# HPE Helion OpenStack 8 with HPE ProLiant

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# Executive Summary

This reference configuration is intended to help an organization create and deploy an on-premises, private cloud infrastructure used to orchestrate and manage application workloads.

For most enterprise-level businesses, the demand for an on-premises, multi-tenancy private cloud is increasing rapidly, enabling the hosting of both production and other phases of workloads, whether bare-metal, virtualized or containerized. This approach can complement an organization's existing public cloud strategy and even help to reduce the financial impact and improve security aspects of data and workloads. An intelligent, software-defined infrastructure consisting of HPE® Helion OpenStack, powered by SUSE®, technology and HPE ProLiant system hardware enables you to transform your enterprise. It delivers infrastructure as a service (IaaS) to reduce costs while still providing flexibility to keep up with your future demands. Leveraging this tested approach, you will have the confidence to deploy a working solution in an agile manner and be able to maintain and scale it as needed over time. This document focuses on a new implementation—pointing out design decisions, citing best practices and providing considerations and recommendations to implement a functional deployment.

This document is for IT decision makers, architects, system administrators and technicians who are implementing the HPE ProLiant platform and need a flexible, software-defined, IaaS platform. The reader should be familiar with all of the traditional pillars of IT infrastructures (networking, computing and storage), along with their local use cases for sizing, scaling and limitations within their environments.

Private cloud delivers access to pools of compute, storage and networking functionality and other resources over a network. The deployment abstracts the complex, internal infrastructures from end users. It enables individual compute nodes and workloads to be provisioned on demand from predefined templates with little concern about the underlying infrastructure or resources. Services consisting of many such orchestrated workloads can be provisioned for use in minutes and then be scaled appropriately to meet service demands for use by multiple tenants.

*Note: As a further reference, the [National Institute of Standards and Technology's (NIST) Definition of Cloud Computing](#) describes the important characteristics of cloud computing.*

These resources are integrated through private cloud software to provide the robust foundation for applications and services before adding deployed workloads. Networking is the unifying component tying computing and storage resources together. Given the complexity of such an infrastructure, the network must be fully configurable and adapt to change requests upon demand. High-speed, scalable devices such as the HPE FlexFabric series of network switches provide a great foundation. Compute resources are provided via physical nodes or virtual machines running atop a hypervisor. Storage resources can be provided through either dedicated storage elements or resilient, distributed storage solutions. Modern, industry-leading x86-based servers such as the HPE ProLiant servers provide an ideal platform for private clouds because the servers balance performance and efficiency. Finally, the private cloud software provides the user interface for setup, configuration, maintenance and long-term operation of these three core components, bonding them into a cohesive service offering.

## 4.1 Facility

While beyond the scope of this document, the heating, ventilation and air conditioning (HVAC) requirements of hosting such a private cloud solution should be carefully considered and planned. To aid in determining the power requirements for system deployment, use the [HPE Power Advisor](#) as either an on-line version or a downloadable application. Using this

tool, you can plan the needs for your solution and order the correct power distribution unit (PDU) to account for the local power conditions and connections in the final installation location.

## 4.2 Network

Networking is the technology component that typically requires the most advance planning. Requirements for a private cloud instance have a fair amount of network complexity, especially when integrated with an existing IT infrastructure. For the physical level, using pairs of HPE FlexFabric Switch Series devices as top-of-rack (ToR) switches enables all servers (each having multiple 10GbE or higher speed NIC ports) to form a link aggregation group (LAG) across the ports with at least one NIC port on each switch in the stack. When using network interface bonding on the resource nodes, the LAG ideally offers switch redundancy within the rack and enables high availability throughout the infrastructure.

For this basic deployment guide, a single 10GbE switch is used, with all resource nodes' 10GbE NIC ports connected; however, these could easily be expanded to the dual ToR configuration at a later date. To address management functions, the iLO, out-of-band interface can be connected to the same or another network switch infrastructure, but are fundamentally required to be accessible for the deployment.

