Hewlett Packard Enterprise

Reference architecture

HPE Reference Architecture for HPE Morpheus VM Essentials Software 8.0.5

HPE ProLiant Servers and HPE Alletra Storage MP B10000-Fibre Channel

Contents

Executive summary

HPE Morpheus VM Essentials is a unique software offering which provides highly-available HPE Morpheus VM Essentials hypervisor (HVM) 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 Morpheus 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 (HVM) 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 (HVM 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 Morpheus VM Essentials software offers an upgrade path to the full HPE Morpheus Enterprise 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.

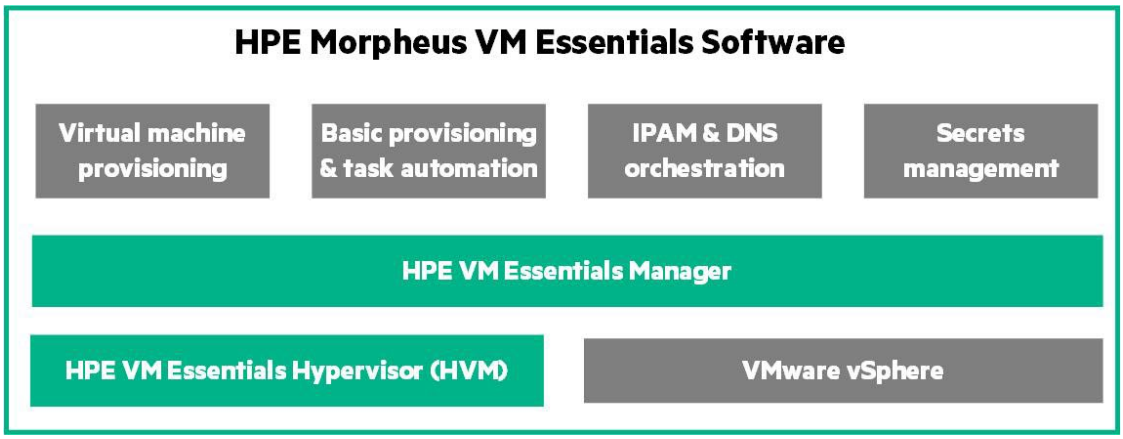

Figure 1. HPE Morpheus VM Essentials capability diagram

HPE VM Essentials hypervisor features

- **HPE Validated Hardware:** The HPE VM Essentials hypervisor (HVM 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-morpheus-vm-essentials-software-compatibility-matrix
- **VM Live Migration:** Migrate a running VM Essentials virtual machine from one host to another within the same cluster with zero downtime.
- **VM High Availability:** Automatically restart 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 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 VM Essentials virtual machine from one storage datastore to another with zero downtime.
- **VMware VM Conversion:** Convert existing VMware virtual machines to the HVM hypervisor using the native conversion feature within the VM Essentials solution.
- **Native Data Protection:** Backup and restore VM Essentials virtual machines using the solution's native data protection feature.
- **Virtual Machine Snapshots:** Create, revert and delete snapshots for VMware and VM Essentials virtual machines.
- **External Storage Support:** The HVM 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 Fibre Channel has been validated.

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

- **Multi-Hypervisor Support:** VM Essentials enables simple provisioning and management of 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:** 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 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 Morpheus VM Essentials software. The reader should be well-versed with virtualization, enterprise networking, storage, and HPE ProLiant DL Servers. For assistance with the deployment of HPE ProLiant DL Servers with 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 Morpheus VM Essentials Software as an enterprise-ready hybrid cloud solution by leveraging the combined value of 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 VM Essentials on HPE ProLiant DL servers with the HPE Alletra Storage MP B10000 Fibre Channel 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 May 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 Morpheus VM Essentials Software 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.

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

Integrated management of VMware and HPE native KVM Workloads

With 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

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

- Support for Ceph, 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 Morpheus VM Essentials Software 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, 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 found in the compatibility matrix https://www.hpe.com/support/VME-Compatibility-Matrix.

HPE Morpheus 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 Fibre Channel storage. VM Essentials, comprising of HPE VM Essentials (HVM) hypervisor and HPE VM Essentials manager, provides a unified platform for managing both HPE VM Essentials (HVM) cluster and VMware-based environments.

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 Fibre Channel.
- **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 SAN Switches** - HPE Storage Fibre Channel B-series SN6700B switches connecting the HPE ProLiant DL servers and HPE Alletra Storage MP B10000 for SAN traffic.
- **HPE VM Essentials Manager** - Enables the HPE VM Essentials administrator to easily manage array storage, datastores, and virtual machines.

Figure 2 shows the HPE VM Essentials solution stack validated by Hewlett Packard Enterprise.

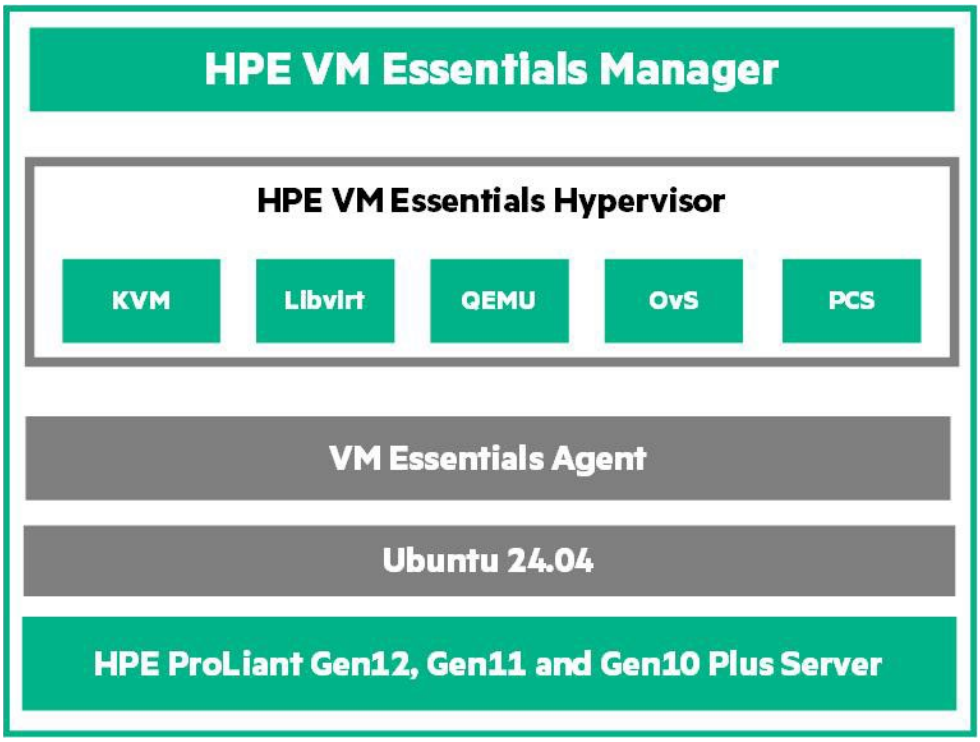

Figure 2. Diagram layout showcasing the HPE VM Essentials solution stack

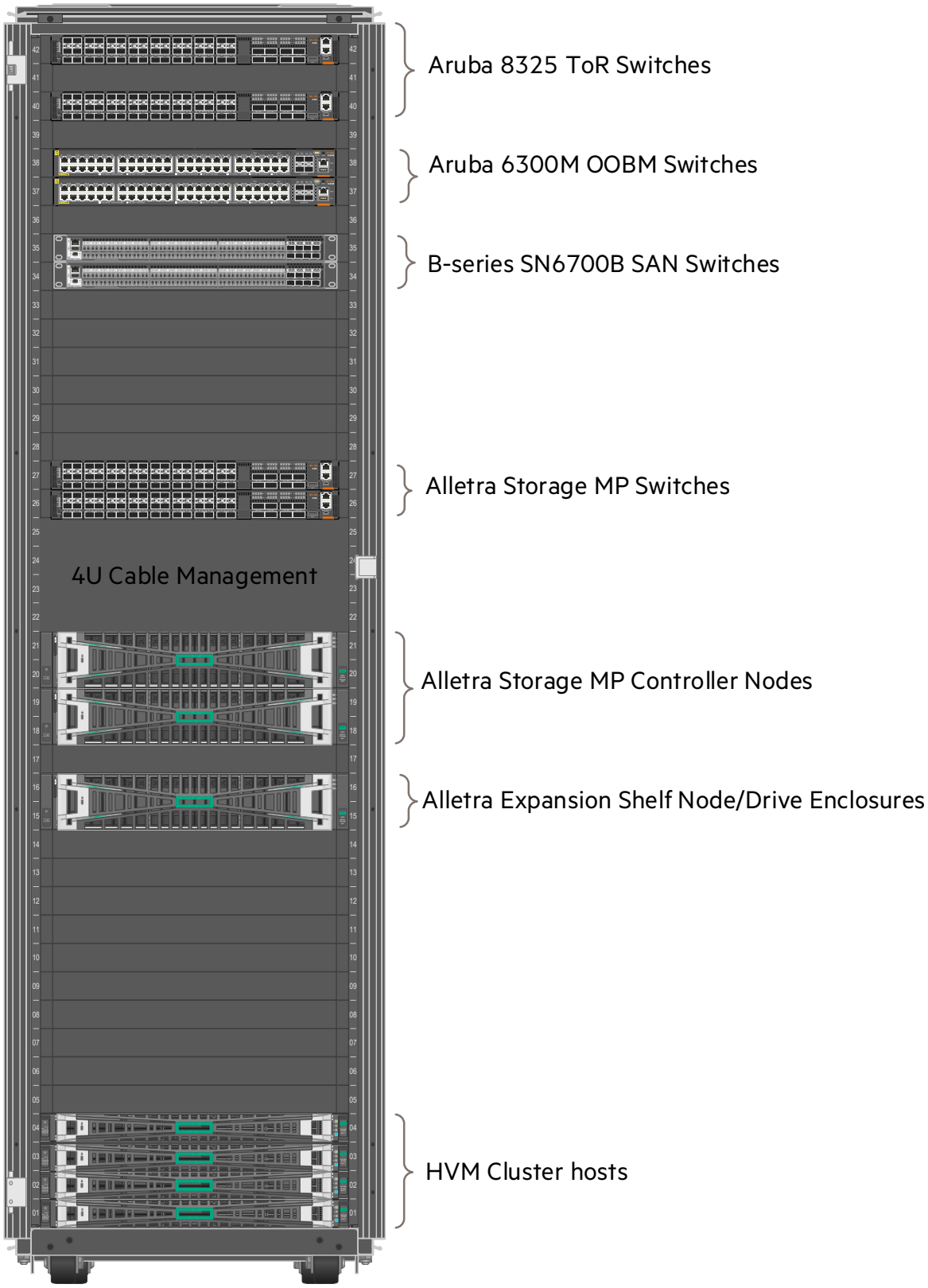

Figure 3. Overview of Hewlett Packard Enterprise VM Essentials Rack

HPE Morpheus VM Essentials Software Solution Components

HPE VM Essentials and HPE Virtualization hypervisor (HVM hypervisor) is validated on the HPE ProLiant DL Servers and is tested with the hardware and software components listed in the following sections.

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

Software

The logical architecture of the validated VM Essentials stack comprises the following components:

HPE VM Essentials Manager

The VM Essentials Manager 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 24.04 HVM host and can be installed in one of three pre-defined sizes as following:

- **Small**: 2 vCPUs and 12 GB RAM (Manages a maximum of 1 HPE VM Essentials (HVM) cluster)
- **Medium**: 4 vCPUs and 16 GB RAM (Manages a maximum of 3 HVM clusters)
- **Large**: 4 vCPUs and 32 GB RAM (Manages a maximum of 10 HVM clusters)

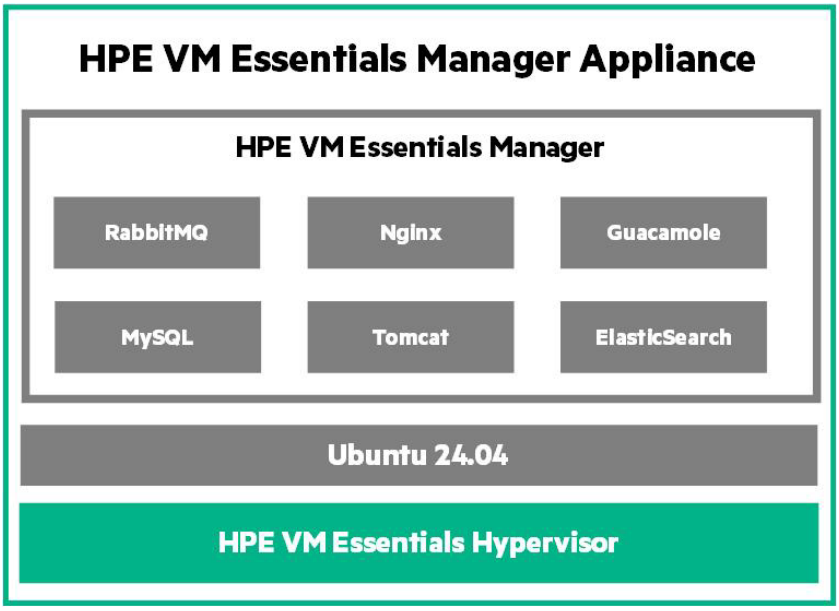

Figure 4. HPE VM Essentials Manager layout diagram

HPE VM Essentials Hypervisor

HVM hypervisor is a KVM-based hypervisor hosting virtual machines being managed by the 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**: For the Ubuntu 24.04 operating system, a minimum of 50 GB disk space is required, with at least 15 GB specifically allocated to the OS partition. The virtual image datastore must maintain at least 20% usable free space to avoid automatic deletion of older images. Clusters can be configured with external storage options such as iSCSI, Fibre Channel, or NFS. In deployments where Ceph is used as a storage solution using internal drives - a minimum of 500 GB is required for the data disk during testing, with larger capacities recommended for production environments.

