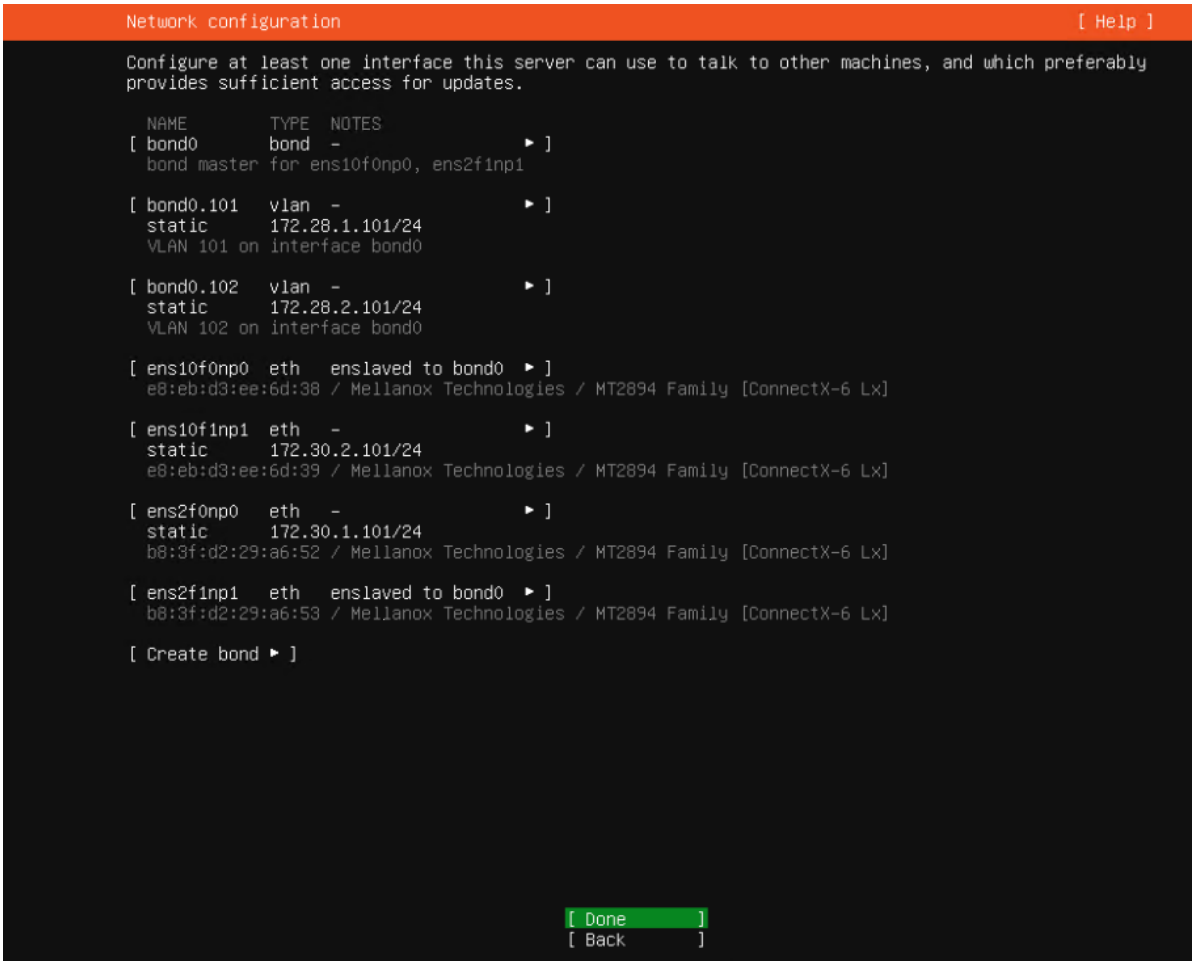

Figure 15. Ubuntu Network Setup

Ubuntu partition setup

During the storage setup portion of the Ubuntu installation, select 'use an entire disk' option and select the Gen11 boot drive that is configured in RAID1 mode. Then select **Set up this disk as an LVM group** option and optionally this LVM group can be encrypted with a passphrase.

After the disk is selected and LVM group is created, file system summary with mount points (for boot and root) will be shown to the end user. The entire boot disk is not utilized by default when creating a root logical volume. It is recommended to increase the root logical volume size to consume the entire size of the boot disk. This helps avoid the hassle of expanding the root disk later if more storage is required. The following figure shows the boot partition and root volume created on the Ubuntu OS using all available space on Gen11 boot drives in RAID1 mode.

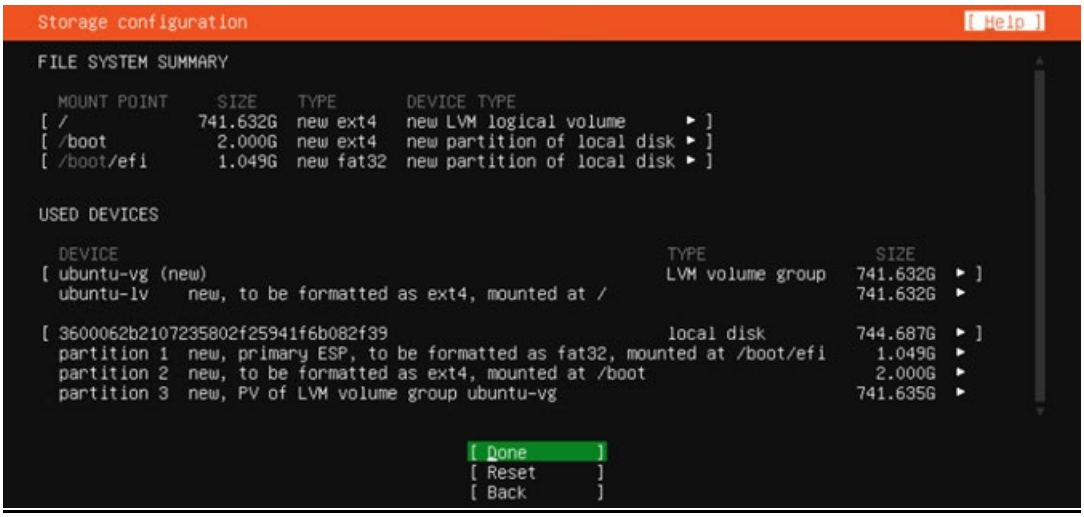

Figure 16. Ubuntu OS Partition Setup

Configure NTP

1. To configure NTP on the Ubuntu server, open the /etc/systemd/timesyncd.conf file on each Ubuntu node and uncomment the following mentioned parameters to assign the IP address of the NTP server.

```
NTP=<ntp server ip>
FallbackNTP=<ntp server ip
```

2. Restart the NTP service by running the following command on each Ubuntu node.

```
#sudo systemctl restart systemd-timesyncd.service
```

3. Run the following command to check the status of NTP configuration. The output shows the sample output for the NTP server successfully set.

```
#timedatectl timesync-status
Server: 16.110.135.123 (16.110.135.123)
Poll interval: 4min 16s (min: 32s; max 34min 8s)
Leap: normal
Version: 4
Stratum: 2
Reference: D8753B5D
Precision: 1us (-24)
Root distance: 6.805ms (max: 5s)
Offset: +86us
Delay: 25.201ms
Jitter: 719us
Packet count: 4
Frequency: -6.761ppm
```

Patch Ubuntu

1. It is recommended to keep all the packages and its dependencies up to date on the Ubuntu nodes. Update the Ubuntu node by executing the following command:

```
#sudo apt-get update
```

2. Also ensure to run the updated kernel with the following command. A reboot may be suggested to apply this kernel updates. Make sure to reboot the system after the kernel upgrade is done.

```
#sudo apt install linux-generic-hwe-22.04
```

Install HPE VM Essentials Software

HPE VM Essentials Software is a lightweight Debian package that enables virtualization capabilities on cluster hosts by installing components such as KVM, OVS, and other necessary dependencies. This package should be installed on a single Ubuntu node that will be part of the HPE VM Essentials cluster.

Note
The HPE VM Essentials Manager *must* be installed on the same node where the Debian package was deployed. Virtualization capabilities on the remaining Ubuntu nodes in the cluster will be automatically configured during the cluster provisioning process. As part of this automated setup, the Manager installs all required packages—including KVM, OVS, and Libvirt—across the remaining hosts.

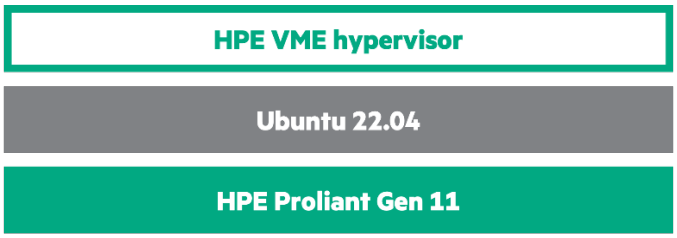

Figure 17. Install HPE VM Essential Software

1. Copy the downloaded HPE VM Essentials software to any one of the ubuntu server. The software can be transferred to Ubuntu server using any of the file transfer utility such as WINSCP.

```
#ls -l *iso
-rw------- 1 root root 7.7G Apr  8 10:18 HPE_VM_Essentials_SW_image_8.0.4_S5Q83-11007.iso
```

2. Create a mount point named ***/mnt/iso*** and mount the HPE VM Essentials software. After the software is successfully mounted, two files (One HPE VM Essentials software and another HPE VM Essentials Manager) will be available for installation.

Note
Only HPE VM Essentials will be installed at this time. The next section will cover the deployment of HPE VM Essentials Manager.

```
#mkdir /mnt/iso
#mount -o ro HPE_VM_Essentials_SW_image_8.0.4_S5Q83-11007.iso /mnt/iso
#cd /mnt/iso
#ls -l
-r--r--r-- 1 root root      34392890 Mar 14 19:26 hpe-vm_1.0.4-1_amd64.deb
-r--r--r-- 1 root root 8130796162 Mar 26 23:03 hpe-vme-8.0.4-1.qcow2.gz
```

Note
hpe-vm_1.0.4-1_amd64.deb enabled VME virtualization capability on Ubuntu hosts while the hpe-vme-8.0.4-1.qcow2.gz installs VME Manager.