The following considerations for the network switching configuration should be attended to:

- Configure 802.3ad for system port bonding to get the maximum performance of bonded network interfaces.
- Ensure that all similar switching devices are consistent and up-to-date with regard to firmware versions, to reduce potential troubleshooting issues later.

*Tip: Meticulous care of the network wiring from the various resource nodes and switches makes troubleshooting much easier. Where possible, also label connections and stick to consistent patterns of port/placement of connections.*

## 4.3 Computing

One of the benefits of a private cloud implementation is that HPE industry-standard servers can fulfill each of the resource node's computational needs. To reduce the time spent on hardware specifications for an initial private cloud implementation, the hardware should be general purpose and allow for a wide range of configuration options. The industry-leading HPE ProLiant rack mount servers with their high performance, multitude of network options and low energy consumption characteristics are ideal virtualization and storage nodes for a private cloud deployment.

For this the implementation, HPE ProLiant DL360 servers were utilized for all node roles. The main distinction is higher-end specifications for the compute node, with more CPU cores and higher amounts of RAM, to host the required workloads.

The following considerations for the system platforms should be attended to:

- Confirm that all similar system devices are consistent and up-to-date with regard to BIOS/uEFI/device firmware versions, to reduce potential troubleshooting issues later.
- Reset the BIOS setup configuration to the default setting, to have a known baseline configuration to provide consistency.
- Ensure that virtualization features are enabled for resource nodes being targeted as hypervisor nodes.
- Set up RAID1 mirroring on the storage controller across a pair of drives for the operating system installation, if possible.

*Note: Any [SUSE YES](#) certified HPE platform (such as the HPE ProLiant DL360) can be used for the physical nodes of this deployment, as long as the certification refers to the major version of the underlying SUSE operating system required by the HPE Helion OpenStack release.*

*Tip: HPE OneView can be set up with Server Profile Templates to apply to the various node roles and consistently deliver platform systems into a known state.*

## 4.4 Storage

Because various OpenStack services have differing storage access needs—object for workload images, block for persistent data volumes and file for shared applications and data—the most popular approach is to utilize a Ceph-based storage cluster. By integrating such a solution, such as SUSE Enterprise Storage, all of these access modes can be satisfied in a resilient, highly-available and scalable fashion across all the resource nodes, services and roles. Since this is an external resource, it can be managed distinctly and grow as needed, even with tiered performance levels, yet still comply with the multi-tenancy benefits of OpenStack. A variety of reference architectures exist for HPE-based solutions.

Each of the resource nodes are also expected to have some local, direct-attached storage, which is predominantly used for the node's operating system. For this deployment, a pair of disk drives configured as a RAID1 volume for the operating system helps to provide fewer points of failure.

## 4.5 Software

HPE Helion OpenStack provides an easy to deploy and manage heterogeneous cloud infrastructure for provisioning your development, test and production workloads in a way that is supportable, compliant and secure. With a focus on ease of deployment, the solution also provides a wide choice of hypervisors; one of the broadest range of hardware certification; and the ability monitor, manage and optimize your private cloud environment. HPE Helion OpenStack provides the enterprise-grade implementation of OpenStack components and abstracts the network, computing and storage resources. Underlying these OpenStack services is an enterprise-grade distribution of SUSE Linux Enterprise Server that provides a stable, secure and performant foundation.

*Note: For information on the OpenStack version and projects or features included, seethe [Planning and Installation with Cloud Lifecycle Manager Guide](#).*

HPE Helion OpenStack enables organizations to set up and manage their own private clouds. This management includes the following components:

**Cloud Lifecycle Management (CLM) Deployment Server:** Sets up the cloud and configures and provisions the remaining resource nodes and roles. It provides the services and tools needed to quickly and easily deploy all the resource nodes in your private cloud instance. This is implemented on a Deployer Node, which can be a physical server, a virtual machine or simply a service on one of the OpenStack Control Nodes. Either a web interface or command-line interface is used during the installation process.

For provisioning and configuration management, technology based upon Ansible is used for repeatable deployment of the remaining software components to the resource nodes.

*Tip*: This server role optionally integrates with HPE OneView for node enumeration and discovery. For this simple, setup, however, such an integration was skipped.