- **Network Connectivity**: HVM Hypervisor hosts must be assigned static IP addresses. They also need DNS resolution for VM Essentials Manager and Internet access to download and install system packages for VM Essentials dependencies, such as KVM, Open vSwitch (OVS), and more.
- HVM clusters require a minimum of three hypervisor hosts when using Fibre Channel 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 FC connectivity.

The following network ports are being used for communication in the 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 HVM hypervisor host and collects system stats, logs, and executes operations received from the VM Essentials Manager.

Ubuntu 24.04

The installation of the base Ubuntu 24.04 operating system is a prerequisite for deploying the HVM hypervisor. Ubuntu 24.04 can be installed either on local disks in the HPE ProLiant servers or via boot from SAN using the HPE Alletra Storage MP B10000. A minimum of 50 GB disk space is required for the installation. During the Ubuntu 24.04 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.

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 100Gb 2-port ethernet network adapters and 32Gb 2-port host bus adapters as HVM hypervisor hosts.
- **HPE Storage** – The HPE Alletra Storage MP B10000 is configured as principal block storage for the HPE ProLiant DL servers over Fibre Channel.
- **HPE Networking** – HPE Aruba 8325 and Aruba 6300 switches connecting the HPE ProLiant DL servers production traffic and management traffic respectively.
- **HPE Aruba MP Switches** - With the HPE Alletra Storage MP B10000, Aruba MP switches serve as the high-performance storage fabric backbone, enabling robust connectivity between HPE servers and storage controller nodes, as well as between controller nodes and disk enclosures. For smaller deployments or limited node scalability, the HPE Alletra Storage MP B10000 also supports switchless configurations through direct-attached connections, making it suitable for test environments or small-scale production setups.

- **HPE SAN** - HPE Storage Fibre Channel B-series SN6700B switches connecting the HPE ProLiant DL servers and HPE Alletra Storage MP B10000 for SAN traffic.

HPE ProLiant DL365 Gen11 server

The HPE ProLiant DL365 Gen11 server is a rack-optimized, 1U 2P solution that delivers exceptional compute performance, upgraded high-speed data transfer rate, and memory depth at 2P compute capability.These servers are powered by 4th & 5th Generation AMD EPYC™ 9004 & 9005 Series Processors with up to 160 cores, increased memory bandwidth and capacity, high-speed PCIe Gen5 I/O, Enterprise and Datacenter Standard Form Factor (EDSFF) and GPU support.The HPE ProLiant DL365 Gen11 server is a superb rack-optimized, 1U 2P, dense solution and, engineered to optimize IT with a cloud operating experience, built-in security, and optimized performance for workloads to drive your business forward.

Front view

Figure 5. Front view of HPE ProLiant DL365 Gen11 Server

Rear view

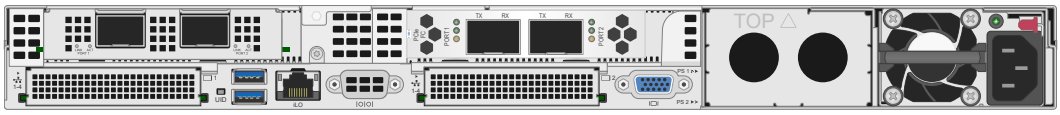

Figure 6. Rear view of HPE ProLiant DL365 Gen11 Server

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 front view of HPE Alletra Storage MP B10000.

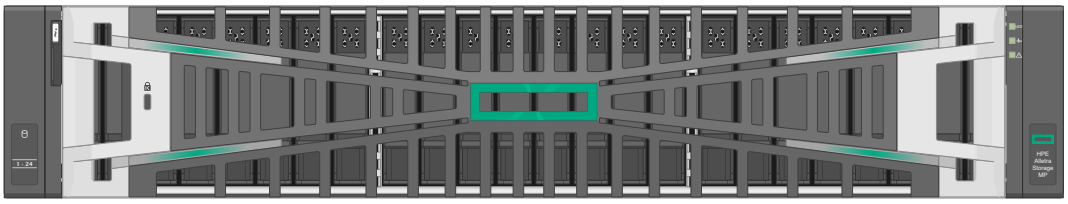

Figure 7. Front view of HPE Alletra Storage MP B10000 Storage

Figure 8 shows the rear view of HPE Alletra Storage MP B10000.

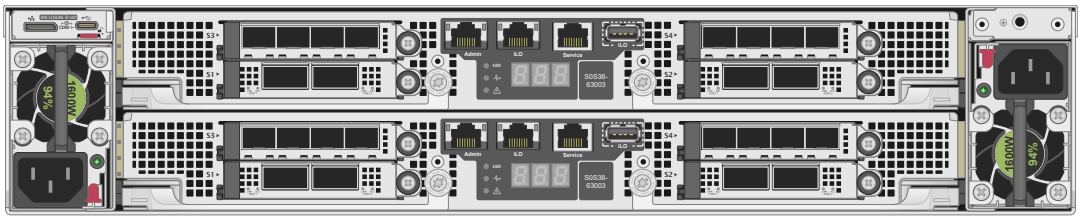

Figure 8. Rear view of HPE Alletra Storage MP B10000 Storage

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

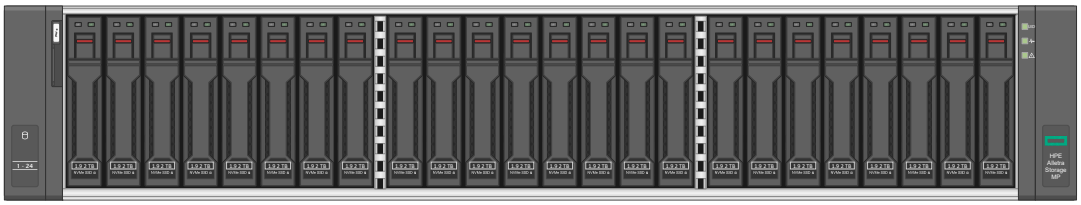

Figure 9. Front View of HPE Alletra Storage MP Drive Enclosure

Rear View

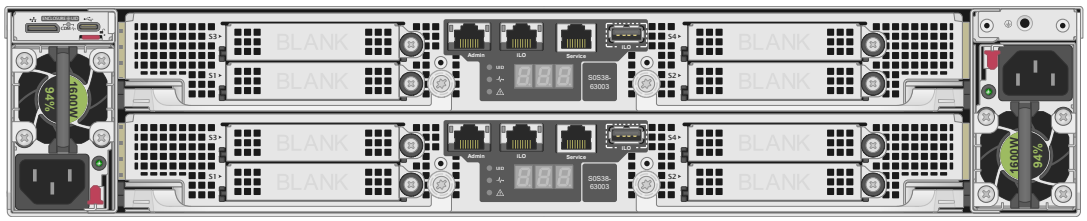

Figure 10. Rear view of HPE Alletra Storage MP

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.

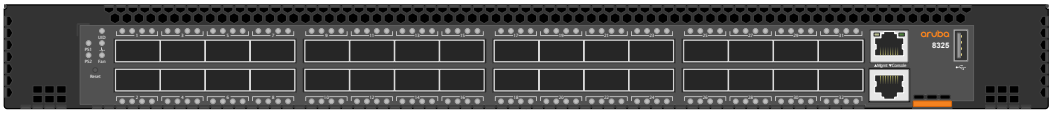

Figure 11. HPE Alletra Storage MP Switches

HPE B-series SN6700B SAN Switches

The HPE Storage Fibre Channel Switch B-series SN6700B is a high-performance, ultra-dense, highly scalable, and easy-to-use enterprise-class storage networking switch delivering Gen7 64Gb Fibre Channel (FC) capabilities. It is designed to support data growth, demanding workloads, and data center consolidation in small to large scale enterprise infrastructures. Delivering 64Gb performance, customized high port density, and integrated network sensors, it accelerates data access, adapts to evolving requirements, and drives 24x7 businesses.

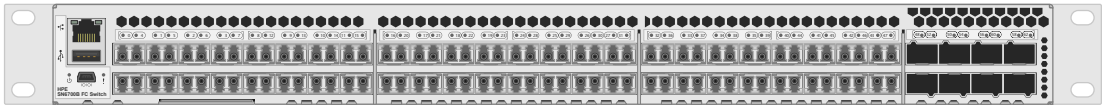

Figure 12. HPE Storage Fibre Channel SN6700B Switch

Aruba 8325 Top of Rack Switches

The Aruba 8325 Switches offers a flexible and innovative approach to addressing the application security and scalability demands of the mobile, cloud, and IoT era. These switches serve the needs of the next-generation core and aggregation layer, as well as emerging data center requirements at the Top of Rack (ToR) and End of Row (EoR). The Aruba 8325 series include industry-leading line rate ports 1/10/25GbE (SFP/SFP+/SFP28) and 40/100GbE (QSFP+/QSFP28) with connectivity in a compact 1U form factor.

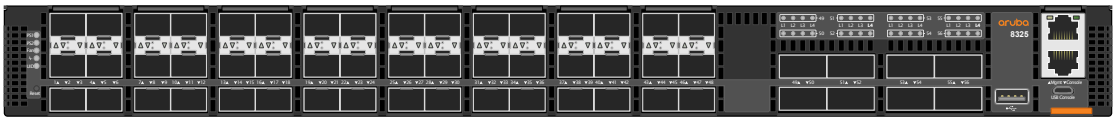

Figure 13. Aruba 8325 32Y8C Switch

Aruba 6300M Out of Band Management Switches

The Aruba CX 6300 Switch Series is a modern, flexible, and intelligent family of stackable switches ideal for enterprise network access, aggregation, core, and data center top of rack (ToR) deployments. Created for game-changing operational efficiency with built-in security and resiliency, the Aruba 6300 switches provide the foundation for high-performance networks supporting IoT, mobile, and cloud applications

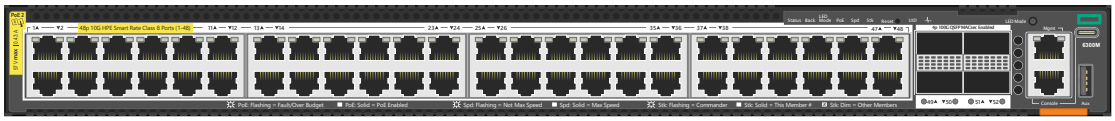

Figure 14. Aruba 6300M Switch

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 Morpheus VM Essentials Software Compatibility matrix can be found here https://hpevm-docs.morpheusdata.com/en/8.0.5-vme/vme_getting_started/vme_getting_started.html#hpe-morpheus-vm-essentials-software-compatibility-matrix.

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

Component	Version
HPE Morpheus VM Essentials Software	8.0.5
SPP for HPE VM Essentials nodes	P81143_001_gen11spp-2025.03.00.00-Gen11SPP2025030000.2025_0326.29.iso
Ubuntu OS	24.04.2
Aruba CX 8325 Switch (R9F67A)	10.13.1070 {ArubaOS-CX_8325_10.13.1020}
Aruba 6300M Switch (R9F63A)	10.13.1070 {ArubaOS-CX_6400-6300_10.13.1020}
HPE SAN Switches 6700B	v9.1.1d2
Aruba Fabric Composer (AFC)	7.1.1 {ArubaFabricComposer-7} Note: Aruba Fabric Composer orchestrates a discrete set of switches as a single entity called a fabric which significantly simplifies operations and troubleshooting
HPE Alletra Storage MP B10000 OS	10.4.5

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 along with Fibre Channel HBA's. The following are the network design considerations for HPE VM cluster deployed on HPE ProLiant Gen11 servers:

- Link Aggregation Control Protocol (LACP) 803.2ad is a type of network bond that is more effective for virtualization. Network ports hosting management and compute (workload) traffic for the HPE VM cluster are bonded in 802.3ad mode to provide maximum throughput and network path redundancy.
- Fibre Channel traffic to HPE Alletra MP array is carried over 2-port FC host bus adapters on the HPE VM hosts with first port connecting to SAN switch A and second port connecting to SAN Switch B.

Converged network connectivity

With converged network connectivity, management and compute (workload) traffic is carried over a set of network adapters bonded together using LACP. Fibre Channel traffic will flow over 2-port FC host bus adapters.