3. Install the HPE VM Essentials software by executing the following command. When prompted to install all the packages provided, confirm your selection and wait for the installation to be finished. This process installs all the necessary packages on the host to set up a virtualization server, including KVM, Libvirt, Ceph, and more.

```
#sudo apt install -f ./hpe-vm_1.0.4-1_amd64.deb
```

4. To launch the hpe-vm console, switch to the root user by running sudo -i.

5. Enter the `hpe-vm` console by running the following command:

```
#hpe-vm
```

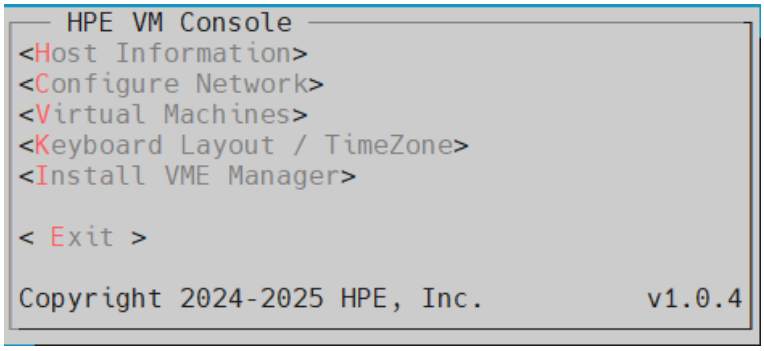

Figure 18. HPE-VM console

6. First, enter the section for keyboard layouts and time zone. Set the time zone and make any changes to the keyboard layout, if needed.
7. Next, enter the section named **configure network** to set the MTU to 9000 for all network interfaces. Setting the MTU to 9000 improves efficiency and reduces latency.
8. From the **Device Type** drop-down list, select **vlan** and select the virtual network adapters configured for management and compute traffic. Select the checkbox next to **mtu** and enter 9000 in the resulting box. Finally, save changes.
9. From the "Device Type" drop-down and select **ethernet**and select the physical adapters configured for iSCSI A and iSCSI B.
10. After selecting the adapters, select the checkbox next to "mtu" and enter "9000" in the resulting box. Then, save changes.

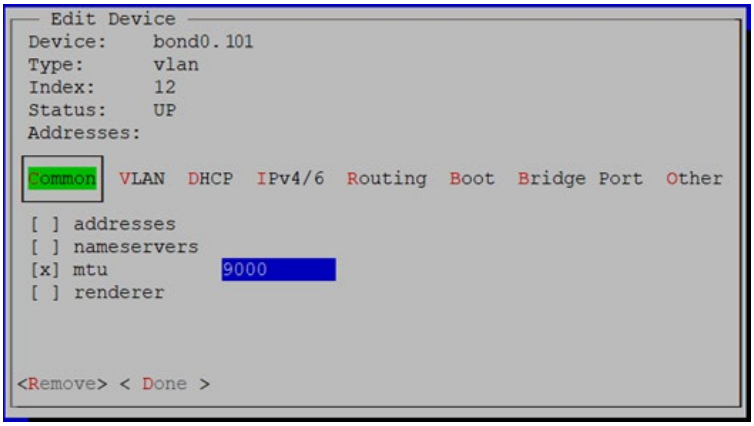

Figure 19. Update MTU onDevice

Note
Make sure the respective VLAN interfaces and physical interfaces on Aruba 8325 switches are also enabled for jumbo frames i.e., MTU 9000

Deploy HPE VM Essentials manager

HPE VM Essentials manager serves as the control plane for the HPE VM Essentials servers in addition to providing a provisioning engine, automation functionality, monitoring, secrets management etc. The HPE VM Essentials Manager *must* be installed on the same node where the Debian package was deployed. Virtualization capabilities on the remaining Ubuntu nodes in the cluster will be automatically configured during

the cluster provisioning process. As part of this automated setup, the Manager installs all required packages—including KVM, OVS, and Libvirt—across the remaining hosts.

HPE VM Essentials Manager software will be available on the Ubuntu host at the mount directory of HPE VM Essentials software.

```
#cd /mnt/iso
#ls -l  *gz
-r--r--r-- 1 root root 8130796162 Mar 26 23:03 hpe-vme-8.0.4-1.qcow2.gz
```

The following information should be readily available to deploy the HPE VM Essentials Manager:

- IP address for the HPE VM Essentials manager
- IP address for the DNS Server
- URL for the web server
- DNS resolution for the URL (points the URL to the manager IP address)
- Management interface name
- The absolute path of HPE VM Essentails Manager software on the Ubuntu host.

Installing HPE VM Essentials manager

1. To install the manager, run the command hpe-vm.
2. Select an option labelled Install VME Manager.

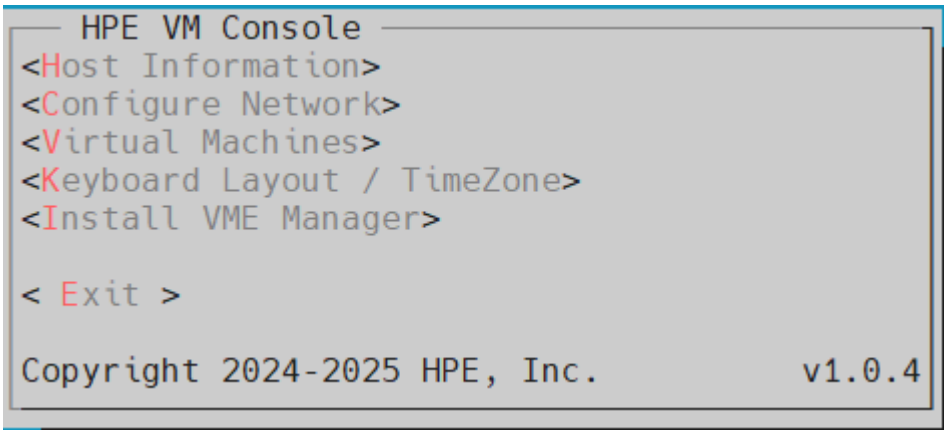

Figure 20. HPE-VM console

3. Enter the following configuration values:
   a. IP Address
   b. Subnet Mask
   c. Gateway
   d. DNS Server
4. **Appliance URL** (the HTTPS URL the appliance administrator and vme manager agents will connect to)
5. **Hostname** (same as Appliance URL without the FQDN)
6. **Image URI:** Since the path begins with a leading /, the final value will look like: file:///mnt/iso/hpe-vme-8.0.4-1.qcow2.gz
7. Enter an admin username and password for an SSH user that can access the VME manager.
8. If necessary, configure proxy details.
9. Specify the size of the HPE VM Essentials Manager appliance vm to install. Defaults to S:

a. **Small:** 2 vCPUs / 12 GB RAM (POC, Lab, test or small environments)

b. **Medium:** 4 vCPUs / 16 GB RAM (Production with moderate workloads)

c. **Large:** 4 vCPUs / 32 GB RAM (recommended for production environments with high workload)

10. Specify the following:

a. Management interface

b. Compute interface (optional)

c. Compute VLAN tag (optional)

Note

At this stage, configuring the **compute interface** and **VLAN** is optional. These settings can be specified later during cluster creation through the **HPE VM Essentials Manager.** Click **Install** to begin the installation process.

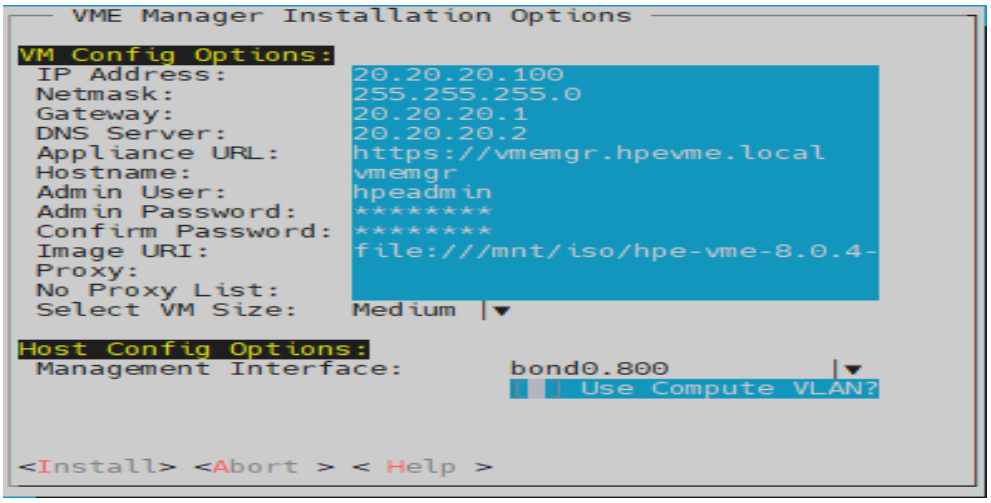

Figure 21. HPE VM Essentials Manager Setup

Monitor HPE VM Essentials manager installation progress

1. During installation, look for the message: **Starting Morpheus Services...**
2. Navigate to the **Appliance URL** in a browser. If a page loads or displays a loading message, services are active.
3. After the message **"Starting Morpheus Services..."** appears in the installation progress bar, you may open a web browser and go to the **Appliance URL**. If the browser returns a response—even if it says the appliance is still loading—it indicates that the web server is installed and working. After full initialization, you will reach the setup page.

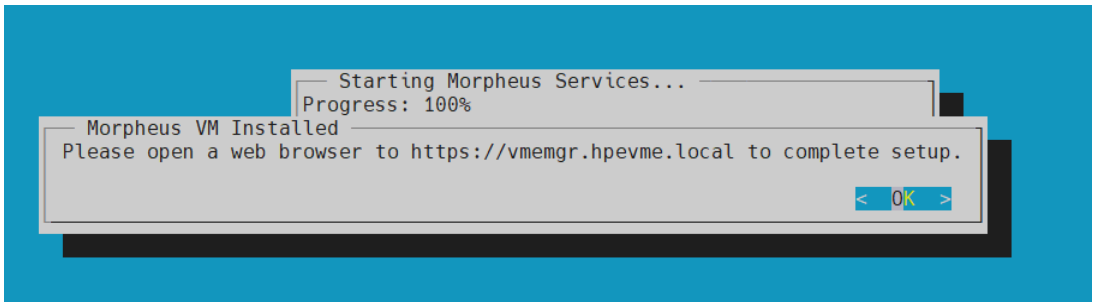

Figure 22. HPE VM Essentials Manager Installation Status

HPE VM Essentials manager initialization

After the HPE VM Essentials Manager successfully deployed, access the UI by navigating to the Appliance URL in a web browser. You will be directed to the registration screen as shown in the following figure:

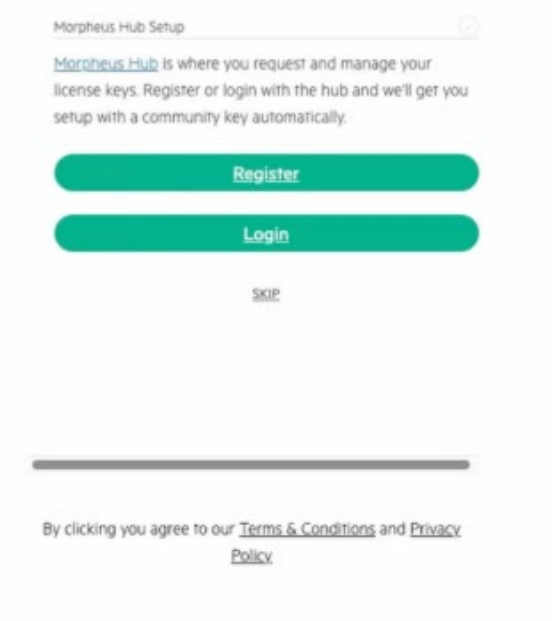

Figure 23. VME Manager Setup

To continue the setup, a valid license key is required as listed in prerequisites:

Continue the setup by performing the following:

1. Define the **account name** for the manager.
2. Provide credentials for the **initial administrator user**.
3. Assign a **name** to the appliance.
4. Confirm the **Appliance URL** is accurate.
5. Select from available global features such as **Backups, Monitoring**, and **Logs based on requirements**.