**Control Node(s):** Host the cloud's self-service portal, providing an image repository and other core OpenStack services. It also automatically track resource state within the network, compute and storage nodes, evaluating available capacity for scheduling and deploying workloads. These functions are delivered in an active-active, high-availability configuration and run on SUSE Linux Enterprise Server.

**Compute Node(s):** Are the physical servers, typically running SUSE Linux Enterprise Server with the KVM hypervisor to host virtual machine workloads. It optionally integrate with VMware vCenter to host ESXi workloadsbor host bare-metal workloads leveraging OpenStack Ironic. HPE Helion OpenStack also supports Red Hat Enterprise Linux KVM compute nodes when purchased and supported through HPE.

*Note*: Information on the supported hypervisors can be found in the [Planning and Installation with Cloud Lifecycle Manager Guide](#).

**Storage Node(s):** Are the physical servers used to host object storage. It use either Swift or (as in this implementation) an external SUSE Enterprise Storage cluster, based upon Ceph, to deliver object, block and file access methods.

**Miscellaneous Services:** Cloud administrators also leverage the following services:

- Network Time Protocol (NTP) is used to keep system clocks in sync and provide consistent timestamps for all resource nodes, logs and actions.
- Domain Name Service (DNS) provides mapping of hostname to IP from both external sources—for the workload's public visibility and internally for the resource nodes within the private cloud.
- Software repositories of all of the needed components to initially install the resource nodes and to allow updates to be applied to the nodes over time.

In preparation for the deployment, obtain the following software media and documentation artifacts:

- From the [HPE Helion OpenStack site](#), download the HPE Helion OpenStack install media (DVD1).
- From the main [SUSE Downloads site](#), download:
    - The SUSE Linux Enterprise Server 12-SP3 (DVD1) operating system install media.
    - The SUSE Linux Enterprise Server Software Development Kit (SDK) 12-SP3 (DVD1).
- Utilize either trial or purchased subscriptions for the all the resource nodes to ensure access to support and software updates. The bill of materials section in the appendices outlines the type and quantity of subscriptions needed.
- In addition, obtain and preview the [HPE Helion OpenStack documentation](#), focusing on:
    - Planning an Installation with Cloud Lifecycle Manager.
    - Installing with Cloud Lifecycle Manager.

## 5.1 Deployment Flow

## 5.2 Additional Considerations

This document focuses on a new HPE Helion OpenStack deployment that can be scaled over time, utilizing an entry-scale KVM configuration with the core OpenStack services. This input model template is included in HPE Helion OpenStack and described in the respective section of the Planning and Installation with Cloud Lifecycle Manager Guide. It serves as a convenient starting point and includes recommended minimum values for node count and resources.
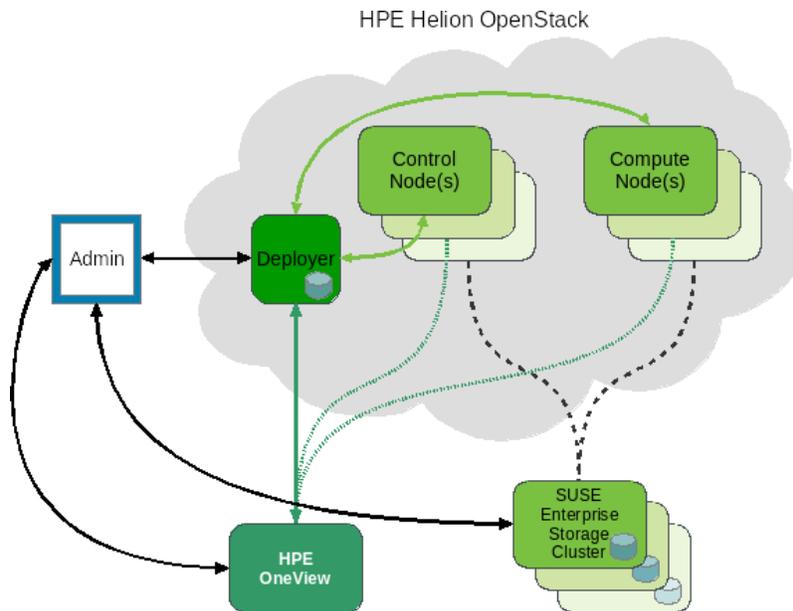


**Figure 5.1:** *Deployment Logical View.*

## 5.1 Deployment Flow

This section is a companion guide to the official network, system and software product deployment documentation, citing specific settings as needed for this reference implementation. Default settings are assumed to be in use unless otherwise cited to accomplish the respective best practices and design decisions herein.