The following diagram illustrates this configuration on a server equipped with 2-port 100 Gbps ethernet network adapter and 2-port 32 Gbps Fibre Channel host bus adapter:

- **pNIC01** and **pNIC02** are bonded (LACP) to handle management and compute traffic.
- **FC HBA Port1** connected to SAN **Switch A.**
- **FC HBA Port2** connected to SAN **Switch B.**

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

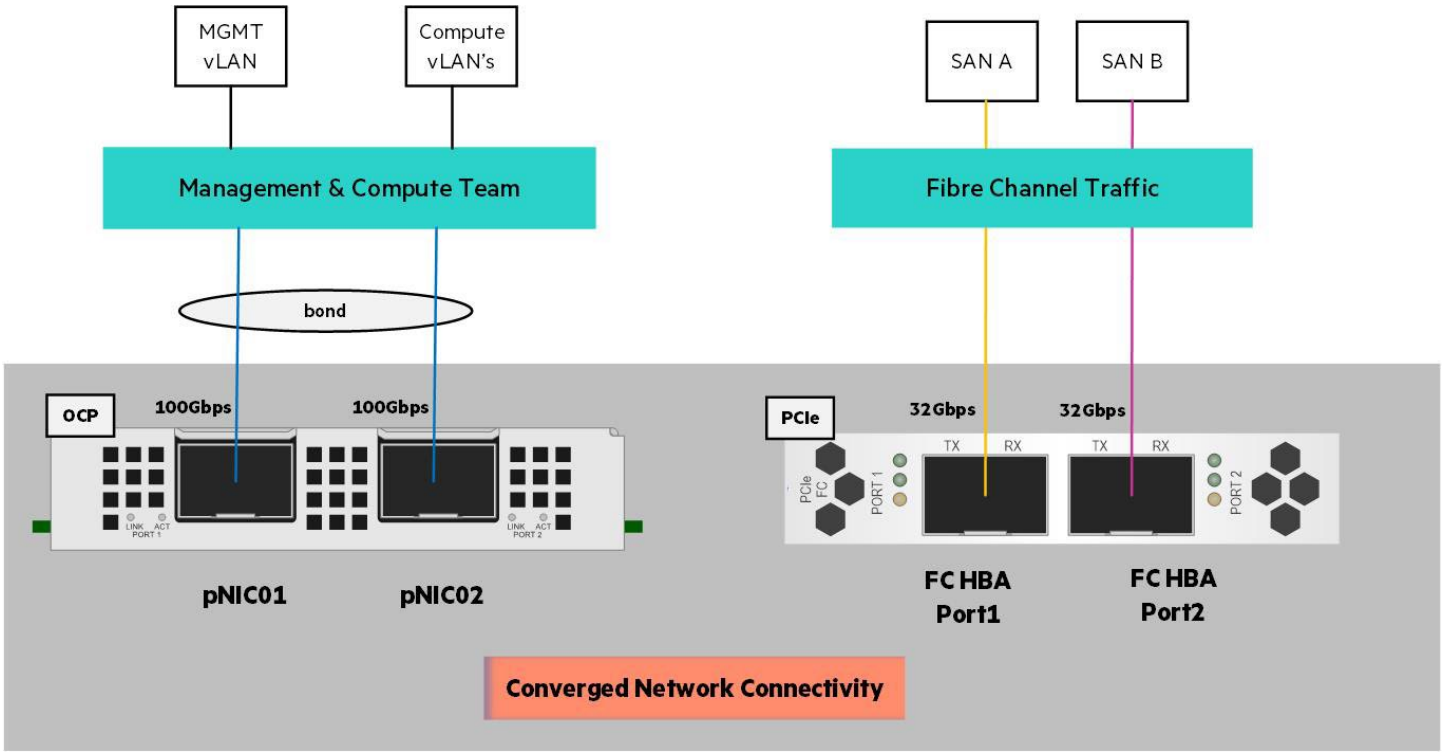

Figure 15. Converged network connectivity

Diverged network connectivity

In a diverged network connectivity model, each traffic type—management, compute, and storage—is isolated and mapped to a dedicated set of physical adapters. Management and compute traffic are handled through separate NIC pairs, each configured with LACP-based bonding for redundancy and performance. This separation ensures clear traffic isolation and optimized network performance. Fibre Channel traffic, on the other hand, is routed exclusively through dedicated dual-port FC Host Bus Adapters (HBAs), providing high-speed, low-latency connectivity to external storage fabrics.

The following diagram illustrates this setup on a server equipped with two 2-port100 Gbps network adapters and 2-port 32 Gbps Fibre Channel host bus adapter:

- **pNIC01** and **pNIC03** are bonded to handle **management traffic.**
- **pNIC02** and **pNIC04** are bonded to handle **compute (workload) traffic**.
- **FC HBA Port1** connected to **SAN Switch A.**
- **FC HBA Port2** connected to **SAN Switch B.**

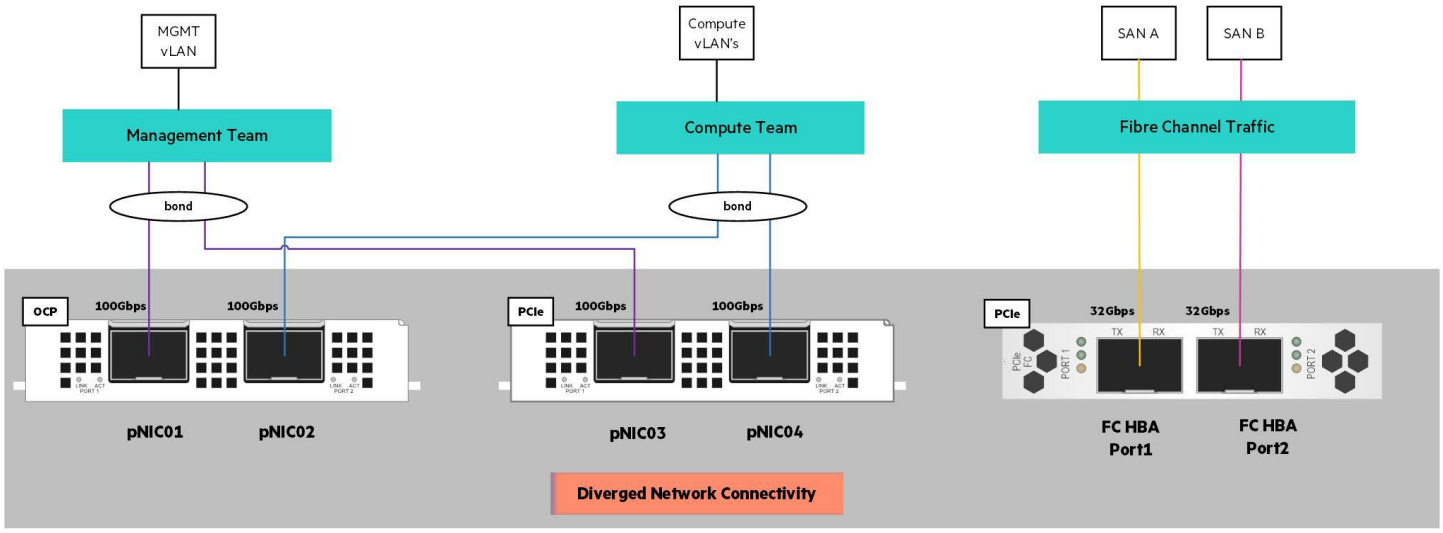

Figure 16. Diverged Network Connectivity

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:

The HPE Alletra Storage MP B10000 offers broad support for multiple storage protocols, making it ideal for a wide range of application environments.

Switch-Based Deployment (Enterprise-Scale):

- Leverages Ethernet or Fibre Channel switches to enable high scalability and redundancy.
- Hosts connect through a redundant switch fabric to ensure high availability and fault tolerance.
- Ideal for large-scale, mission-critical enterprise workloads requiring maximum uptime and flexibility.

Direct-Attached Deployment (Switchless):

- Storage nodes are connected directly to hosts using NVMe, iSCSI, or Fibre Channel interfaces.
- Simplified architecture with reduced cost and setup complexity.
- Best suited for edge deployments, test environments, or smaller-scale production use cases with limited scalability requirements.

Note
For 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.

Software

HPE Gen11 SPP: HPE Gen 11 SPP (P81143_001_gen11spp-2025.03.00.00-Gen11SPP2025030000.2025_0326.29.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 24.04 available at https://releases.ubuntu.com/jammy/.

HPE Morpheus VM Essentials Software and HPE VM Essentials Manager: VM Essentials software version 8.0.5 and VM Essentials Manager comes bundled in a single package file HPE_VM_Essentials_SW_image_8.0.5_S5Q83-11009.iso. For customer or partner's access to VM Essentials software, contact your Hewlett Packard Enterprise Sales Representative.

Storage

The storage provisioning process requires that physical connectivity is properly established between the HPE VM Essentials nodes, the HPE Alletra MP B10000 storage array, and the associated HPE network switches. In Fibre Channel configurations, appropriate zoning must be configured on the Fibre Channel switches to ensure secure and isolated communication paths between each host and the storage array. Additionally, the storage array must be initialized and accessible via the HPE Data Services Cloud Console (DSCC) to enable configuration management, monitoring, and lifecycle operations.

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 HPE ProLiant Gen11 servers need to be configured in RAID 1 mode. Workload profile in HPE ProLiant 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:

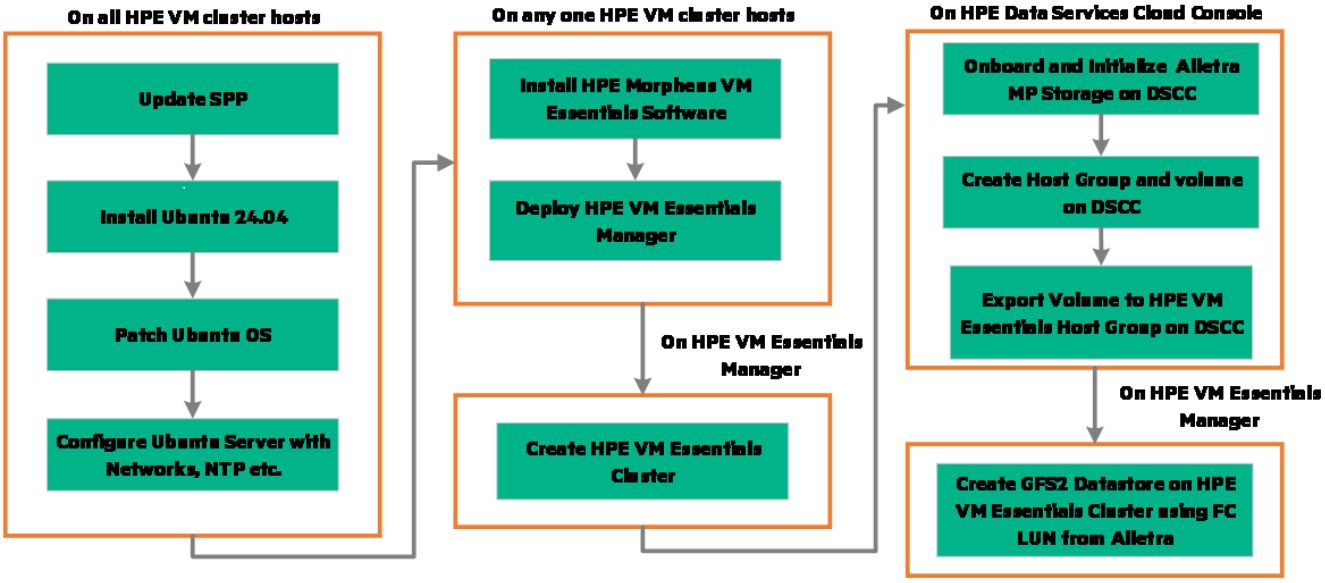

Figure 17. Workflow

Install and configure Ubuntu 24.04

This section discusses installation and configuration of Ubuntu 24.04 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 24.04.2 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. This network set up is in line with converged network connectivity discussed earlier in this document.

1. Select the first port of ethernet network adapter (connects to first Aruba switch) and the second port of the same 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 allowing both host management and compute network.

   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 Mgmt, and HPE VM Essentials Node Mgmt.
102	172.28.2.0/24	Compute (workloads)

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. The following figure shows the bonding created for management and compute networks.

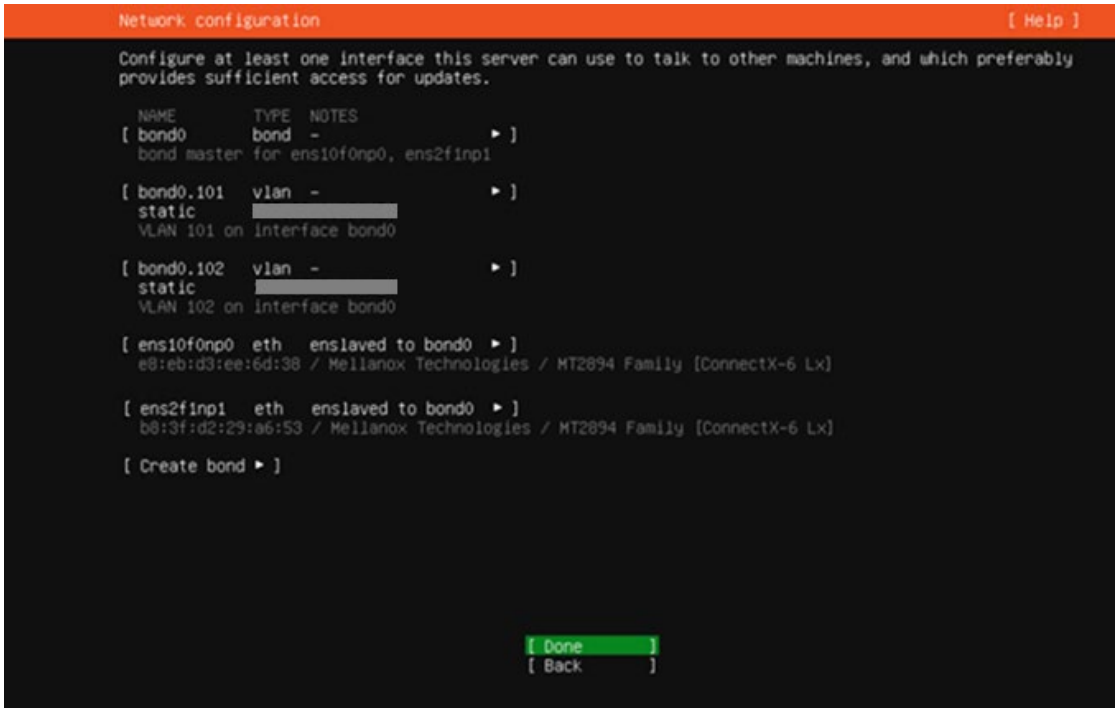

Figure 18. Ubuntu Network Setup

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.