After configuring these settings, paste in the license key when prompted and click **"Complete Setup".**

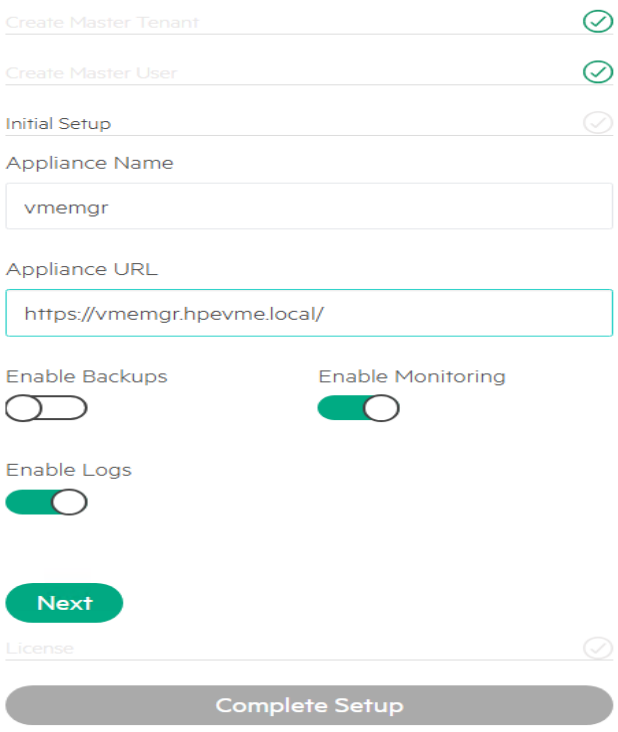

Figure 24. Complete setup

Upon completion, you will be directed to the HPE VM Essentials Manager dashboard. At this point, installation is complete.

Create HPE VM Essentials cluster

Perform the following steps to create a VME cluster:

1. Log into the VME Manager using admin username and password.
2. Navigate to the Infrastructure tab.
3. Create a Group.
   a. Go to **Infrastructure > Groups**.
   b. Click **+ CREATE**
   c. Provide the required details to create the group.
4. Create a Cloud
   a. Navigate to **Infrastructure > Clouds**.
   b. Click **+ ADD** Select Morpheus
5. Click **Next** and provide the required details.

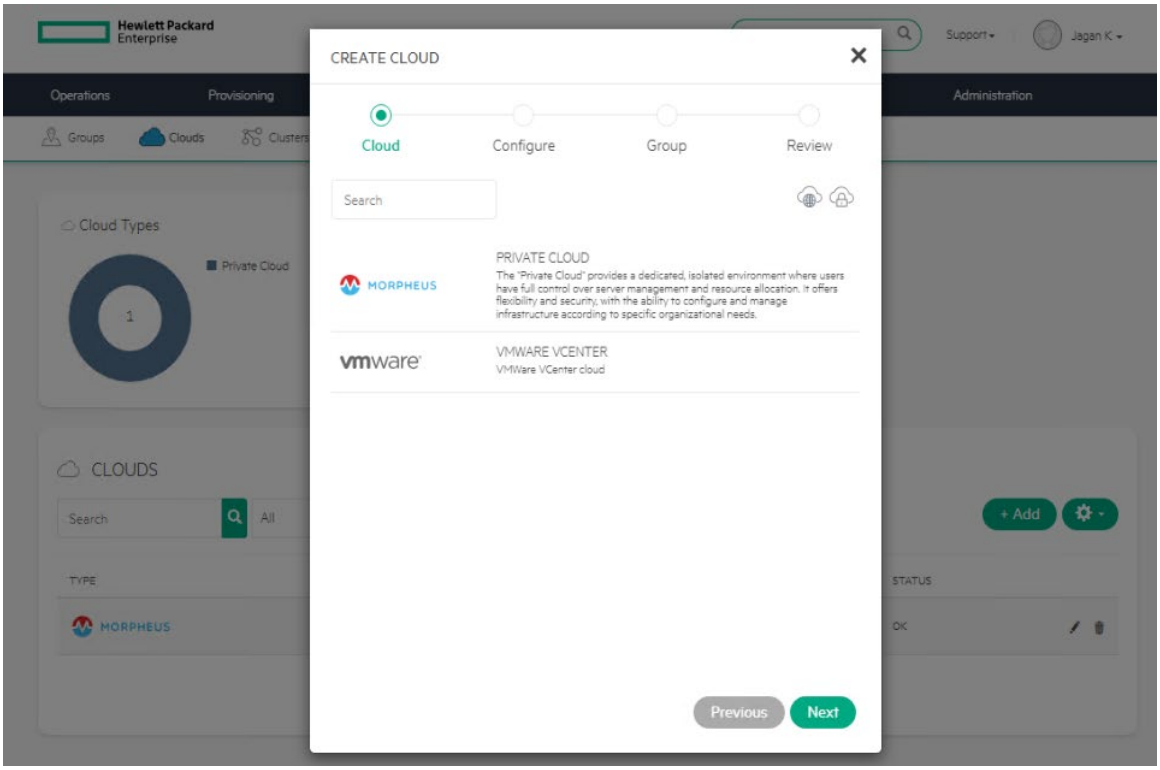

Figure 25. Create Cloud

Create an HPE VM Essentials Cluster.

1. Navigate to **Infrastructure > Clusters.**
2. Click + **ADD CLUSTER**. Currently, the only available cluster type is **"HPE VM".**
3. Select the **HPE VM** as the cluster type and click **NEXT**. On the Group tab, select the group created earlier and click **Next.**
4. On the **Name** tab, select the cloud created earlier and enter a name for the cluster. Click **Next**.

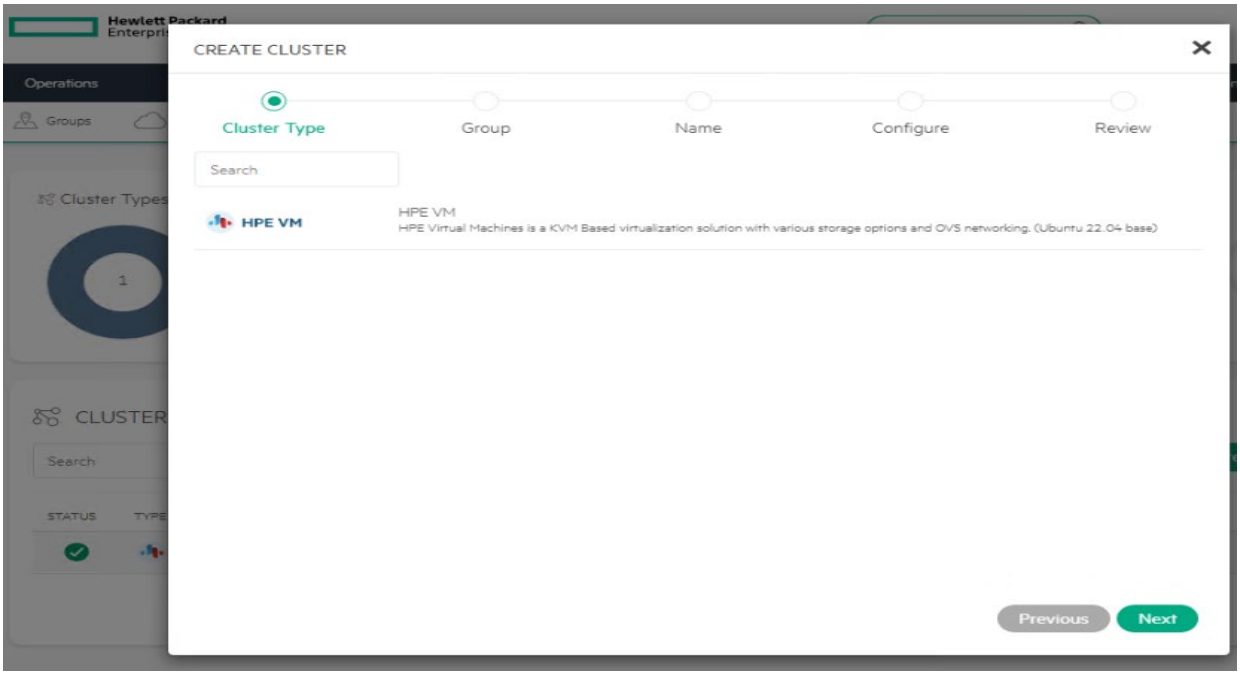

Figure 26. Create Cluster

5. Under Configuration Options, select the layout "HPE VM 1.1 on Existing Ubuntu 22.04". Provide the required Ubuntu host details including FQDN, IP address, SSH username and password, the management interface (a bonded interface with the management VLAN tag, e.g., bond0.<mgmt-vlan-id>), and the compute interface (a bonded interface with the compute VLAN tag, e.g., bond0.<compute-vlan-id>). Click Next to proceed with the creation of the HPE VM Essentials cluster.

Note
This reference architecture does not cover the "HPE VM 1.1 HCI Ceph Cluster on Existing Ubuntu 22.04" layout option, which leverages Ceph-based storage.