Given the detailed information contained in the installing with Cloud Lifecycle Manager Guide, only the following additional, incremental modifications are described below:

- Pre-Installation Checklist
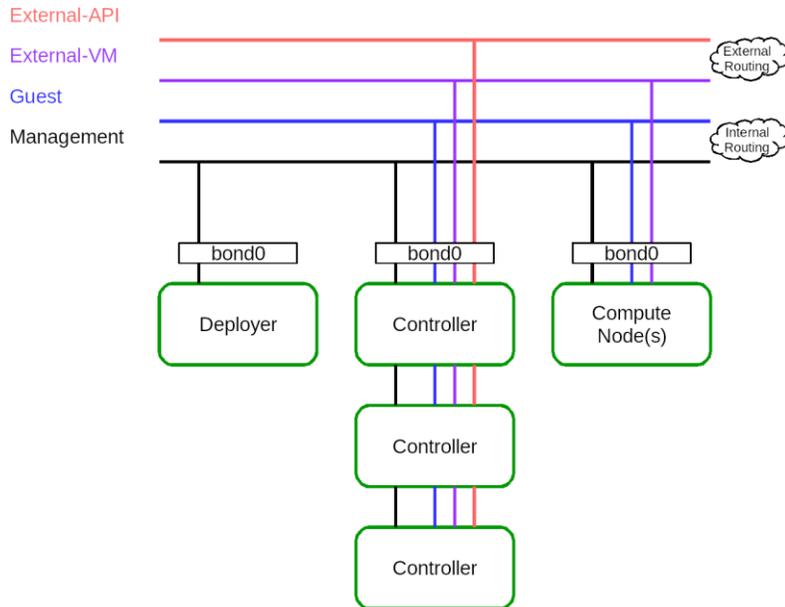  - The network topology shown in the following figure was utilized.

**Figure 5.2:** *Deployment Network Topology.*

- Installing the Cloud Lifecycle Manager server
    - In this implementation, an existing [Subscription Management Tool](#) (SMT) server was available in the environment and already mirrored all the necessary product and update channels.
    - No SAN nor FibreChannel was utilized in this deployment, since all resource nodes had sufficient local storage and an external SUSE Enterprise Storage cluster could later be integrated with the OpenStack services.
- Cloud Installation
    - To simplify the process, the Install UI approach was utilized for the initial deployment. As noted in the HPE Helion OpenStack documentation, you must gather some physical hardware details for inputs to the web interface forms as you step through the various stages:
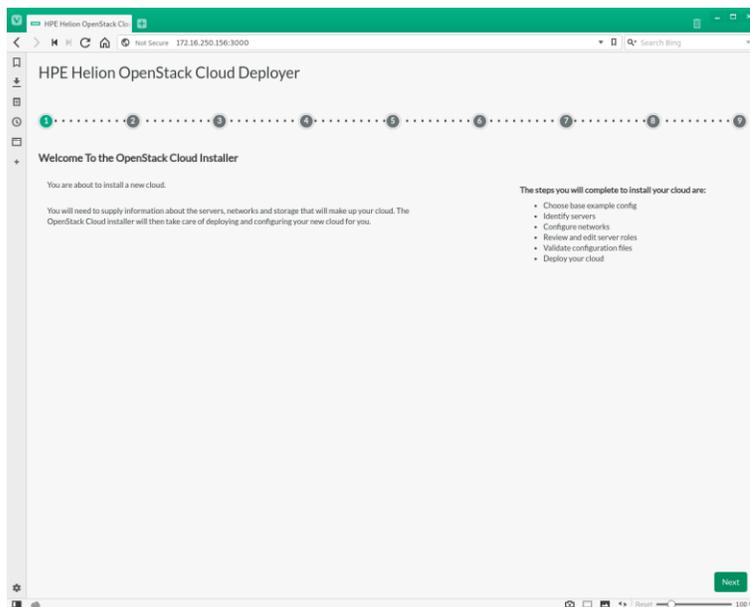        - Welcome