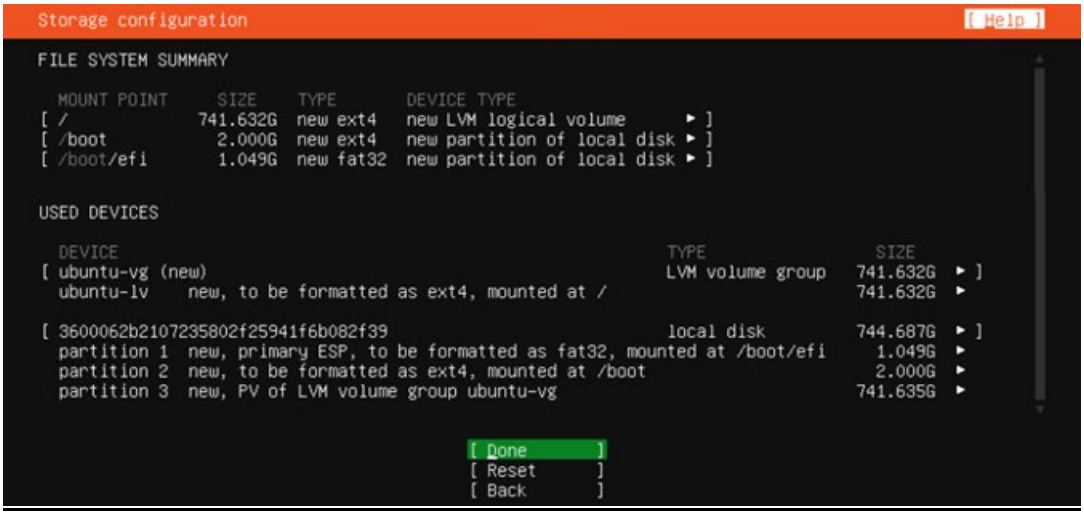

Figure 19. Ubuntu OS Partition Setup

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: <<ntp-server-ip-address>>
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. To ensure all installed packages are brought up to their latest available versions, run the following command:

```
#sudo apt-get upgrade
```

3. This upgrades the current packages without removing or installing any new dependencies.

Install HPE Morpheus VM Essentials Software

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 HVM cluster.

Note
The 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.

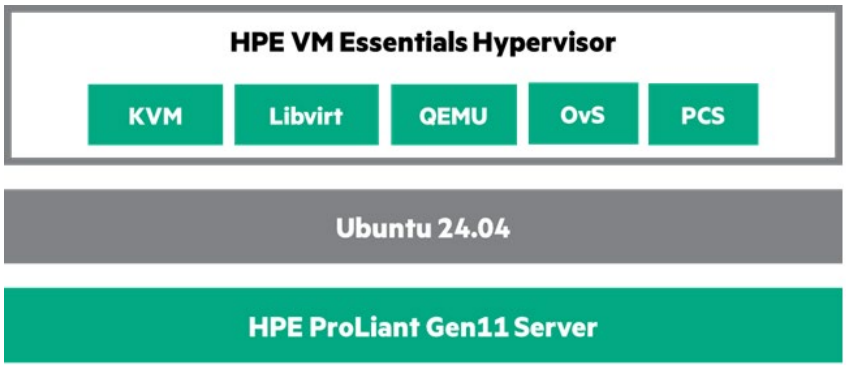

Figure 20. Install HPE VM Essential Software

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-r--r--. 1 root root 7.6G May  6 05:13 HPE_VM_Essentials_SW_image_8.0.5_1_S5Q83-11009.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_8.0.5_1_S5Q83-11009.iso /mnt/iso
#cd /mnt/iso
#ls -l
-r--r--r--. 1 root root   34439392 Apr  4 12:17 hpe-vm_1.0.5-1_amd64.deb
-r--r--r--. 1 root root 8049158038 Apr 18 19:41 hpe-vme-8.0.5-1.qcow2.gz
```

Note
hpe-vm_1.0.5-1_amd64.deb enabled VME virtualization capability on Ubuntu hosts while the hpe-vme-8.0.5-1.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_1.0.5-1_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
```

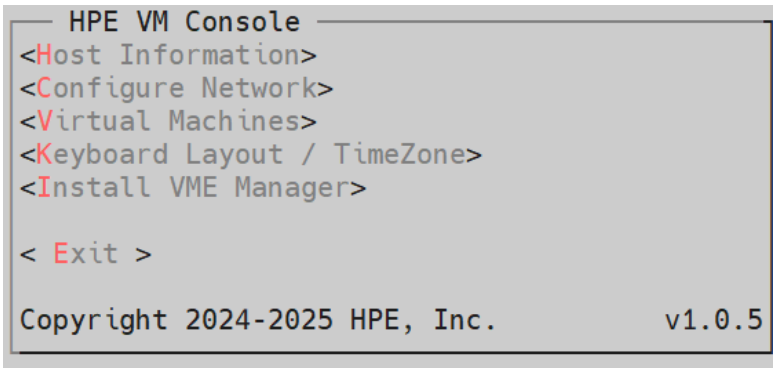

Figure 21. HPE-VM console

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.

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

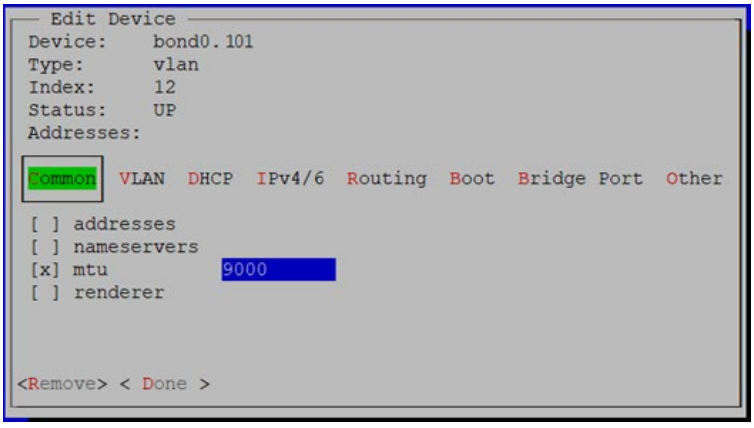

Figure 22. Update MTU on Device

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 8049158038 Apr 18 19:41 hpe-vme-8.0.5-1.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.

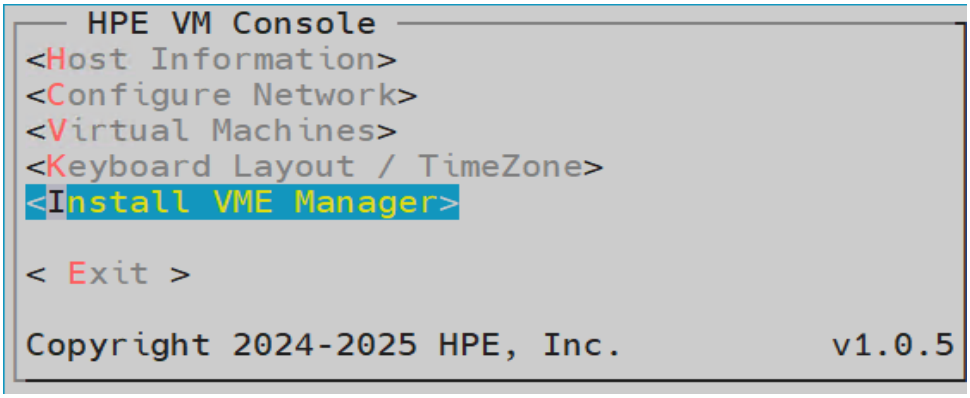

Figure 23. HPE-VM console

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-8.0.5-1.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.

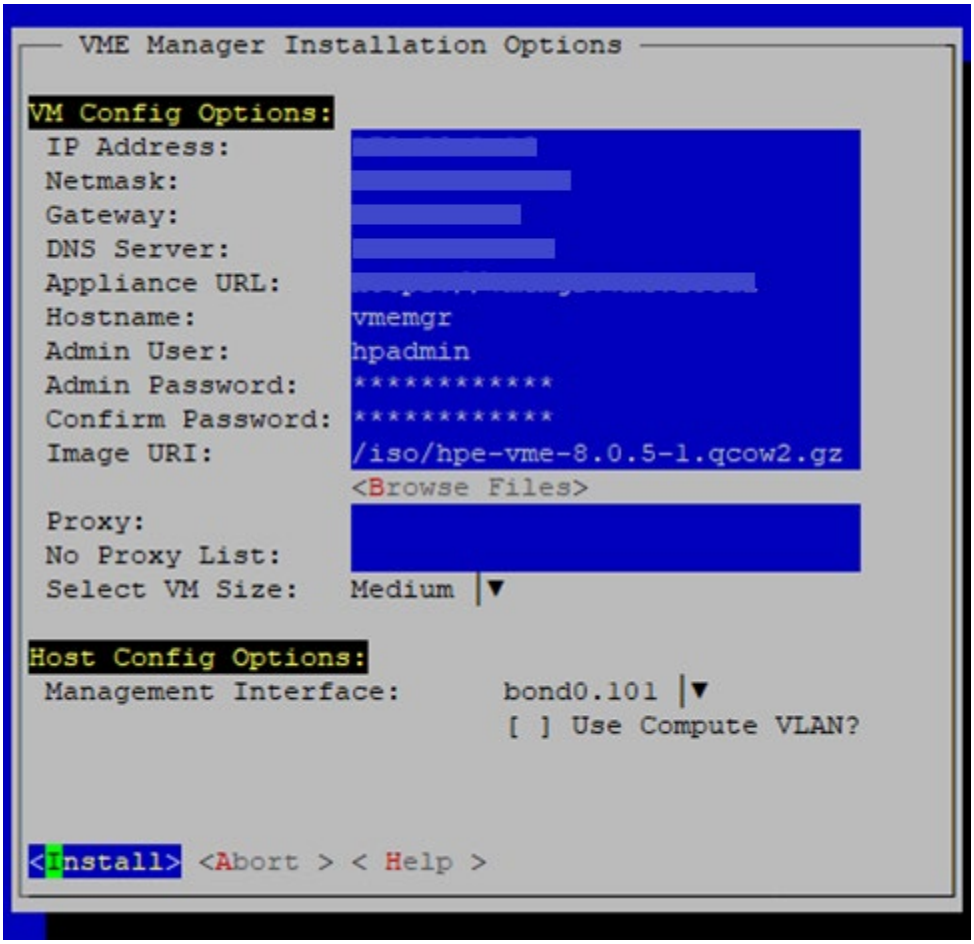

Figure 24. HPE VM Essentials Manager Setup

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.

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:

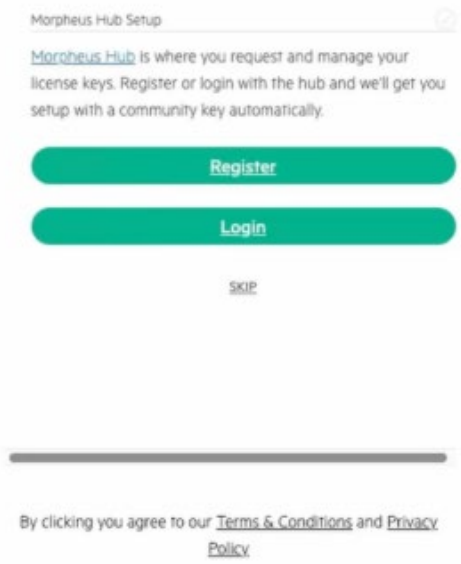

Figure 25. VME Manager Setup

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

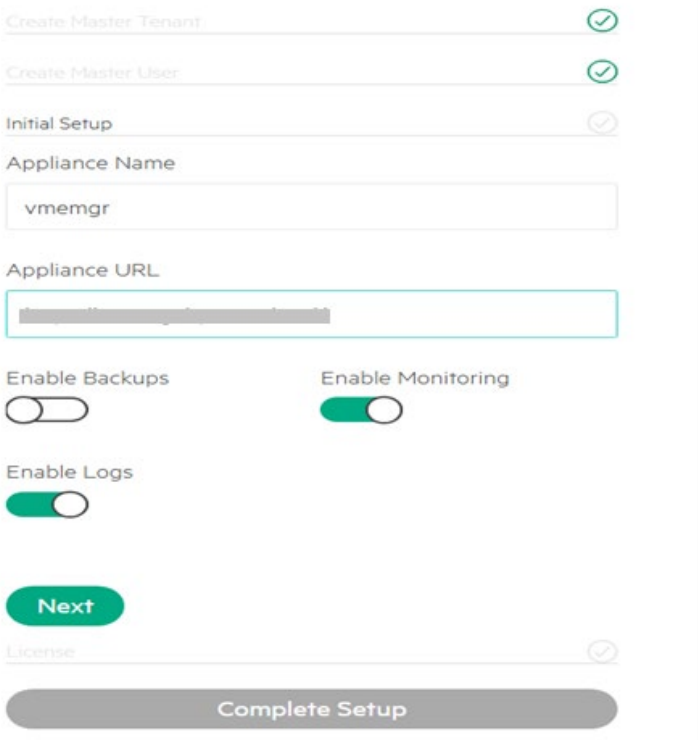

Figure 26. Complete setup

7. 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.