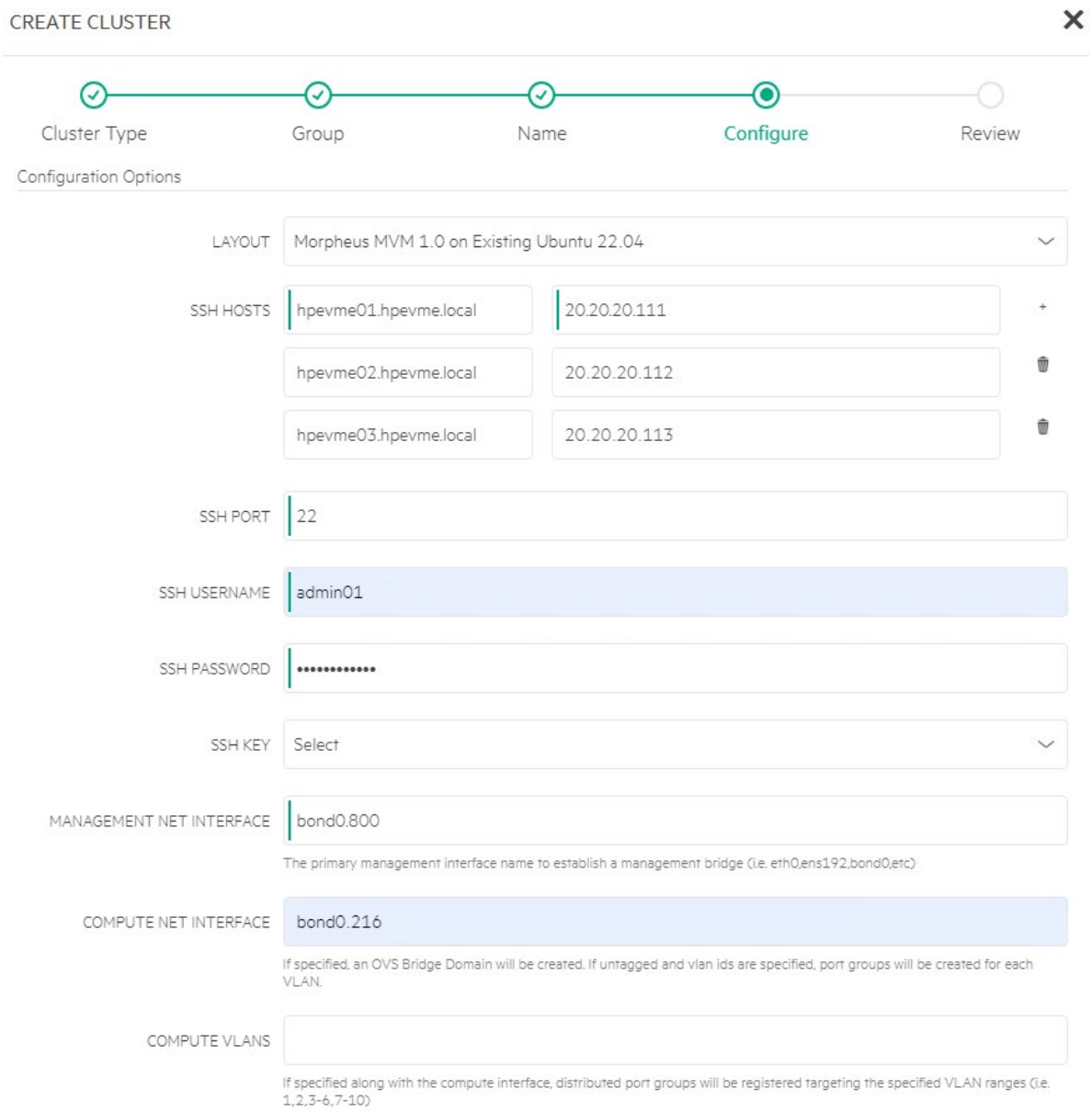

Figure 27. Create Cluster

Storage Provisioning

In HPE Virtual Machine Essentials (VME), storage can be provisioned using two supported methods:

- **GFS2 over iSCSI:** GFS2 (Global File System 2) is a clustered file system that enables shared access to datastores across multiple nodes in the HPE VM Essentials cluster. In this setup, storage is provisioned from **HPE Alletra Storage MP B10000** and accessed over **iSCSI.** This approach provides high availability and consistent access, making it suitable for clustered workloads.
- **HPE Alletra Storage MP Plugin:** The HPE Alletra Storage MP plugin for HPE VM Essentials enables seamless integration between HPE VM Essentials and HPE Alletra Storage MP arrays allowing users to provision and manage storage volumes directly from the VME UI. This integration enables the creation of virtual machines with virtual disks (vDisks) backed by Alletra provisioned volumes. Each virtual machine is mapped to a dedicated volume enabling simplified storage management.

Note
As listed in the prerequisites - the storage provisioning process requires proper physical connectivity between the HPE VM Essentials nodes, the HPE Alletra Storage MP B10000 array, and the HPE network switches; it also requires the storage array to be initialized and accessible via HPE DSCC (Data Services Cloud Console) with iSCSI ports configured. Each HPE Alletra Controller Node uses dual host bus adapters to connect to two Aruba switches for iSCSI VLAN A and B, enabling all node and enclosure communication through a dual-switch fabric.

iSCSI Target Configuration on HPE-VM Cluster Hosts

As part of the storage provisioning process, adding all iSCSI targets is a mandatory prerequisite—regardless of whether the datastore is created using GFS2 or the plugin. In this reference architecture, the build includes a total of eight iSCSI targets: four from the controller nodes and four from the disk enclosure nodes. As illustrated in the following steps , ensure that all iSCSI_A and iSCSI_B targets are added accordingly.

1. Log into the HPE VM Essentials Manager.
2. Navigate to the **Infrastructure** section and select **Cluster**.
3. Next, select the Storage option, then choose iSCSI.
4. Click **Add**, provide the target IP addresses for iSCSI_A and iSCSI_B, along with port (3260), and then click Save Changes.

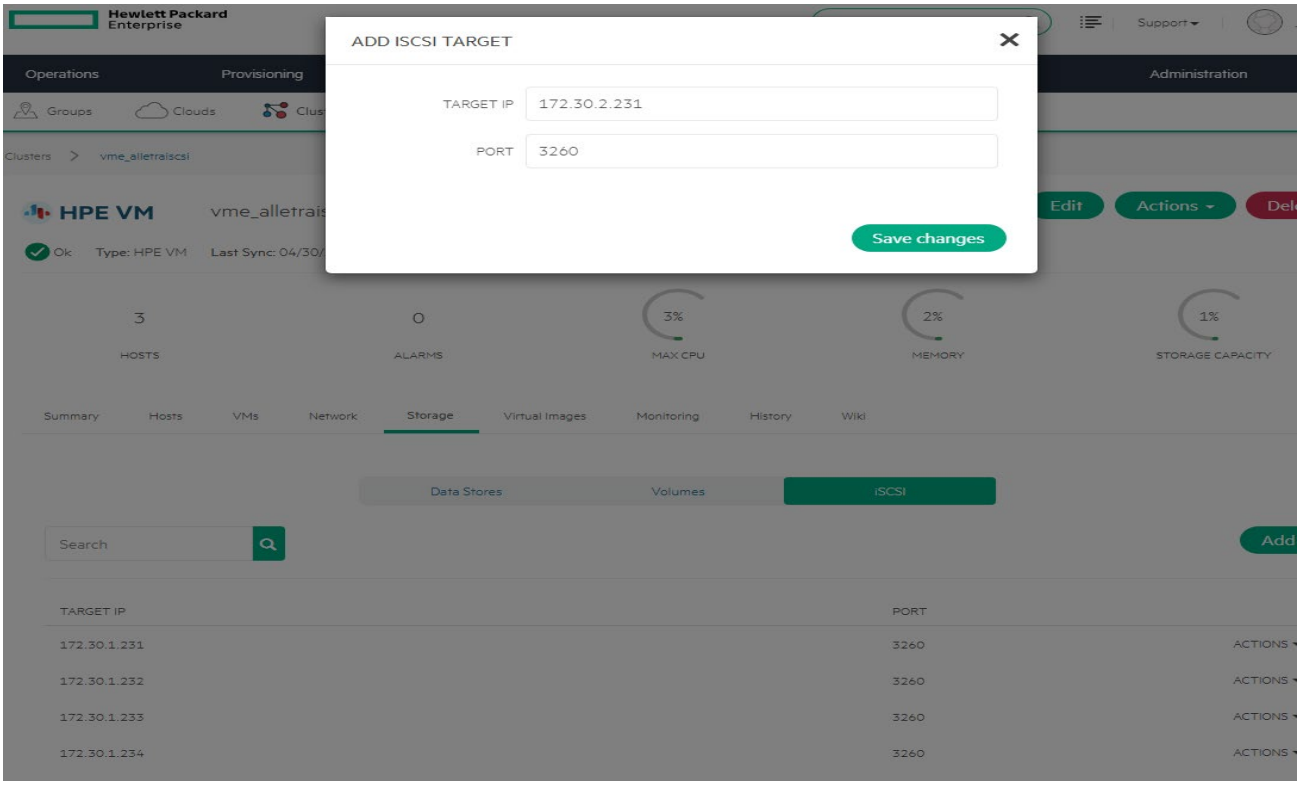

Figure 28. Add iSCSI Target ip address.

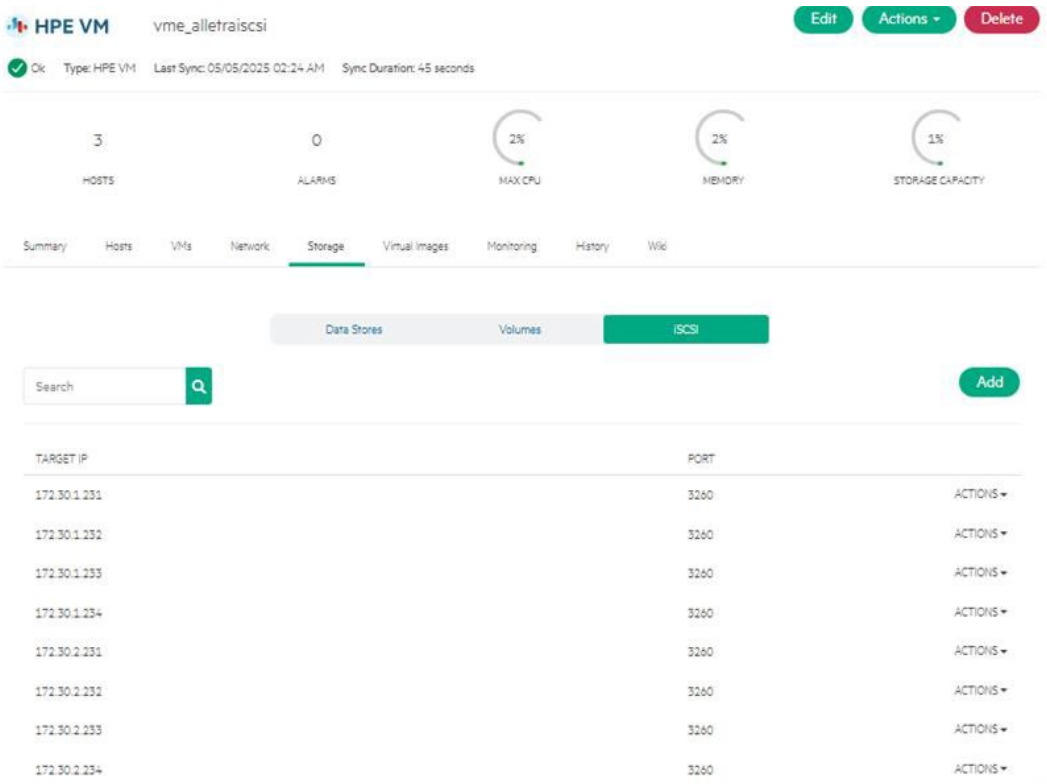

Figure 29. Example of iSCSI target IP addresses added.

Provisioning Datastore via GFS2

1. Before provisioning a host set ensure that values are set as shown in the following sample for every HPE VM Essentials node.

```
defaults {
find_multipaths yes
user_friendly_names no
 }
```

2. Restart the multipath service if values are changed:

```
#sudo systemctl restart multipathd
```

Create a Host Group on Data Services Cloud Console

1. In Data Services Cloud Console, launch **Data Ops Manager**.
2. Under Menu, select **Data Access** and click **+** under **Host Groups**.
3. In the **Create Host Group** section, add a host to the host group by clicking **+ Create**.
4. In the **Create Host** dialog, provide a host name, select iSCSI as the protocol, choose Ubuntu as the operating system, and then click Next.
5. In the **Initiators** section, click **+ Create**. In the **Add iSCSI Initiator** provide the iSCSI Qualified Name (IQN) and the IP address of the host, then click **Done**.
6. Click **Next**, then click **Create** to complete the host creation process.
7. Repeat steps 3-5 to add all the HP VM Essential hosts to the host group.
8. Click **Next** on the **Create Host Group** dialog to verify the HP VM Essential hosts details, then click **Create**.