**Figure 5.3:** *Install UI Welcome.*

*Note: Since there are many possible cloud configurations, the remaining steps might differ in content and scope from this Entry-scale KVM sample.*

- The following is a summary of actions performed across the workflow process to complete the installation:
  - Welcome
  - Choose an OpenStack Cloud Model: Entry Scale KVM
  - Cloud Model to Deploy: 3 Controller Nodes, 1 Compute Nodes
  - Add Servers and Assign Server Roles
    - Edit each node's server details
    - Manage Cloud Settings: set up DNS/NTP, designate Disk Models/NIC Mappings/Interface Model/Networks
    - Manage Subnet and Netmask: edit Management Network information
  - Choose servers on which SUSE Linux Enterprise Server will be installed

*Note: Given the small number of initial nodes in this deployment, each was installed with the SUSE Linux Enterprise Server operating system, using the ISO media and the HPE iLO virtual media methodology instead of the PXE/Cobbler approach. An autoYaST file (obtained from the first resource node install via "yast clone-system") was leveraged for the other nodes as an answer file for consistent operating system deployments. Therefore, this step was effectively skipped, since all nodes were pre-installed in this fashion.*

  - Server and Server Role Summary: confirm settings for each node's role and Manage Cloud Settings
  - Review Configuration Files: adjust as needed, until Validate completes successfully, and then Deploy
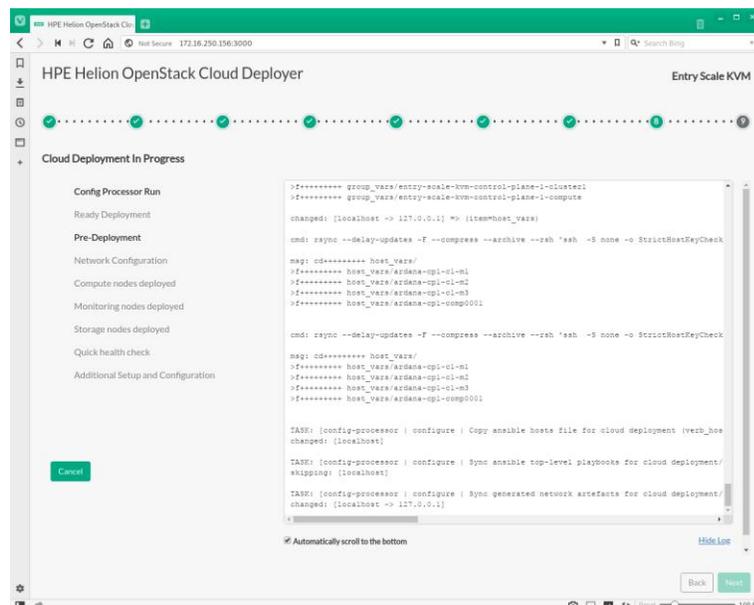


**Figure 5.4:** *Install UI Deploy.*

When all of these steps complete successfully, the next screen will provide links to both the OpenStack Horizon and Ops Console user interfaces. If issues arise at any of the above steps, you can simply use the "Back" button to address them and continue to iterate through the process until completed.

To complete the integration with Ceph-based SUSE Enterprise Storage, refer to the Installing with Cloud Lifecycle Manager Guide.

## 5.2 Additional Considerations

As a verification of your HPE Helion OpenStack deployment, it is common to utilize Tempest to ensure that the APIs are present and functioning as expected (refer to the Installing with Cloud Lifecycle Manager Guide). Individual, interactive user-interface tasks are also detailed in that guide.