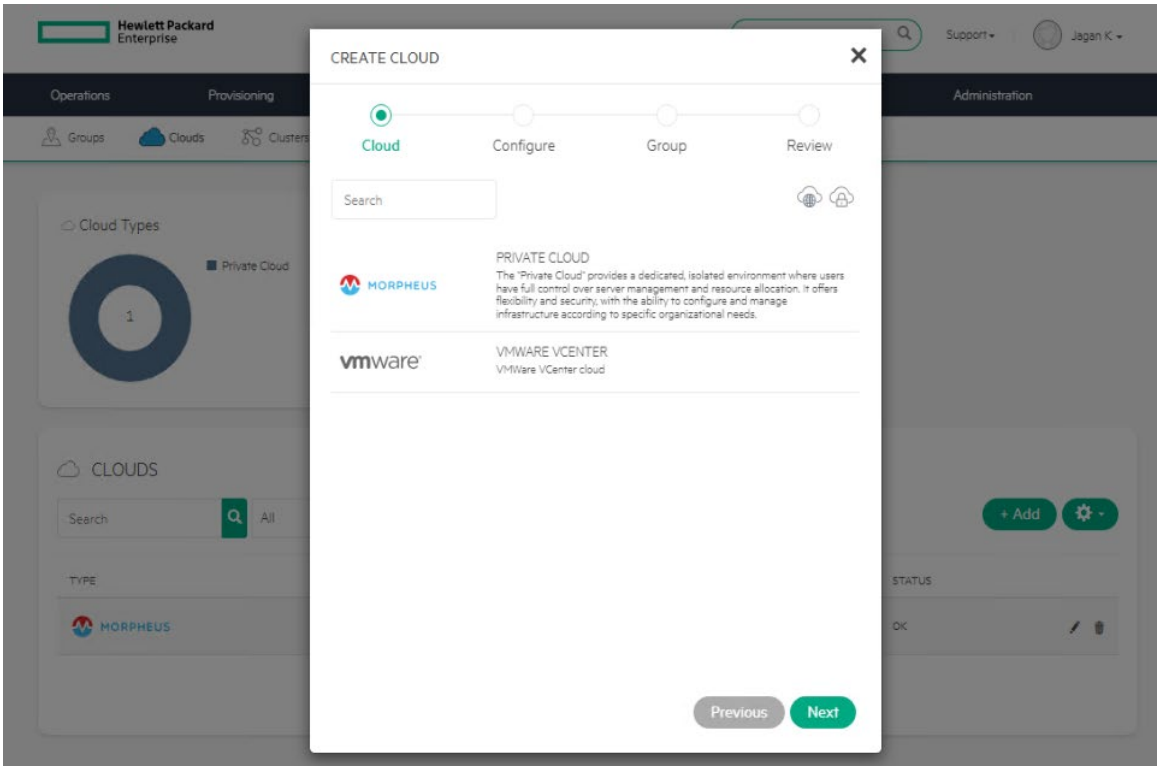

Figure 27. Create Cloud

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**.

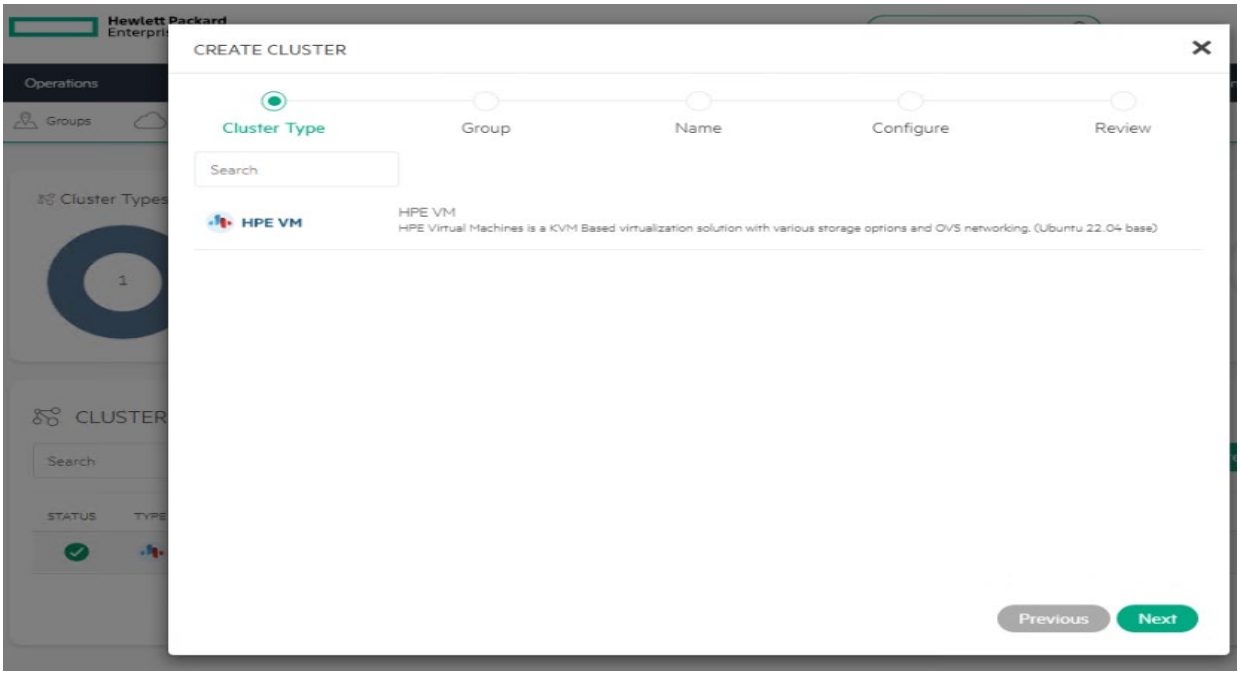

Figure 28. Create Cluster

6. Under Configuration Options, select the layout "HPE VM 1.2 cluster on Existing Ubuntu 24.04". 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 cluster 1.2 HCI Ceph Cluster on Existing Ubuntu 24.04" layout option, which leverages Ceph-based storage.

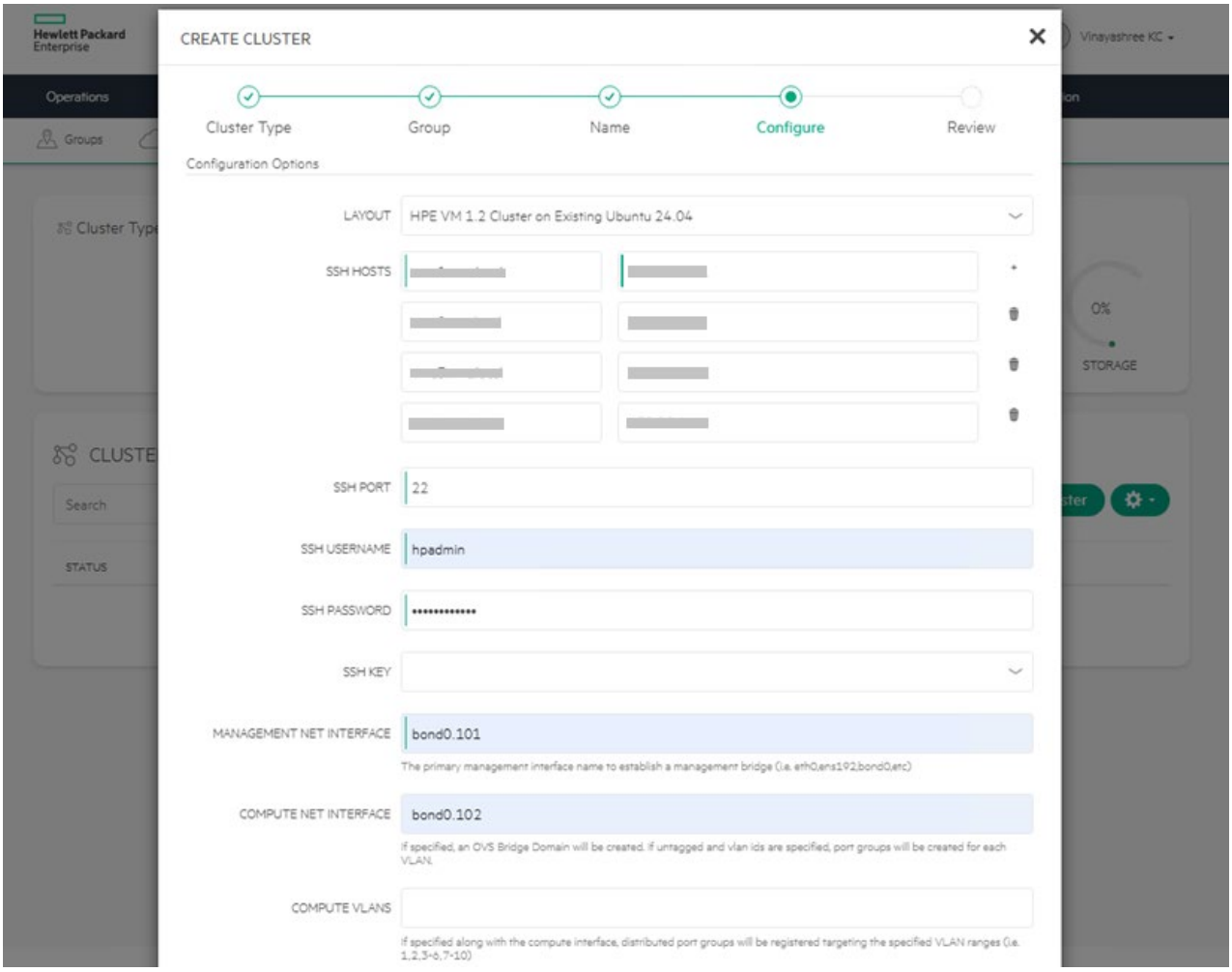

Figure 29. Create Cluster

Storage Provisioning

- Storage will be provisioned to the HPE VM Essentials (HVM) nodes using GFS2 over Fibre Channel. GFS2 is a clustered file system that enables multiple nodes in the cluster to concurrently access a shared datastore. In this setup, storage is provided by the HPE Alletra Storage MP B10000 array and accessed via Fibre Channel for clustered workloads that require shared storage access.

Note

As listed in the prerequisites - The storage provisioning process requires that physical connectivity is properly established between the HPE VM Essentials nodes, the HPE Alletra MP B10000 storage array, and the associated HPE network switches. In Fibre Channel configurations, appropriate zoning must be configured on the Fibre Channel switches to ensure secure and isolated communication paths between each host and the storage array. Additionally, the storage array must be initialized and accessible via the **HPE Data Services Cloud Console (DSCC)** to enable configuration management, monitoring, and lifecycle operations

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Configuring HPE Alletra MP B10000 Fibre Channel

Prerequisites

1. HPE Alletra MP storage and HVM cluster hosts are cabled to SAN switches ensuring FC port redundancy on hosts and controller node redundancy on Alletra MP Storage.

2. Alletra MP storage backend cabling to Aruba 8325 MP switches and disk enclosure is as per https://infosight.hpe.com/welcomecenter/cabling/?family=hfblock&mode=csi.
3. Serial number and product number of the Alletra Storage MP array (located on the array tag).
4. Subscription ID: The recipient (i.e. customer) of the HPE Alletra Storage MP order will receive an HPE Software delivery receipt email along with necessary details to activate the subscription. The recipient should follow the instructions on the delivery receipt to activate subscription.
5. HPE discovery tool 1.1.2 to discover HPE Alletra Storage MP array.
6. Serial connection to the SAN switches.
7. Network configuration details for Alletra MP Storage such as IP address, network mask, gateway, DNS, and NTP. This will be used during discovery phase to configure networking on Alletra Storage MP, and this network should have access to internet.

HPE Alletra Storage MP B10000 initialization and configuration

HPE Alletra MP Storage cloud enablement

1. Create a new workspace on HPE GreenLake cloud to on-board the HPE Alletra Storage MP array.
2. Add the **Data Services Cloud Console** application to the workspace under the correct region <EU West, AP North East, US West, or EU Central>.
3. Add or invite right set of users to the workspace.
4. Onboard Alletra Storage MP array to HPE GreenLake Data Services Cloud Console. This requires Alletra subscription ID, Serial number and product number.

Refer HPE GreenLake for Block Storage Getting Started Guide for more information on onboarding Alletra to DSCC.

On premises HPE Alletra MP storage discovery

To begin the discovery process, ensure the Installation System/Jump station is configured with the same subnet as Alletra management network.

Here are the steps to discover HPE Alletra Storage MP array and to configure the base network parameters as follows:

1. Launch HPE Discovery Tool (1.1.2) with administrator permissions and enter the array serial number captured as part of prerequisite.
2. Ensure that Network type is enabled for IPv4 and click **Search**.
3. Click yes on the pop-up window to accept and allow application to make changes on the installation system user account control by adding an IP route.
4. After the array is discovered, a default URL will be displayed on the tool. Click **Launch**.