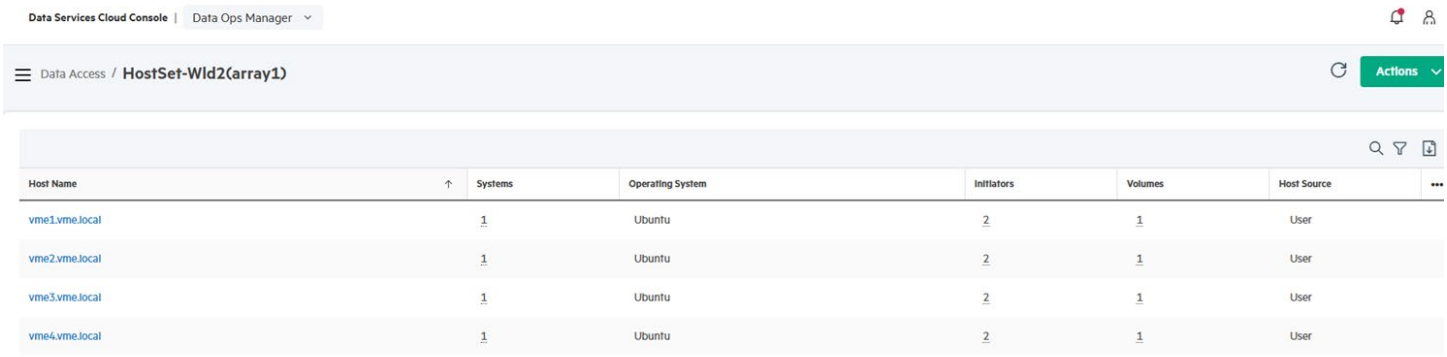

Figure 30. Host set created on DSCC Data Ops Manager

Create a Volume Set and Export Volume to Host Group on Data Services Cloud Console

1. To create and export a volume to host group, launch **Data Ops Manager** in Data Services Cloud Console.
2. Under **Menu**, select **Storage** and click **+** and select the right storage tier and the workload type.
3. Enter the name for the volume set, number of volumes and their respective size.
4. Select the already created host group under **Which group of hosts need access to this storage?**.
5. Under protection policy, select **No Protection** and click **Continue.**
6. Leave the rest of the options to default and in the Review screen, click **Submit.**

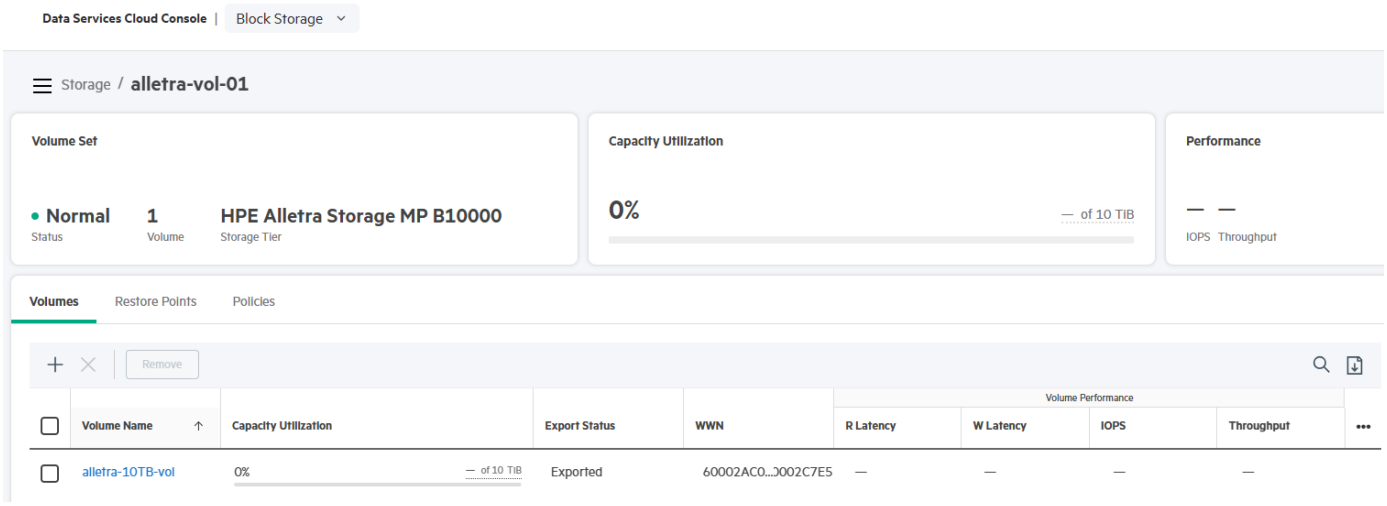

Figure 31. iSCSI volume set created on DSCC Block Storage

Verify Provisioned Disks on Hosts of HPE VM Essentials Cluster

1. Display the iSCSI disks on the hosts using the command:

```
#lsblk
```

2. Display the multipath target devices using the following command. Expected sample output is also shown here. The following data in the ouput indicates the datastore from HPE Alletra storage MP storage is successfully provisioned.
   a. 3PARdata,VV – The volumes comes from an HPE Alletra Storage MP B10000 array and is a virtual volume (VV)

b. size=1.0T – indicates 1.0 TB has been provisioned

```
#multipath -ll
360002ac0000000000000000620002c335 dm-2 3PARdata,VV
size=1.0T features='1 queue_if_no_path' hwhandler='1 alua' wp=rw
|-+- policy='service-time 0' prio=50 status=active
| |- 2:0:0:1 sdk 8:160 active ready running
| |- 3:0:0:1 sdl 8:176 active ready running
| |- 6:0:0:1 sdo 8:224 active ready running
| `- 7:0:0:1 sdp 8:240 active ready running
`-+- policy='service-time 0' prio=10 status=enabled
  |- 4:0:0:1 sdm 8:192 active ready running
  |- 5:0:0:1 sdn 8:208 active ready running
  |- 8:0:0:1 sdq 65:0  active ready running
  `- 9:0:0:1 sdr 65:16 active ready running
```

Create GFS2 Datastore on HPE-VM Cluster

GFS2 (Global File System 2) is a cluster file system that allows multiple nodes in a cluster to simultaneously read from and write to a shared storage device (with FC, iSCSI, NBD, etc).

1. Log in to the HPE VM Essentials Manager UI and navigate to the **HPE VM Essentials cluster's Storage** tab.
2. Navigate to **Infrastructure > Clusters**.
3. Click the name of required **HPE VM Essentials cluster**.
4. Select **Storage** tab.
5. On **Data Stores** option, click **ADD**.
6. Add a GFS Datastore to the HPE VM Essentials Cluster.
7. Under **Add Data Store** screen, enter a name for the datastore and set the type to GFS2 Pool.
8. Enter the block device name for the shared iSCSI LUN. This block device name can be obtained by running multipath -ll on the Ubuntu nodes.

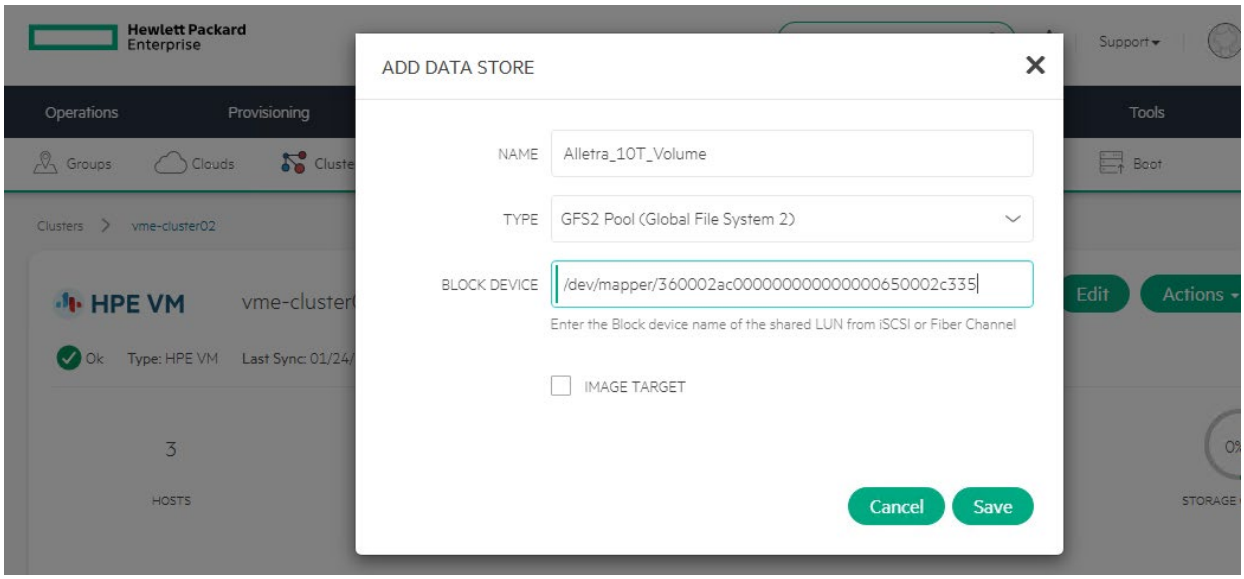

Figure 32. Add Data store

9. Verify the status of the newly created datastore on the HPE VM Essentials Manager. The status should show the correct capacity of the datastore and should be online.