While this minimal deployment provides most of the OpenStack functionality, you can scale the cloud instance as needed to meet your demands (refer to the Planning an Installation with Cloud Lifecycle Manager Guide). As a reminder, multiple input model templates are available in HPE Helion OpenStack, which can be used as a starting point or just to leverage approaches for your specific private cloud needs. In addition, you can find these other comprehensive documents in the Helion OpenStack 8 Documentation suite: Operations Guide, Ops Console Guide, Security Guide and User Guide.

If you are using an earlier version of HPE Helion OpenStack, instructions are available to upgrade or migrate to this newer release. You can find these process details in the form of specific tasks at HPE Helion OpenStack.

After understanding and working through the steps described in this document, you should have a working cloud that is scalable through the addition of even more compute and storage nodes, as needed. HPE Helion OpenStack Cloud is a complete suite of software and can be configured in many different ways. This solution architecture provides a baseline for a private cloud implementation with highly available control plane services, using HPE FlexFabric networking and ProLiant rack servers, and can serve as a functional environment for many workloads. HPE ProLiant DL360 series hardware is an excellent platform for the implementation of OpenStack software. It provides powerful, dense compute and storage capabilities via the servers selected for this solution architecture. And the ProLiant iLO management capability is indispensable in deploying and managing a cloud cluster of this kind.

- HPE FlexFabric Switch

- HPE ProLiant DL360 System

*Table 7.1:* Bill of Materials - HPE ProLiant DL360 Systems Number

| Role | Quantity | Product Number | Product Name | Description |
|------|----------|----------------|--------------|-------------|
| **Deployer** | 1 | 755259-B21 | ProLiant DL360 Gen9 | HPE ProLiant DL360 Gen9 4LFF Configure-to-order Server HPE Dynamic Smart Array B140i, 4-Bay LFF Drive Cage |
| | 1 | 755382-L21 | Processor | Intel Xeon E5-2620v3 (2.4GHz/6-core/15MB/85W) |
| | 4 | 726718-B21 | Memory | 8GB (1x8GB) Single Rank x4 DDR4-2133 CAS-15-15-15 Registered Memory Kit |
| | 1 | 665243-B21 | Flexible LOM | HPE Ethernet 10Gb 2-port 560FLR-SFP+ FIO Adapter |
| | 2 | 720478-B21 | Power Supplies | HPE 500W Flex Slot Platinum Hot Plug Power supply Kit |
| | 1 | 749974-B21 | Storage Controller | HPE Smart Array P440ar/2GB FBWC 12Gb 2-ports Int FIO SAS Controller |
| | 1 | 766211-B21 | Storage Cable | HPE DL360 Gen9 LFF P440ar/H240ar SAS Cbl |