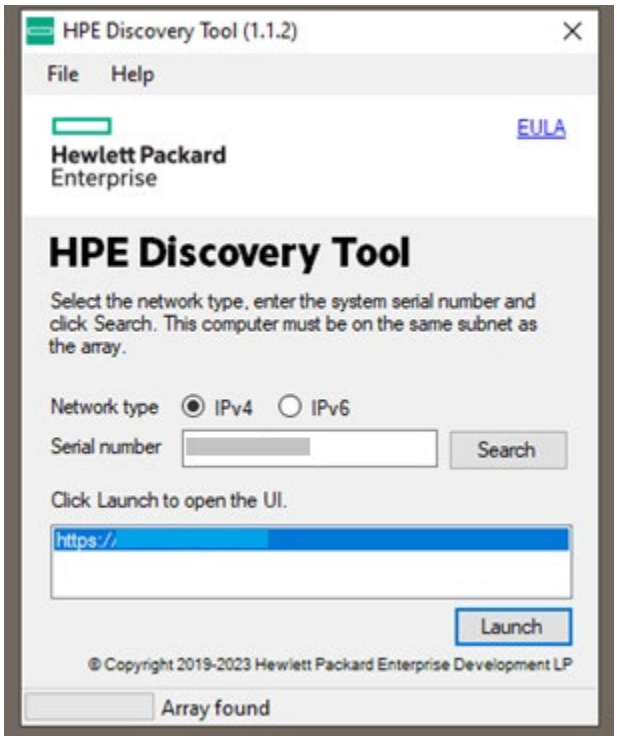

Figure 30. Alletra Array Discovery Tool

5. This will redirect to array UI on the default web browser of the system and will land on the **Welcome to HPE Cloud Connectivity** Wizard. Accept any warnings to proceed to the unsafe URL and click **Get Started.**
6. Read and accept End-User License Agreement (EULA) and click **Continue.**
7. Configure management network and proxy for Alletra MP storage array with the inputs below.
    a. Network
        I. IP address: **<<Alletra_mgmt_ip>>**
        II. Netmask: **<<mgmt_net_mask>>**
        III. Gateway: **<<mgmt_net_gw>>.**
        IV. DNS server IP address 1: **<<mgmt_net_dns>>**
        V. Click **Continue**
    b. Proxy
        I. Select HTTP Proxy
        II. Proxy Server: **<<proxy_ipaddress>>**
        III. Proxy Server Port: **80**
        IV. Click **Continue**

c. Time

I. Time (NTP) server: **<<mgmt_net_ntp>>**

II. Region: from drop-down select array installation region
For example> Region: America

III. Country/State/City: from drop-down select locale that maps to the region previous selected

For example > Country/State/City: America/Chicago (UTC-05:00)

IV. Click **Continue**.

d. Review the settings and accept configuration, click **submit**.

8. This will redirect to the progress screen as network settings, date and time are set and finally **Data Services Cloud console** connection is checked to ensure connectivity to HPE GreenLake Cloud portal.

Note
During the process the array will sync with DSCC services and validate subscription, in case of any issues the process will fail and denote at what point it failed. The option is made available to modify settings and rerun initial network configuration.

---

9. After successful configuration, the system will be connected to Data Services Cloud Console, subscription key will be published and validated. To complete the initialization, the array should also be initialized through DSCC.

Initialize HPE Alletra MP Storage on Data Services Cloud Console

1. Connect to Data Services Cloud Console - HPE GreenLake Cloud platform at https://common.cloud.hpe.com.
2. Sign-In using your HPE SSO credentials.
3. After landing on the welcome pane, navigate to the workspace created as a prerequisite and click **Go to Workspace.**
4. Upon landing on the workspace, navigate on the top ribbon to **Services** and launch **Data Services** under the region for which the HPE Alletra MP Storage array is being deployed.
5. Navigate to **Setup Service** tile within the Data Services Cloud Console pane.
6. Select the storage system associated with the deployment that has been configured earlier. Here the connection status will indicate as **Connected** and Setup Status as **Not initialized** and click **Set Up System**.
7. Configure the following through the Setup Wizard. Most of the values will be prepopulated here as per on-premises array discovery process, if values are already populated just click continue.

a. Domain

I. DNS Server

II. Click "+" icon to the far right to add additional DNS servers

III. Click **Continue**

b. Time

I. NTP Server

II. Region

III. Timezone

IV. Click Continue

c. Proxy

I. Proxy URL

II. Click **Continue**

d. Support Contract: Add the appropriate contact information for GLVCF support (Managed Services-CSP) aligning with the customer's locale in which the array will be deployed.

e. System

I. Update Software on Setup: move the slider to the left to ensure that latest OS is not immediately updated after installation

II. System Name: <<Alletra_system_name>>

III. System Country Location: <Array Installation site country>

IV. System Credentials

1. Click **"+"** icon to create credentials

2. Create Credential

a. Name: <<Alletra_username>>

b. Description: Administrator

c. Username: <<Alletra1_username>>

d. Password: <<Alletra1_password>>

e. Confirm Password: <<Alletra1_password>>

f. Click **Create.**

3. Credentials: select <<Alletra_username>> from drop-down.

4. Click **Continue**

f. Review the configuration and then click Submit to start the initialization.

8. On the System Setup page, the status for the storage system will be updated with its progress as it cycles through initialization and configuration of the array.

9. Upon successful completion of initialization, navigate back to Data Services Cloud Console.

10. Click Launch on Data Ops Manager tile and verify the dashboard lists the HPE Alletra MP storage array.

Update HPE Alletra Operating System

To perform the software update, HPE Alletra Storage MP should be synced with DSCC. As part of the operating system upgrade an associated upgrade toolkit must be flashed first before upgrading the operating system.

The instructions for staging and updating the upgrade toolkit are same as staging and upgrading of operating system. Embedded within the OS is the firmware for the internal array's Aruba 8325c switches along with other hardware components.

1. Perform sanity check on the array to ensure its ready for operating system upgrade.
   a. Open SSH session to the HPE Alletra Storage MP management IP address and login with the appropriate admin credentials.
   b. Verify current operating system of array by executing % showversion -a -b
   c. Perform health check of the array by executing % checkhealth -svc -detail.
   d. Validate if the array is ready to perform an upgrade by executing % checkupgrade

Note

This will take a few minutes to complete.

2. Upon successful precheck, proceed to connect to the local UI of HPE Alletra Storage MP using its management IP address and admin user credentials. It might be necessary to obtain the software locally including Upgrade Toolkit if the expected release is a version below the available version.
3. Create Maintenance Window to put the storage system into maintenance mode for a set time. Using maintenance mode prevents certain events and alerts from being sent to HPE Infosight. The events and alerts are logged on the storage system but do not generate support alerts or service calls. On Dashboard navigate to System > Create Maintenance Window
4. Under General, provide the values as follows:.
   a. Reason for maintenance: System Upgrade
   b. Duration: 90 minutes
   c. Type: other
   d. Click **Start**
5. Navigate **System > Software >** click **Check for updates** on the **Actions** menu. If stagging the update package, instead click **Load an update package** on the **Action** menu. Follow the instructions on the dialog box.
   a. Load an update package -> point to the local location of operating system package on Installation System or laptop.
   b. Wait for the system readiness checks to complete after uploading the package. Click **Done**.

   Upon completion UI will lose connectivity and will require a refresh on the internet browser.
6. Update Software after package has been staged. Under **System > Software >** click **Update software** on the **Actions** menu.
   a. Select package to install and click **Install**.
   b. Read the warning message, select that you understand the implications and click **Yes**, install.
   c. Monitor the progress of the update and click **View details.**
7. Validate operating system update by navigating to **System > Software > Current version.**

SAN Zoning

1. Access the SAN switch through serial console, and set the password for 'admin' user.
2. Initialize the SAN switch with management network and time zone details.
3. Create aliases for HPE Alletra Storage MP host ports:
   a. SSH to the Alletra management IP and capture the port WWNs of controller nodes by executing % **showport**
   b. Construct array host port aliases as per PCE standard policy: "SiteNumber+Rack_array-hostname_Node:Slot:Port_SANSwitchPort"
   c. SSH to the SAN switch using management IP and appropriate login credentials. Configure the aliases using the below cli syntax and associate the storage host port with the WWPN captured from the array's showport output:

      ```
      #alicreate "<standard_naming_convention>", "<WWPN from Alletra host port>>"
      ```

      For example:

      ```
      #alicreate "S1R1_array2_NOS3P1_P10", "XX:XX:XX:XX:XX:XX:XX:XX"
      ```

      Note
      An alias must be created for every Alletra port that is cabled to SAN switch and is online.

   d. Save the configuration by running **cfgsave** on the SAN switch and verify the aliases created by running **alishow**
   e. SSH to another SAN switch and repeat steps c and d as applicable

Table 4. Alletra ports cabled to SAN switch for 2 node and 4 node configurations

Array	MP B10000 Slot 3 ports		MP B10000 Slot 4 ports	
Two-node	0:3:1	1:3:1	0:4:1	1:4:1
	0:3:2	1:3:1	0:4:2	1:4:2
	0:3:3	1:3:3	-	-
	-	-	0:4:4	1:4:4
Four-node	2:3:1	3:3:1	2:4:1	3:4:1
	2:3:2	3:3:2	2:4:2	3:4:2
	2:3:3	3:3:3	-	-
	-	-	2:4:4	3:4:4

4. Create aliases for WWPNs of HVM cluster hosts.
   a. Login to the iLO IP of each HP-VM host and capture the port WWNs (WWPN) of FC adapters under **System Information > Network**
   b. SSH to the SAN switch using management IP and appropriate login credentials. Construct HP-VM aliases as per data centers standard policy.

      Example: "SiteNumber+Rack_server-serialnumber_Slot:Port_SANSwitchPort"

   c. Configure the aliases using the below cli syntax and associate the storage host port with the WWPN captured from the array's showport output:

```
#alicreate “<standard_naming_convention>”, “<WWPN from HP-VM host port>>”
For example:
#alicreate “S1R1_3M1D1X110P_S1P1_P0”, "XX:XX:XX:XX:XX:XX:XX:XX "
```

Note
An alias must be created for every host port that is cabled to SAN switch and is online.

c. Save the configuration by running cfgsave on the SAN switch and verify the aliases created by running alishow.

d. SSH to another SAN switch and repeat steps c and d as applicable.

5. Configure SAN zoning as per the below table.

Table 5. Mapping of Alletra ports and workload server ports for 2 node and 4 node configurations

Host Grouping	Source Port	Workload servers	HPE Alletra Storage MP B10000 port mapping
1	PCIe HBA prt 1	<1,3,5,7,9,11, 13,15,17 … fx = last host # in range +2>	N0:S3:P1, N1:S3:P1, N2:S3:P1 & N3:S3:P1
	PCIe HBA prt 2		N0:S3:P2, N1:S3:P2, N2:S3:P2 & N3:S3:P2
2	PCIe HBA prt 1	<2,4,6,8,10,12,14,16,18… fx = last host # in range +2>	N0:S4:P1, N1:S4:P1, N2:S4:P1 & N3:S4:P1
	PCIe HBA prt 2		N0:S4:P2, N1:S4:P2, N2:S4:P2 & N3:S4:P2

a. SSH to the SAN switch using management IP and appropriate login credentials.
b. Configure the zone using the following cli syntax:

```
#Zonecreate “SiteNumber+Rack_server-serialnumber_array-hostname_SlotPorts”,  “<server_alias>; <HPE Alletra MP Node#_port_alias>; <HPE Alletra MP Node#_port_alias>; <HPE Alletra MP Node#_port_alias>;<HPE Alletra MP Node#_port_alias>”
For example:
#zonecreate  ”S1R1_3M1D1X110P_array2_S3P2”,
”S1R1_3M1D1X110P_S1P2_P0;S1R1_array2_N0S3P2_P10;S1R1_array2_N1S3P2_P14”
```

Note
Zone creation must be done for all the HVM hosts in the HVM cluster as per the zone mapping information provided in the above table.

2. Save the configuration by executing cfgsave on the SAN switch.

3. Create and activate the configuration by running below commands on SAN switch:

```
# cfgcreate  “<<SAN-A-config-file-name”, “zones”
For example:
cfgcreate ”GLPCE_VME_SAN_A_cfg”,
”S1R1_3M1D1X110P_array2_S3P1;S1R1_3M1D1X110M_array2_S4P1;S1R1_3M1D1X110N_array2_S3P1;S1R1_3M1D1X110L_array2_S4P1”
# cfgenable  “<<SAN-A-config-file-name”
```

4. Verify the effective configuration on the SAN switch by executing **cfgactvshow.**

5. SSH to another SAN switch and repeat steps b to e as applicable.

Host Group and volume creation on Data Services Cloud Console

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 **FC** as the protocol, choose Ubuntu as the operating system, and then click Next.
5. In the **Initiators** section, click **+ Create**. In the **Add FC Initiator** provide the FC Qualified Name (WWNs) of the host, click **Add** then click **Done**.
6. Click **Next**, then click **Create** to complete the host creation process.
7. Repeat steps 3-5 to add all the HPE 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**.