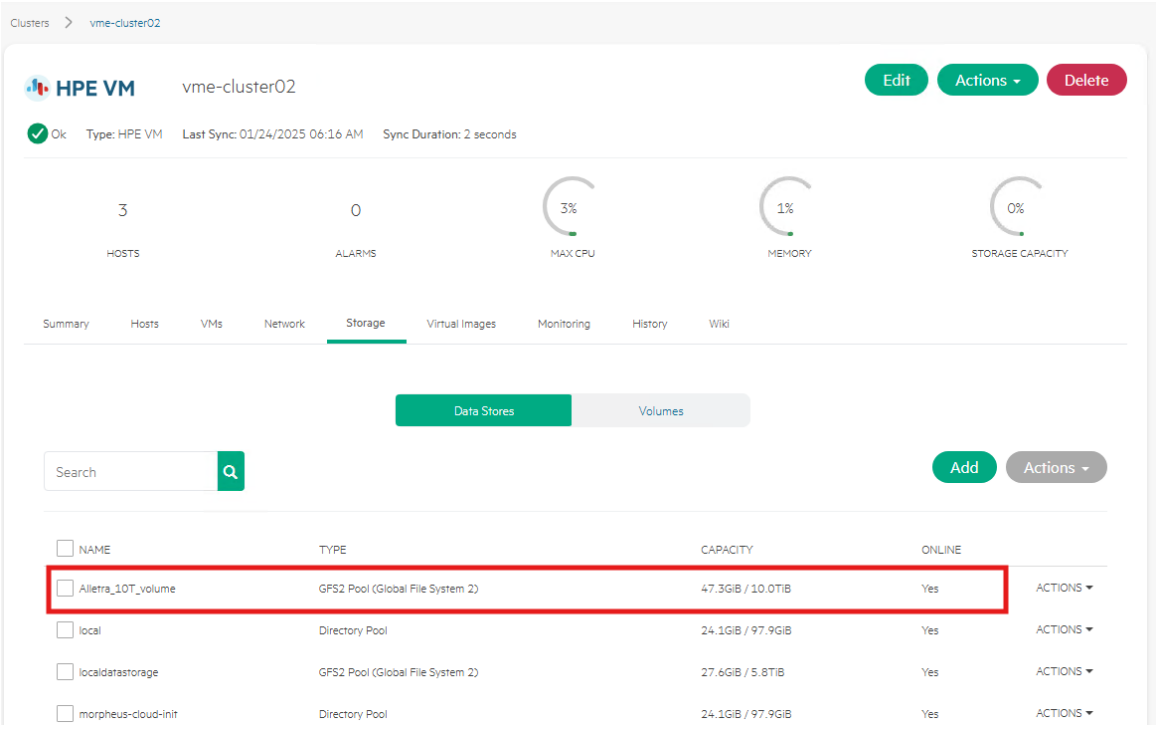

Figure 33. Verify Data Store

Provisioning Data storage via HPE Alletra Storage MP plug-in

The HPE Alletra MP Storage Plugin enables integration between HPE Alletra Storage MP and HPE VM Essentials. With the help of this plugin, customers can create virtual machines with their virtual disks backed by volumes provisioned on HPE Alletra Storage MP. Starting from HPE VM Essentials 8.0.4, the plug-in is included in the VME manager.

1. Ensure all the iSCSI ports are reachable from each of the cluster hosts and the values are set as shown in the following sample for every HPE VM Essentials node:

```
defaults {
    find_multipaths yes
    user_friendly_names no
}
```

2. Restart the multipath service if values are changed:

```
#sudo systemctl restart multipathd
```

Add Storage Server

The first step is to add HPE Alletra Storage MP B10000 as a storage server in HPE VM Essentials. Log in to the HPE VM Essentials Manager UI.

1. Navigate to **Infrastructure > Storage.**
2. Select **Server** tab.
3. Click **ADD**
4. On the **Add Storage Server** screen, provide a **Name**, select **Type** as **HPE Alletra MP**, enter the URL (Alletra management IP), and input the Alletra username and password. Then, click **Save Changes**.

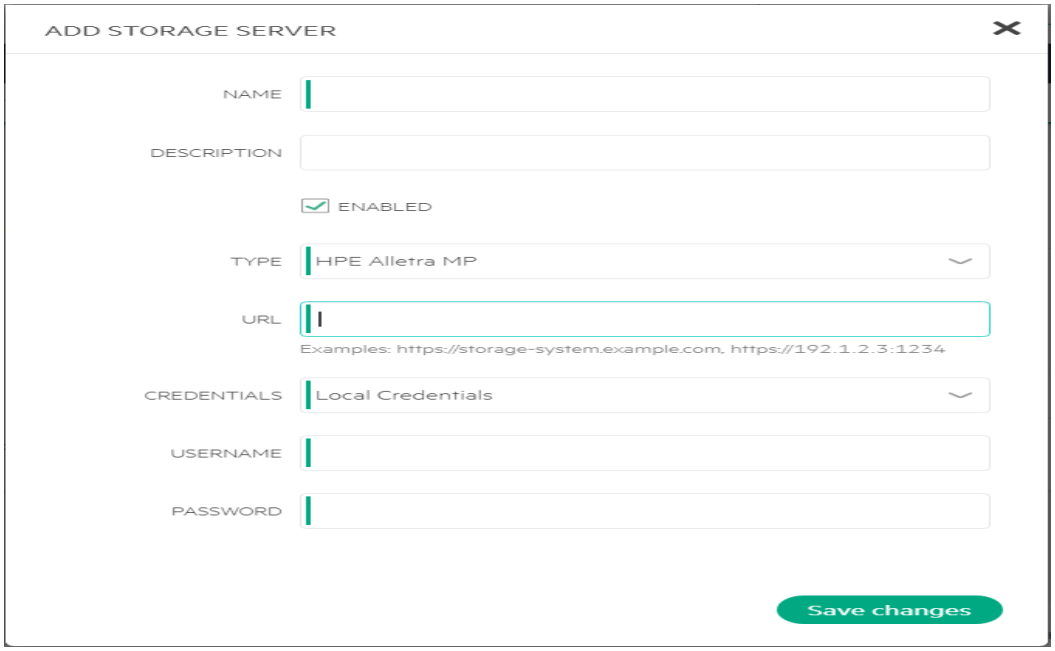

Figure 34. HPE Alletra MP plug-in

Create Datastore

1. In HPE VM Essentials Manager UI, Navigate to **Infrastructure > Clusters**.
2. Click the name of HPE VM Essentials cluster.
3. Select **Storage** tab.
4. On the **Data Stores** option, click **ADD**.
5. On the Add Data Store screen, provide a Name, select Type as HPE Alletra Storage MP and selecte “Alletramp” as Storage Server name. Then, click **Save**.

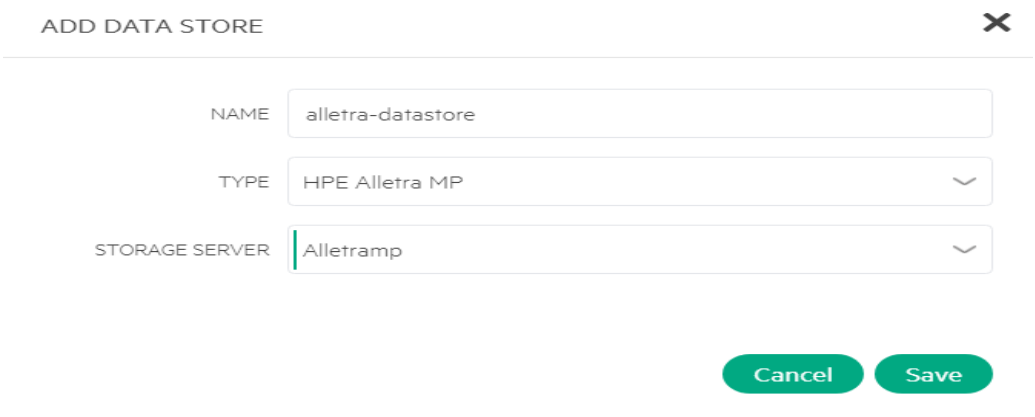

Figure 35. HPE Alletra Storage MP datastore

The datastore will be added and displayed under the **'Datastore'** tab. Check the status of the newly created datastore in the HPE VM Essentials Manager. The status should accurately display the datastore's capacity and indicate that it is online.

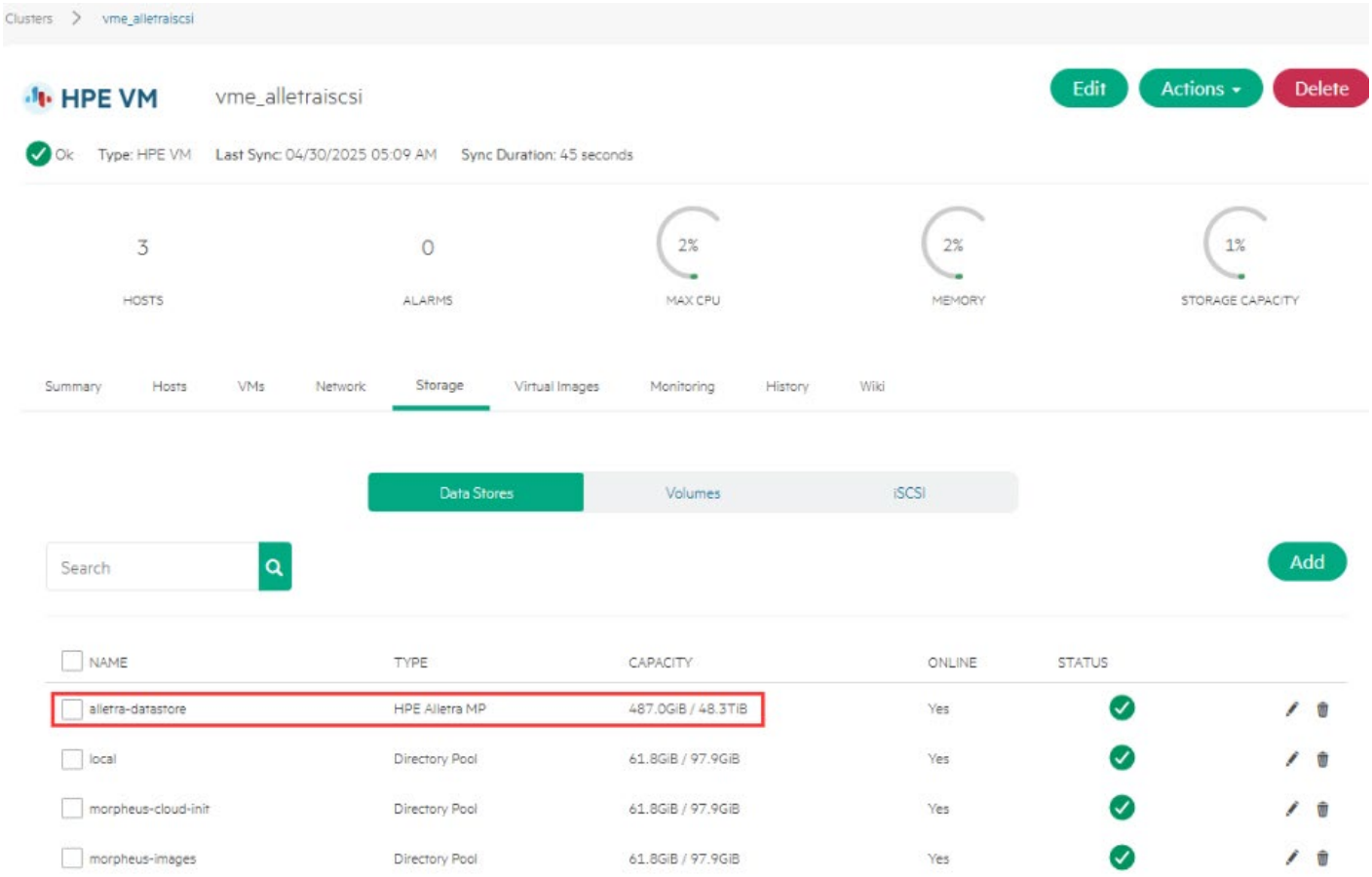

Figure 36. Verify HPE Alletra Storage MP datastore.