| | 2 | 652757-B21 | Hard Drives | HPE 2TB 6G SAS 7.2K rpm LFF (3.5-inch) SC Midline 1yr Warranty Hard Drive |
|---|---|---|---|---|
| | 1 | 663202-B21 | Rail Kit | HPE 1U Large Form Factor Ball Bearing Rail Kit |
| | 1 | 663203-B21 | Cable Management Arm | HPE 1U Cable Management Arm for Ball Bearing Rail Kit |
| **Controller** | 1 | 755259-B21 | ProLiant DL360 Gen9 | HPE ProLiant DL360 Gen9 4LFF Configure-to-order Server HPE Dynamic Smart Array B140i, 4-Bay LFF Drive Cage |
| | 1 | 755382-L21 | Processor 1 | Intel® Xeon® E5-2690v3 (2.6GHz/12-core/30MB/135W) FIO Processor Kit |
| | 1 | 755382-B21 | Processor 2 | Intel® Xeon® E5-2690v3 (2.6GHz/12-core/30MB/135W) FIO Processor Kit |
| | 4 | 726718-B21 | Memory for 1st processor | 8GB (1x8GB) Single Rank x4 DDR4-2133 CAS-15-15-15 Registered Memory Kit |
| | 4 | 726718-B21 | Memory for 2nd processor | 8GB (1x8GB) Single Rank x4 DDR4-2133 CAS-15-15-15 Registered Memory Kit |
| | 1 | 665243-B21 | FlexibleLOM | HPE Ethernet 10Gb 2-port 560FLR-SFP+ FIO Adapter |
| | 2 | 720478-B21 | Power Supplies | HPE 800W Flex Slot Platinum Hot Plug Power Supply Kit |
| | 4 | 765424-B21 | Hard Drives | HPE 600GB 12G SAS 15K rpm LFF (3.5-inch) SC Enterprise 3yr Warranty Hard Drive |
| | 1 | 749974-B21 | Storage Controller | HPE Smart Array P440ar/2GB FBWC 12Gb 2-ports Int FIO SAS Controller |
| | 1 | 766211-B21 | Storage Cable | HPE DL360 Gen9 LFF P440ar/H240ar SAS Cbl |
| | 1 | 663202-B21 | Rail Kit | HPE 1U Large Form Factor Ball Bearing Rail Kit |
| | 1 | 663203-B21 | Cable Management Arm | HPE 1U Cable Management Arm for Ball Bearing Rail Kit |
| **Compute** | 1 | 755258-B21 | ProLiant DL360 Gen9 | HPE ProLiant DL360 Gen9 8SFF Configure-to-order Server HPE Dynamic Smart Array B140i, 8-Bay SFF Drive Cage |
| | 1 | 780003-L21 | Processor 1 | Intel® Xeon® E5-2699v3 (2.6GHz/18-core/45MB/145W) FIO Processor Kit |
| | 1 | 780003-B21 | Processor 2 | Intel® Xeon® E5-2699v3 (2.6GHz/18-core/45MB/145W) FIO Processor Kit |
| | 8 | 726719-B21 | Memory for 1st processor | 16GB (1x16GB) Dual Rank x4 DDR4-2133 CAS-15-15-15 Registered Memory Kit |

| | 8 | 726719-B21 | Memory for 2nd processor | 16GB (1x16GB) Dual Rank x4 DDR4-2133 CAS-15-15-15 Registered Memory Kit |
|---|---|---|---|---|
| | 1 | 665243-B21 | FlexibleLOM | HPE Ethernet 10Gb 2-port 560FLR-SFP+ FIO Adapter |
| | 2 | 720479-B21 | Power Supply | HPE 800W Flex Slot Platinum Hot Plug Power Supply Kit |
| | 6 | 759212-B21 | Hard Drives | HPE 600GB 12G SAS 15K rpm SFF (2.5-inch) SC Enterprise 3yr Warranty Hard Drive |
| | 1 | 749974-B21 | Storage Controller | HPE Smart Array P440ar/2GB FBWC 12Gb 2-ports Int FIO SAS Controller |
| | 1 | 663201-B21 | Rail Kit | HPE 1U SFF Ball Bearing Rail Kit |
| | 1 | 663203-B21 | Cable Management Arm | HPE 1U Cable Management Arm for Ball Bearing Rail Kit |

HPE Helion OpenStack

- [Product Documentation](#)
- [Migration Documentation](#)

***Table 7.2:*** *Bill of Materials - Software Number*

| Role | Quantity | Product Number | Product Name | Description |
|---|---|---|---|---|
| **Software** | 1 | R0H19AAE | HPE Helion OpenStack Cloud Control Node plus Admin Server, x86-64, 1 Instance, 24x7, 3 Year | For both Deployer and first Control Node, including SUSE Linux Enterprise Server |
| | 1 | R0H21AAE | HPE Helion OpenStack Cloud Control Node, x86-64, 1 Instance, 24x7, 3 Year | For each remaining Control Node, including SUSE Linux Enterprise Server |
| | 1 | R0H13AAE | HPE Helion OpenStack Cloud Compute Node, x86-64, 1-2 Sockets, 24x7, 3 Year | For each Compute Node |
| | 1 | M6K29AAE | SUSE Linux Enterprise Server, 1-2 Sockets/KVMXen+Unlimited VMs, 24x7, 3 Year | For each KVM-based Compute Node |