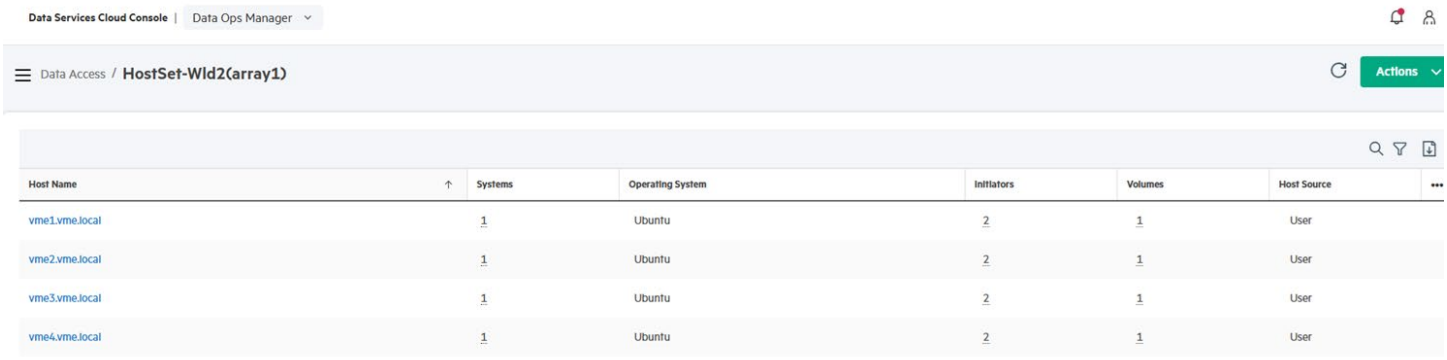

Figure 31. Host set created on DSCC Data Ops Manager

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.**

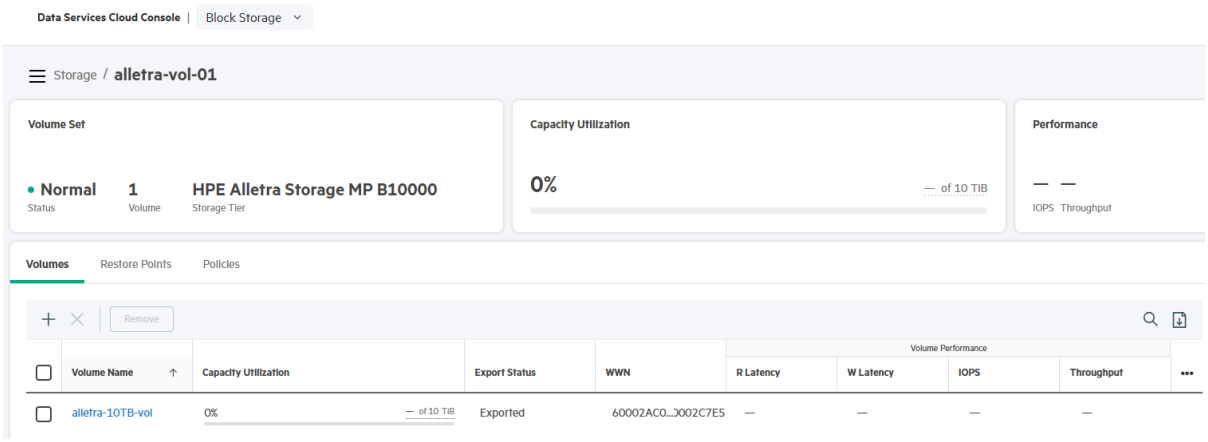

Figure 32. iSCSI volume set created on DSCC Block Storage

Verify Provisioned Volumes(LUNs) on Hosts of HPE VM Essentials Cluster

1. Scan the FC host bus adapters on each host of the HPE VM Essentials cluster using the commands following:

```
#ls /sys/class/fc_host/                                                    -- lists the FC HBAs on
the host
# echo "- - -" > /sys/class/scsi_host/<<hostx>>/scan          -- scans the host HBAs to detect LUNs. Replace
<<hostx>> with FC HBA name.
```

2. Display the FC disks on the hosts using the command:

```
#lsblk
```

3. 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 is successfully provisioned.

    a. 3PARdata,VV – The volume comes from an HPE Alletra Storage MP B10000 array and is a virtual volume (VV)