VM Provisioning on HPE VM Essentials Cluster

Before the VM is provisioned, operating system image needs to be made available to the HPE VM Essentials Manager.

Upload OS Images to HPE VM Essentials Manager

1. Log into the VME Manager.
2. Navigate to **Library > Virtual Images.**
3. Click **Add+** and provide the name of the virtual image.
4. Select the operating system of the virtual image and the required memory.

Note
The supported formats of the virtual images are ISO, QCOW2, RAW and VMware (vmdk/ovf/ova).

---

5. Click **Add File** to upload the operating system image and then click **Save changes.**

The following figure shows the virtual images uploaded to HPE VM Essentials Manager.

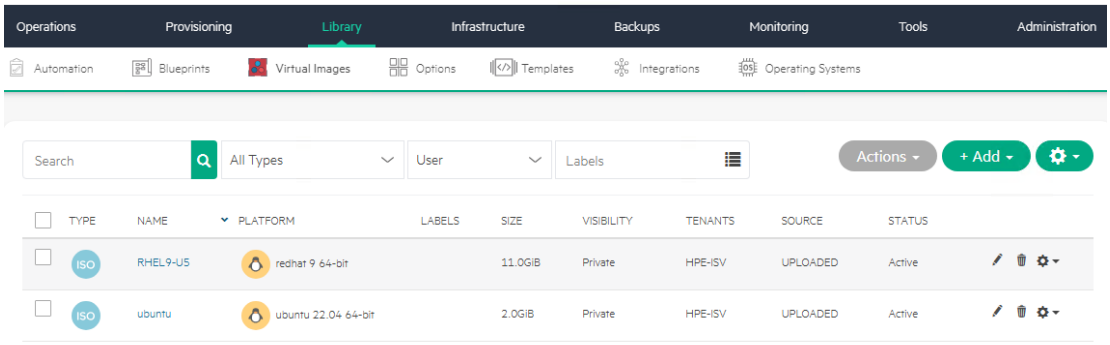

Figure 37. Virtual images

Deploy a VM on HPE VM Essentials cluster

Provision Instances

1. Navigate to **Provisioning > Instances.**
2. Click **+Add** and select HPE-VM as the instance type. Click **Next**.

Note

Only HPE-VM is the supported instance type on HPE VM Essentials Manager for now

---

3. Choose the required **Group, Cloud,** and **Environment** for the instance. Provide the Instance name.
4. Under **Configuration Options**, choose the CPU, Memory, cluster, volume, network, Host, and the VM's image.

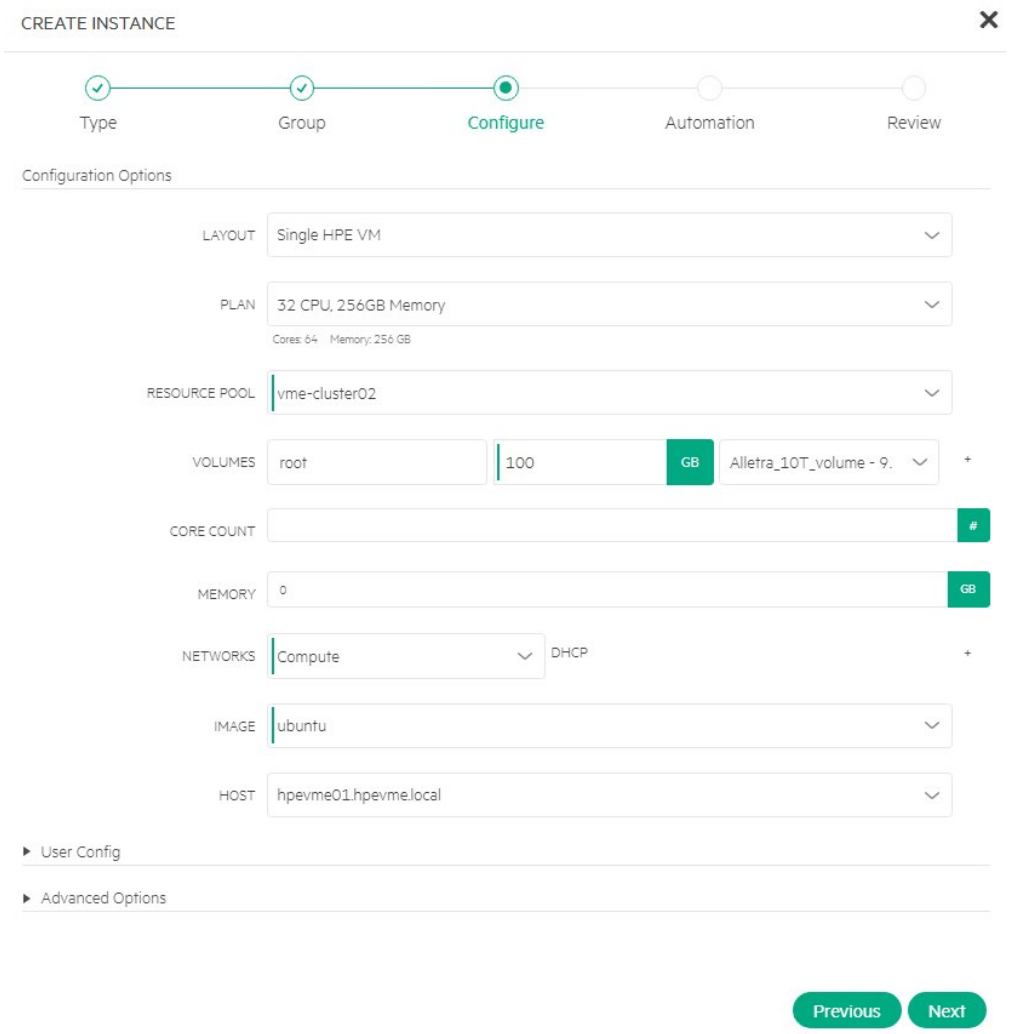

Figure 38. Create Instances

5. Click **Next** and click **Complete.**
6. After the VM gets **provisioned**, click **VM**.
7. Under **Actions** , select **Open Console** to start the deployment of the VM.
8. The following figure shows the sample Ubuntu VM deployed on the HPE-VM cluster.

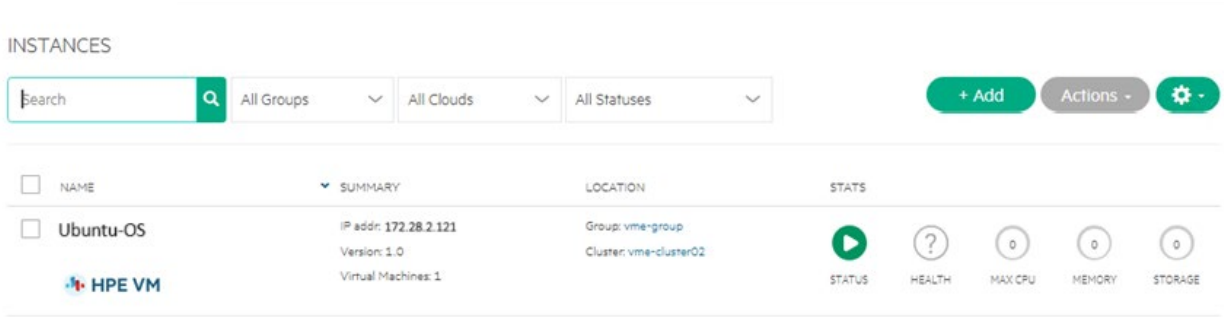

Figure 39. Verify Virtual machine deployed

Summary

HPE VM Essentials includes the HPE VM Essentials KVM-based hypervisor but also supports your existing VMware licenses, providing ease of use, agility, and a unified VM-vending experience for HPE VM Essentials and VMware clusters. The KVM stack is ideal for those exploring alternatives to VMware, starting with non-mission-critical workloads such as test and development.

Over the course of 2025, HPE plans to ramp performance testing and solution engineering to provide specific recommendations and other reference architectures for common workloads and an expanded set of target use cases.

Morpheus is well known for its integration into dozens of third-party technologies. HPE VM Essentials leverages that same pluggable abstraction framework to enable partner ecosystem integration, such as with backup providers Cohesity, Commvault, and Veeam.

At launch, HPE VM Essentials is offered under a term-based subscription license and shall be priced competitively on a per-CPU socket basis, with no extra charge for connecting existing VMware clusters.

Hewlett Packard Enterprise is delivering this Reference Architecture to demonstrate the following:

- The deployment overview of HPE VM Essentials Hypervisor with HPE VM Essentials Manager.
- How to build HPE VM Essentials environment with your choice of HPE ProLiant servers listed in the compatibility matrix, HPE Alletra Storage MP B10000 as principal storage for iSCSI connectivity.

Appendix

Appendix A: Terminology

Table A1. Terminology

Name	Description
Ubuntu 22.04	The base operating system for the HPE VM Essentials hypervisor is Ubuntu 22.04. The installation of the base Ubuntu operating system is a requirement for deployment of the hypervisor
Morpheus Agent	The software that runs on each hypervisor host that collects system stats, logs, and executes operations received from the management server
Kernel Virtual Machine (KVM)	KVM is the underlying virtualization technology used in the HPE Virtualization solution
QEMU	A generic machine emulator and virtualizer for running Windows and Linux operating systems
Libvirt	A hypervisor independent API for managing platform virtualization
Open vSwitch (OvS)	OvS is the underlying virtual networking technology used in the HPE Virtualization solution
HPE VM Essentials manager	The management server that provides KVM clustering, identity, virtual machine provisioning, monitoring, logging, and more

Table A2. Terminology

Name	Description
Hypervisor network	The virtual network synced or created from VMware vSphere and HPE VM Essentials hypervisor
HPE VM Essentials network	The logical construct in HPE VM Essentials used to tie together the IPAM, DNS, and the hypervisor network
Network pool	The IP address pool used to assign IP addresses to the provisioned virtual machines Native: HPE VM Essentials includes a native IP pools capability to provide a lightweight IPAM solution IPAM Integration: HPE VM Essentials supports integrating with third party IPAM solutions such as SolarWinds, BlueCat, Infoblox, and more
Domain	The network domain used to manage the DNS records for the provisioned virtual machines –DNS Integration –HPE VM Essentials supports integrating with third party DNS solutions such as BlueCat, MS DNS, Infoblox, and more.
Management network	Used for managing the VM environment, including access to the HPE-VME console and hypervisor management
Compute network	Used for VM traffic between compute nodes. This network carries data traffic generated by virtual machines
Storage network	Handles traffic for accessing storage systems like Ceph, NFS, or iSCSI
Aggregated network	Compute Network and Management Network are managed together on two ports while storage is managed via two ports
Disaggregated network	Compute Network , Management Network, Storage network are all managed on two ports each requiring three network adapters total
Virtual Machine network Interface	The network interface attached to the virtual machine that is “visible” from within the virtual machine
Tap interface	The virtual connection used to connect the virtual machine to the Open vSwitch Bridge
Open vSwitch port	The virtual port on the Open vSwitch bridge that a network interface connects to
Open vSwitch Bridge	A virtual switch used to connect virtual machines and the physical network
Bonded Network Interface	A “virtual” network interface used to aggregate multiple physical network interfaces into a single “virtual” interface
Physical network interface	The physical network interface that connects to the physical network. Cloud Module instances use CX6 cards
Round Robin	Transmit packets are load balanced in sequential order across the bonded physical network interfaces.
Active-Backup	Only one physical network interface is active at a time while the other network interfaces are only used in the event of a failure.
Balance XOR	Transmit packets are load balanced across the bonded physical network interfaces based upon a hashing algorithm
802.3ad	Dynamic link aggregation mode that transmits and receives on all members in the active aggregator. Requires switch configuration and 802.3ad compliant switches