    b. size=10.0T – indicates 10.0 TB has been provisioned

```
#multipath -ll
360002ac0000000000000000620002c335 dm-2 3PARdata,VV
size=10.0T 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 Global File System 2 Datastore on HPE VM Essentials 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.

1. Log into 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 **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. Choose the block device name for the shared Alletra Fibre Channel LUN.

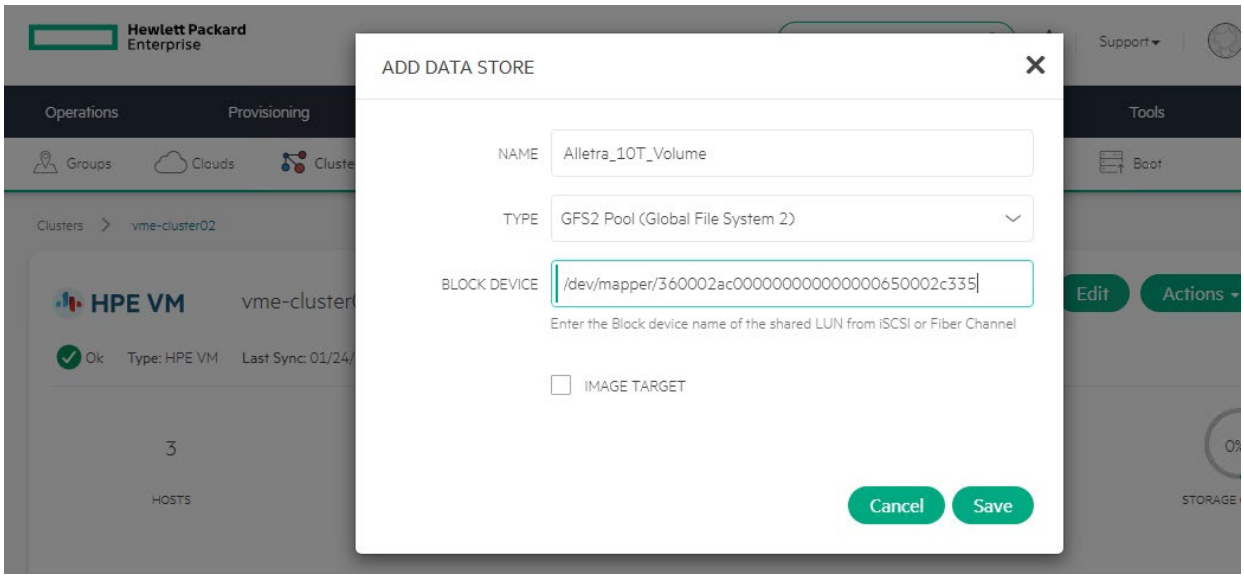

Figure 33. Add Data store

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.

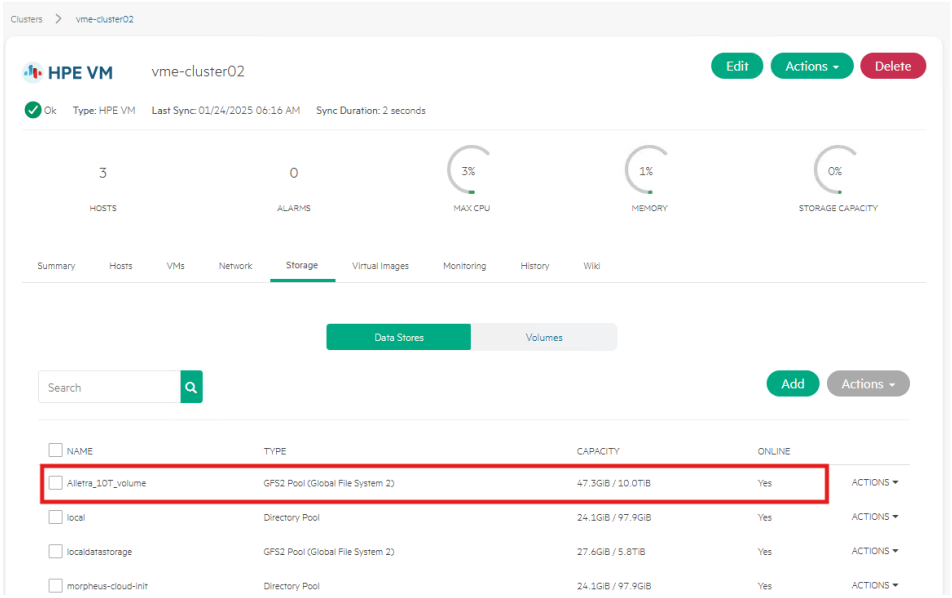

Figure 34. Verify Data StoreVM Provisioning on HPE VM Essentials Cluster

Deploy a VM on HPE VM Essentials clusters

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 VM Essentials 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).

---

4. 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.

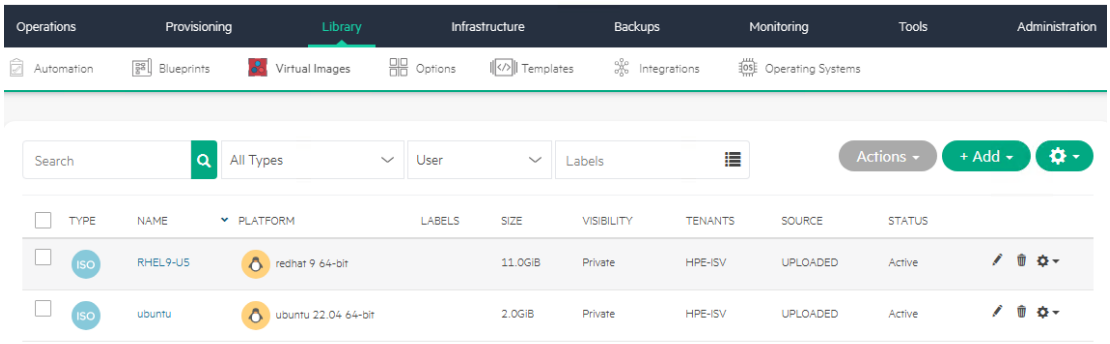

Figure 35. Virtual images

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.

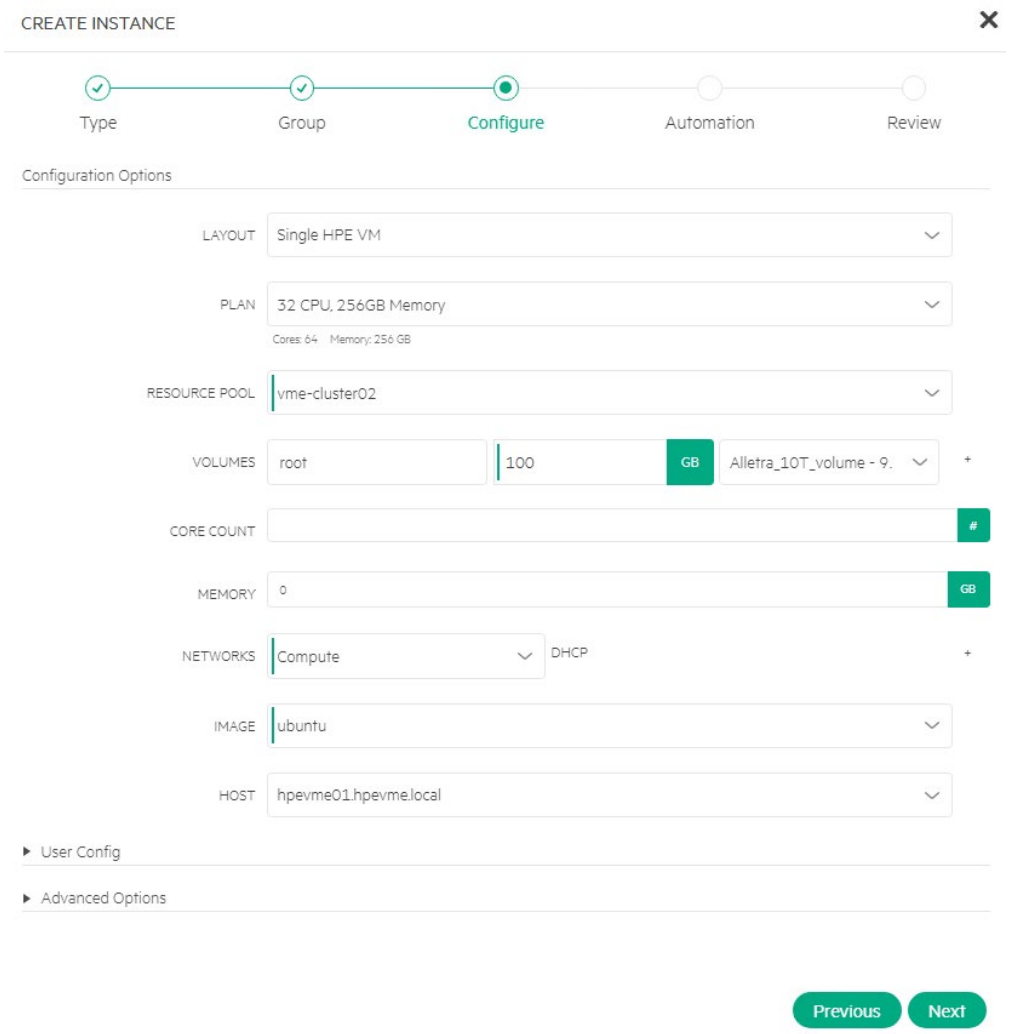

Figure 36. Create Instances

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

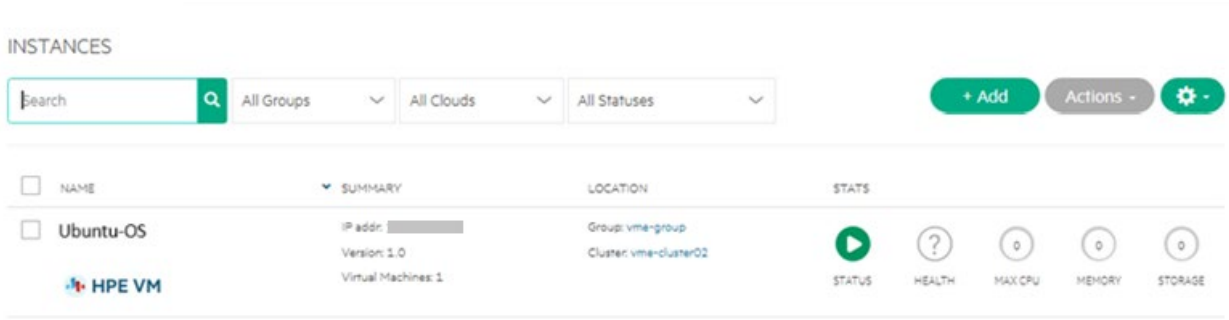

Figure 37. Verify Virtual machine deployed

Summary

HPE Morpheus VM Essentials Software delivers a modern, enterprise-ready virtualization solution built on a KVM-based hypervisor and a unified management platform. It empowers organizations to seamlessly manage both HPE-native and existing VMware environments through a single, streamlined interface. Designed to reduce licensing costs and operational complexity, the solution supports live migration, high availability, and integrated data protection—making it an ideal foundation for hybrid infrastructure modernization.

With a flexible upgrade path to HPE Morpheus Enterprise Software, the solution extends beyond virtualization to support full-stack orchestration, automation, governance, FinOps, and integration with a broad partner ecosystem. This evolution makes it suitable for a wide range of customer use cases—from development and test environments to mission-critical production workloads.

Throughout 2025, HPE will continue to expand performance validation and solution engineering efforts to deliver targeted reference architectures and best practices for an increasingly diverse set of operational scenarios. HPE VM Essentials leverages the extensible Morpheus integration framework, ensuring seamless interoperability with key ecosystem partners such as Cohesity, Commvault, and Veeam for enterprise-grade data protection and backup.

HPE VM Essentials is offered as a term-based subscription, competitively priced on a per-CPU socket basis. There are no additional licensing costs for managing existing VMware clusters, making it an attractive option for organizations aiming to reduce virtualization costs while maintaining operational flexibility and compatibility.

This Reference Architecture demonstrates:

- The deployment of the HPE VM Essentials Hypervisor along with centralized management through HPE VM Essentials Manager.
- How to build an HPE VM Essentials environment using supported HPE ProLiant servers (as listed in the compatibility matrix), with HPE Alletra Storage MP B10000 serving as the primary storage platform over Fibre Channel.

Appendix

Appendix A: Terminology

Table A1. Terminology

Name	Description
Ubuntu 24.04	The base operating system for the HPE VM Essentials hypervisor is Ubuntu 24.04. The installation of the base Ubuntu operating system is a requirement for deployment of the hypervisor
HPE VM Essentials manager	The management server that provides KVM clustering, identity, virtual machine provisioning, monitoring, logging, and more
HPE Morpheus VM Essentials software	The solution software that provides a platform for running virtual machine workloads
HPE Morpheus Enterprise Software	The full solution software that adds orchestration, governance, finops, in addition to virtualization
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
PCS	Pacemaker/Corosync – Service that provides high availability feature for cluster resources and services.

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	A network model where all traffic types - management, compute and storage (iSCSI) are carried over a set of physical ethernet adapters without traffic segregation
Converged network	A network model where management and compute traffic share bonded adapters (using LACP), while iSCSI traffic is isolated over two dedicated physical ethernet adapters and Fibre Channel traffic is isolated over FC HBA's
Diverged Connectivity	A model where each traffic type management, compute, and storage use its own dedicated physical adapters.
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

Name	Description
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
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
P9K40A	1	HPE 42U 600mmx1200mm G2 Enterprise Shock Rack
P9K40A 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
P53701-B21	8	AMD EPYC 9354 3.25GHz 32-core 280W Processor for HPE
P53701-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	16	HPE 1.6TB SAS Mixed Use SFF BC Self-encrypting FIPS 140-2 PM7 SSD
P63871-B21 0D1	16	Factory Integrated
R2E09A	4	HPE SN1610Q 32Gb 2-port Fibre Channel Host Bus Adapter
R2E09A 0D1	4	Factory Integrated
P47789-B21	4	HPE MR216i-o Gen11 x16 Lanes without Cache OCP SPDM Storage Controller
P47789-B21 0D1	4	Factory Integrated
P31348-B21	4	HPE InfiniBand HDR/Ethernet 200Gb 2-port QSFP56 PCIe4 x16 OCP3 MCX653436A-HDAI Adapter
P31348-B21 0D1	4	Factory Integrated
P58462-B21	28	HPE ProLiant DL3XX Gen11 1U Performance Fan Kit
P58462-B21 0D1	28	Factory Integrated
P44712-B21	8	HPE 1800W-2200W Flex Slot Titanium Hot Plug Power Supply Kit
P44712-B21 0D1	8	Factory Integrated
E5Y43A	4	HPE OneView for ProLiant DL Server including 3yr 24x7 Support FIO Bundle Physical 1-server LTU
P56901-B21	4	HPE ProLiant DL365 Gen11 8SFF OROC x1 SAS/SATA/NVMe Cable Kit
P56901-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

Part number	Quantity	Description
P08040-B21	4	HPE iLO Common Password FIO Setting
P52351-B21	4	HPE DL3XX Gen11 Easy Install Rail 2 Kit
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
R6B05A	2	HPE SN6700B 64Gb 56/24 24-port 32Gb Short Wave SFP28 Integrated Fibre Channel Switch
R6B05A 0D1	2	Factory Integrated
C7533A	5	HPE 1.2m/4ft CAT5 RJ45 M/M Ethernet Cable
C7533A 0D1	5	Factory Integrated
C7535A	6	HPE RJ45 to RJ45 Cat5e Black M/M 7.6ft 1-pack Data Cable
C7535A 0D1	6	Factory Integrated
C7536A	4	HPE 4.3m/14ft CAT5 RJ45 M/M Ethernet Cable
C7536A 0D1	4	Factory Integrated
QK733A	12	HPE Premier Flex LC/LC Multi-mode OM4 2 Fibre 2m Cable
QK733A 0D1	12	Factory Integrated
QK734A	8	HPE Premier Flex LC/LC Multi-mode OM4 2 Fibre 5m Cable
QK734A 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
R9G06A	2	HPE Aruba Networking 50G SFP56 to SFP56 0.65m Direct Attach Copper Cable
R9G06A B01	2	HPE Aruba Networking 50G SFP56 to SFP56 0.65m Direct Attach Copper Cable
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	1	HPE Aruba Networking CX 8325-32C Power-to-Port Airflow 6 Fans 2 Power Supply Units Bundle
R9F67A 0D1	1	Factory Integrated
R9F67A B2B	1	HPE Aruba Networking CX 8325-32C Power-to-Port Airflow 6 Fans 2 Power Supply Units Bundle PDU
845416-B21	2	HPE 100Gb QSFP28 to 4x25Gb SFP28 3m Direct Attach Copper Cable
845416-B21 0D1	2	Factory Integrated
R9F77A	1	HPE Aruba Networking 100G QSFP28 to QSFP28 1m Direct Attach Copper Cable
R9F77A B01	1	HPE Aruba Networking 100G QSFP28 to QSFP28 1m Direct Attach Copper Cable

Part number	Quantity	Description
R9F78A	4	HPE Aruba Networking 100G QSFP28 to QSFP28 5m Direct Attach Copper Cable
R9F78A B01	4	HPE Aruba Networking 100G QSFP28 to QSFP28 5m Direct Attach Copper Cable
R9F67A	1	HPE Aruba Networking CX 8325-32C Power-to-Port Airflow 6 Fans 2 Power Supply Units Bundle
R9F67A 0D1	1	Factory Integrated
R9F67A B2B	1	HPE Aruba Networking CX 8325-32C Power-to-Port Airflow 6 Fans 2 Power Supply Units Bundle PDU
845416-B21	2	HPE 100Gb QSFP28 to 4x25Gb SFP28 3m Direct Attach Copper Cable
845416-B21 0D1	2	Factory Integrated
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
R9F78A	4	HPE Aruba Networking 100G QSFP28 to QSFP28 5m Direct Attach Copper Cable
R9F78A B01	4	HPE Aruba Networking 100G QSFP28 to QSFP28 5m Direct Attach Copper Cable
S1R06A	1	HPE Alletra Storage MP B10200 Base Configuration
S1R06A 0D1	1	Factory Integrated
S3Q02A	1	HPE Alletra Storage ArcusOS per TB 5-year LTU
S3Q02A 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
R7D02A	2	HPE Alletra Storage MP B10230 Controller Node
R7D02A 0D1	2	Factory Integrated
S2A68A	4	HPE Alletra Storage MP 100GbE 2-port OCP Host Bus Adapter
S2A68A 0D1	4	Factory Integrated
S2S64A	4	HPE Alletra Storage MP 32Gb 4-port Fibre Channel OCP LPm37004 Host Bus Adapter
S2S64A 0D1	4	Factory Integrated
S3N85A	8	HPE 32Gb SFP28 Short Wave 1-pack LP Pull Tab Optical Transceiver
S3N85A 0D1	8	Factory Integrated
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

Part number	Quantity	Description
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
R9H67A	12	HPE Alletra Storage MP 3.84TB NVMe SFF Self-encrypting SSD
R9H67A 0D1	12	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
S0A95A	1	HPE Switch Pair Installation Kit with 4U Cable Tray
S0A95A 0D1	1	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
S0A98A	1	HPE Storage Data Encryption LTU
S0A98A 0D1	1	Factory Integrated
P59411-B21	2	Enlogic by nVent G3 Metered 3-phase 8.6kVA/Outlets (30) C13 (6) Combo C13/C19 PDU for HPE
P59411-B21 0D1	2	Factory Integrated
Q1H95A	1	HPE Storage 1U Rack Accessories Kit
Q1H95A 0D1	1	Factory Integrated
P9L11A	1	HPE G2 Rack Grounding Kit
P9L11A 0D1	1	Factory Integrated
P9L12A	1	HPE G2 Rack Baying Kit
P9L12A B01	1	HPE G2 Rack Baying Kit
P9L16A	1	HPE G2 Rack 42U 1200mm Side Panel Kit
P9L16A 0D1	1	Factory Integrated
P9T01A	1	HPE G2 PDU Environmental Temperature and Humidity Sensor
P9T01A 0D1	1	Factory Integrated
P9T02A	1	HPE G2 PDU Environmental 3 Temperature and 1 Humidty Sensor
P9T02A 0D1	1	Factory Integrated

Part number	Quantity	Description
P9T03A	1	HPE G2 PDU Open Door Sensor
P9T03A 0D1	1	Factory Integrated
120672-B21	1	HPE Rack Ballast Kit
120672-B21 0D1	1	Factory Integrated
BW930A	1	HPE Air Flow Optimization Kit
BW930A B01	1	Include with complete system
BW932A	1	HPE 600mm Rack Stabilizer Kit
BW932A B01	1	HPE 600mm Rack include with Complete System Stabilizer Kit
R9J32A	1	HPE Aruba Networking USB-A reversible to USB-C PC-to-Switch 3m Cable
JL448A	1	HPE Aruba Networking X2C2 RJ45 to DB9 Console Cable
142257-002	4	HPE C13 - C14 WW 250V 10Amp 2.5m Jumper Cord
R9G32AAE	2	HPE Aruba Networking Fabric Composer Device Management Service Tier 3 Switch 3y Subscription E-STU
R9G27AAE	2	HPE Aruba Networking Fabric Composer Device Management Service Tier 4 Switch 3y Subscription E-STU
H1SR4AS	1	HPE Service Credit
H0JD4A5	1	HPE 5Y Service Credits 10 Per Yr SVC
H0JD4A5 WFM	2	HPE 5Y Service Credits Qty 50 SVC
S3Q02AAE	46	HPE Alletra Storage MP B10000 per TB 5-year Software and Support SaaS
H38NHAS	1	HPE Alletra Storage MP B10000 SVC
R8J60A	1	HPE GreenLake R1 Module Tracking
R8J62A	4	HPE GreenLake Leaf Network Module Tracking
R9H46A	4	HPE GreenLake Dense Compute Module Tracking
R9Z57A	1	HPE GreenLake Block Storage Mission Critical Tracking
HA124A1	1	HPE Technical Installation Startup SVC
HA124A1 VZJ	1	HPE AlletraSTG 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
HA124A1 VZN	1	HPE Alletra STG MPB10000Swch2N Srtup 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 Morpheus VM Essentials Software Compatibility matrix, https://hpevm-docs.morpheusdata.com/en/8.0.5-vme/vme_getting_started/vme_getting_started.html#hpe-morpheus-vm-essentials-software-compatibility-matrix

HPE Alletra MP Cabling Tool- 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

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