Name	Description
Balance-TLB (Transmit Load Balancing)	Transmit packets are load balanced across the bonded physical network interfaces based upon the transmit load.
Balance-ALB (Active Load Balancing)	Transmit and receive packets are load balanced across the bonded physical network interfaces

Appendix B: Bill of materials

Note

Part numbers are at time of publication/testing and subject to change. The bill of materials does not include complete support options or other rack and power requirements. If you have questions regarding ordering, please consult with your Hewlett Packard Enterprise Reseller or Hewlett Packard Enterprise Sales Representative for more details. hpe.com/us/en/services/consulting.html

Table B1. Bill of materials

Part number	Quantity	Description
P9K08A	1	HPE 42U 600mmx1075mm G2 Kitted Advanced Shock Rack with Side Panels and Baying
P9K08A 001	1	HPE Factory Express Base Racking Service
P53933-B21	4	HPE ProLiant DL365 Gen11 8SFF Configure-to-order Server
P53933-B21 0D1	4	Factory Integrated
P53933-B21 ABA	4	HPE DL365 Gen11 8SFF CTO Svr
P53699-B21	8	AMD EPYC 9534 2.45GHz 64-core 280W Processor for HPE
P53699-B21 0D1	8	Factory Integrated
P50312-B21	96	HPE 64GB (1x64GB) Dual Rank x4 DDR5-4800 CAS-40-39-39 EC8 Registered Smart Memory Kit
P50312-B21 0D1	96	Factory Integrated
P55020-B21	4	HPE ProLiant DL365 Gen11 8SFF Tri-Mode U.3 x1 BC FIO Backplane Kit
P63871-B21	8	HPE 1.6TB SAS Mixed Use SFF BC Self-encrypting FIPS 140-2 PM7 SSD
P63871-B21 0D1	8	Factory Integrated
P47785-B21	4	HPE MR216i-p Gen11 x16 Lanes without Cache PCI SPDM Plug-in Storage Controller
P47785-B21 0D1	4	Factory Integrated
P42041-B21	8	Mellanox MCX631432AS-ADAI Ethernet 10/25Gb 2-port SFP28 OCP3 Adapter for HPE
P42041-B21 0D1	8	Factory Integrated
P58462-B21	28	HPE ProLiant DL3XX Gen11 1U Performance Fan Kit
P58462-B21 0D1	28	Factory Integrated
P03178-B21	8	HPE 1000W Flex Slot Titanium Hot Plug Power Supply Kit
P03178-B21 0D1	8	Factory Integrated
E5Y43A	4	HPE OneView for ProLiant DL Server including 3yr 24x7 Support FIO Bundle Physical 1-server LTU
P56903-B21	4	HPE ProLiant DL365 Gen11 8SFF x1 SAS/SATA/NVMe PCIe Cable Kit
P56903-B21 0D1	4	Factory Integrated
P57849-B21	4	HPE ProLiant DL3X5 Gen11 x16 OCP1 OCP2 2P Upgrade Cable Kit
P57849-B21 0D1	4	Factory Integrated
P48922-B21	4	HPE ProLiant DL3XX Gen11 Intrusion Cable Kit
P48922-B21 0D1	4	Factory Integrated
P08040-B21	4	HPE iLO Common Password FIO Setting
P52351-B21	4	HPE DL3XX Gen11 Easy Install Rail 2 Kit

Part number	Quantity	Description
P52351-B21 0D1	4	Factory Integrated
P58457-B21	8	HPE ProLiant DL3X5 Gen11 1U CPU Performance Heat Sink Kit
P58457-B21 0D1	8	Factory Integrated
R9F63A	2	HPE Aruba Networking CX 6300M 48G Power-to-Port Airflow 2 Fans 1 Power Supply Unit Bundle
R9F63A 0D1	2	Factory Integrated
R9F63A B2B	2	HPE Aruba Networking CX 6300M 48G Power-to-Port Airflow 2 Fans 1 Power Supply Unit Bundle PDU
R9F61A	2	HPE Aruba Networking CX 6300M 12VDC 250W 100-240VAC Power-to-Port Airflow Power Supply Unit
R9F61A B2B	2	HPE Aruba Networking CX 6300M 12VDC 250W 100-240VAC Power-to-Port Airflow Power Supply Unit PDU
R9F61A 0D1	2	Factory Integrated
R9F57A	2	HPE Aruba Networking 1U Universal 4-post Rack Mount Kit
R9F57A 0D1	2	Factory Integrated
R9F59A	2	HPE Aruba Networking 4-post Rack Kit
R9F59A 0D1	2	Factory Integrated
R9F67A	2	HPE Aruba Networking CX 8325-32C Power-to-Port Airflow 6 Fans 2 Power Supply Units Bundle
R9F67A 0D1	2	Factory Integrated
R9F67A B2B	2	HPE Aruba Networking CX 8325-32C Power-to-Port Airflow 6 Fans 2 Power Supply Units Bundle PDU
R9F77A	2	HPE Aruba Networking 100G QSFP28 to QSFP28 1m Direct Attach Copper Cable
R9F77A B01	2	HPE Aruba Networking 100G QSFP28 to QSFP28 1m Direct Attach Copper Cable
845416-B21	6	HPE 100Gb QSFP28 to 4x25Gb SFP28 3m Direct Attach Copper Cable
845416-B21 0D1	6	Factory Integrated
BW932A	1	HPE 600mm Rack Stabilizer Kit
BW932A B01	1	HPE 600mm Rack include with Complete System Stabilizer Kit
ZU715A	1	HPE Virtual Rack Service
S1R06A	1	HPE Alletra Storage MP B10200 Base Configuration
S1R06A 0D1	1	Factory Integrated
581817-B21	1	HPE Configurator Defined Build Instruction Option
R7C75A	1	HPE Alletra Storage MP 10000 2U Chassis
R7C75A 0D1	1	Factory Integrated
R7D03A	2	HPE Alletra Storage MP B10240 Controller Node
R7D03A 0D1	2	Factory Integrated
R7C90A	4	HPE Alletra Storage MP 32/64Gb 4-port Fibre Channel Host Bus Adapter
R7C90A 0D1	4	Factory Integrated
Q2P62A	16	HPE 32Gb SFP28 Short Wave 1-pack Pull Tab Optical Transceiver
Q2P62A 0D1	16	Factory Integrated
S2A68A	4	HPE Alletra Storage MP 100GbE 2-port OCP Host Bus Adapter
S2A68A 0D1	4	Factory Integrated

Part number	Quantity	Description
R7C76A	2	HPE Alletra Storage MP C14 1600W AC Power Supply
R7C76A 0D1	2	Factory Integrated
S3L68A	1	HPE C13 - C14 250V 10Amp Black 2m WW Power Cord
S3L68A 0D1	1	Factory Integrated
S3L69A	1	HPE C13 - C14 250V 10Amp Gray 2m WW Power Cord
S3L69A 0D1	1	Factory Integrated
S1J10A	1	HPE Alletra Storage MP 10001 NVMe Configure-to-order Expansion Shelf
S1J10A 0D1	1	Factory Integrated
R7C76A	2	HPE Alletra Storage MP C14 1600W AC Power Supply
R7C76A 0D1	2	Factory Integrated
S1R28A	2	HPE Alletra Storage MP 10010 Expansion Shelf Node
S1R28A 0D1	2	Factory Integrated
S2A68A	2	HPE Alletra Storage MP 100GbE 2-port OCP Host Bus Adapter
S2A68A 0D1	2	Factory Integrated
R9H66A	24	HPE Alletra Storage MP 1.92TB NVMe SFF Self-encrypting SSD
R9H66A 0D1	24	Factory Integrated
S3L68A	1	HPE C13 - C14 250V 10Amp Black 2m WW Power Cord
S3L68A 0D1	1	Factory Integrated
S3L69A	1	HPE C13 - C14 250V 10Amp Gray 2m WW Power Cord
S3L69A 0D1	1	Factory Integrated
S1R08A	2	HPE Alletra Storage MP 32-port 100GbE Switch Bundle
S1R08A 0D1	2	Factory Integrated
S3L68A	2	HPE C13 - C14 250V 10Amp Black 2m WW Power Cord
S3L68A 0D1	2	Factory Integrated
S3L69A	2	HPE C13 - C14 250V 10Amp Gray 2m WW Power Cord
S3L69A 0D1	2	Factory Integrated
R9F76A	12	HPE Aruba Networking 100G QSFP28 to QSFP28 2m Active Optical Cable
R9F76A B01	12	HPE Aruba Networking 100G QSFP28 to QSFP28 2m Active Optical Cable
S0A95A	1	HPE Switch Pair Installation Kit with 4U Cable Tray
S0A95A 0D1	1	Factory Integrated
S0A98A	1	HPE Storage Data Encryption LTU
S0A98A 0D1	1	Factory Integrated
S3Q02A	1	HPE Alletra Storage ArcusOS per TB 5-year LTU
S3Q02A 0D1	1	Factory Integrated
R9G33AAE	2	HPE Aruba Networking Fabric Composer Device Management Service Tier 3 Switch 5y Subscription E-STU
R9G28AAE	2	HPE Aruba Networking Fabric Composer Device Management Service Tier 4 Switch 5y Subscription E-STU

Part number	Quantity	Description
S3Q02AAE	46	HPE Alletra Storage MP B10000 per TB 5-year Software and Support SaaS
H38NHAS	1	HPE Alletra Storage MP B10000 SVC
HA124A1	1	HPE Technical Installation Startup SVC
HA124A1 VZJ	1	HPE Alletra STG MP B10000 DrvEncl Fld SVC
HA124A1 V1Q	1	HPE Alletra STG MPB10000BkedSwch Fld SVC
HA124A1 VZW	1	HPE Alletra Storage Arcus OS Startup SVC
HA124A1 VZM	1	HPE Alletra STG MPB10000Swtch 2N Fld SVC

Resources and additional links

HPE Reference Architectures, hpe.com/info/ra

HPE Servers, hpe.com/servers

HPE Storage, hpe.com/storage

HPE Networking, hpe.com/networking

HPE Alletra MP Cabling - https://infosight.hpe.com/welcomecenter/cabling/?family=hfblock

HPE Alletra Storage MP B10000 quick specs - https://www.hpe.com/psnow/doc/a50006985enw.pdf?jumpid=in_pdp-psnow-qs

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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