Designing HP Data Center and Cloud Solutions



Learner Guide

HP ExpertOne
Rev. 15.11
ExpertOne course #: 00936427
Part #: 00936427S11503

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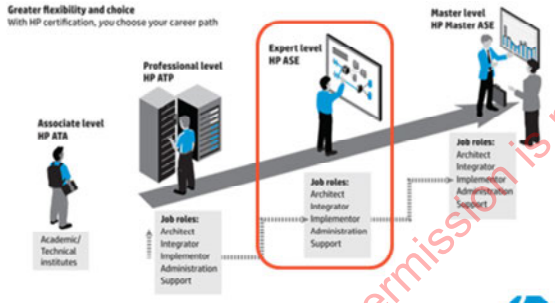
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About this certification (1 of 2)

- This course prepares you for the **HP ASE – Data Center and Cloud Architect V1** certification
- Prerequisite knowledge
  - Working knowledge individual HP Converged Infrastructure components
  - Working knowledge of virtualization, HP OneView, and HP ICsp
  - Foundational knowledge of:
    - Cloud computing
    - HP Helion portfolio
    - OpenStack
    - HP Helion CloudSystem 8 Foundation and Enterprise



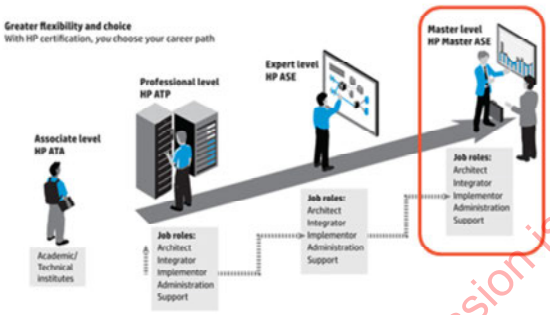
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About this certification (2 of 2)

- Recommended follow-on certification
  - HP Master ASE – Data Center and Cloud Architect
- Certification requirements
  - See http://www.hp.com/go/certification
  - Associated exam is HP0-D31
- Recommended preparation for the HP0-D31 exam
  - Exam Preparation Guide (EPG) for HP0-D31



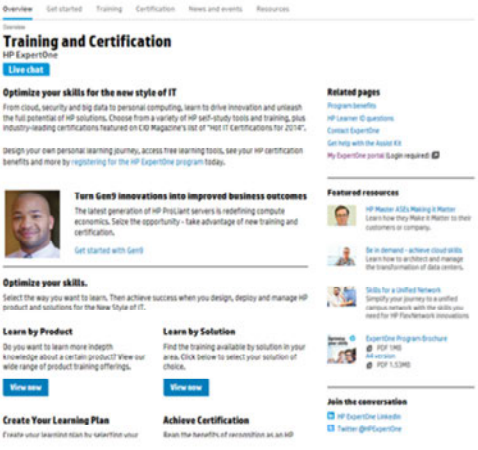
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HP ExpertOne certifications

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About this class

- Duration: 3 days
- Delivery method: instructor-led (face-to-face or virtual)
- Target audience
  - *Anyone who needs to learn how to describe, position, recommend, demonstrate, select, and design HP Converged Infrastructure and HP Helion cloud solutions to meet a customer's technical and business requirements. The candidate should have a working knowledge of the individual HP Converged Infrastructure components, including HP servers, storage, networking, IT operations, software, security, and services, as well as awareness of appropriate third-party hardware and software. It is recommended that the candidate has prior experience with architecting IT solutions.*

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Recommended agenda—Day 1

Module/lab number	Module/lab title
Module 0	Course Overview
Module 1	Review of the *Navigating the Journey to Cloud* course
Module 2	OpenStack Fundamentals
Module 3	HP Reference Architectures
	Lunch break
Module 4	HP Helion CloudSystem 8 Architecture
Lab 1	*Accessing and Exploring HP Helion CloudSystem 8.1 Foundation*

NOTE: Where applicable, this course has soft skill modules in the morning and technology skills in the afternoon.

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Recommended agenda—Day 2

Module/lab number	Module/lab title
	Review Day 1 progress
Module 5	Implementing the Plan
Module 6	Customer Engagement Tools
Lab 2	*Analyzing a CI-CM Report*
Lab 3	*Working with Business Value Tools*
	Lunch break
Module 7	HP Converged Infrastructure Management Tools
Lab 4	*Creating Projects and Instances*
Lab 5	*Using HP OneView*
Lab 6	*Creating a Tenant Private Network and Floating IP Address*

NOTE: Where applicable, this course has soft skill modules in the morning and technology skills in the afternoon.

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Recommended agenda—Day 3

Module/lab number	Module/lab title
	Review Day 2 progress
Module 8	HP Helion CloudSystem 8 Enterprise
Lab 7	*Using Advanced CloudSystem Options*
Lab 8	*Installing and Exploring CloudSystem Enterprise*
	Lunch break
Module 9	Planning and Designing HP Converged Infrastructure and Cloud Solutions
Lab 9	*Using HP Cloud Service Automation*
Lab 10	*Working with the HP Customer Intent Document*

NOTE: Where applicable, this course has soft skill modules in the morning and technology skills in the afternoon.

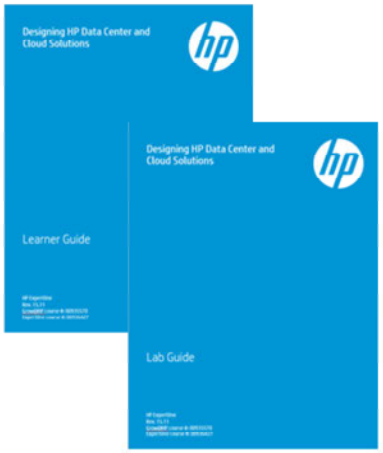
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Learner materials

- Learner Guide
- Lab Guide



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Introductions

Your instructor

- Name
- Location
- Professional background
- Personal hobbies and interests



You (learner)

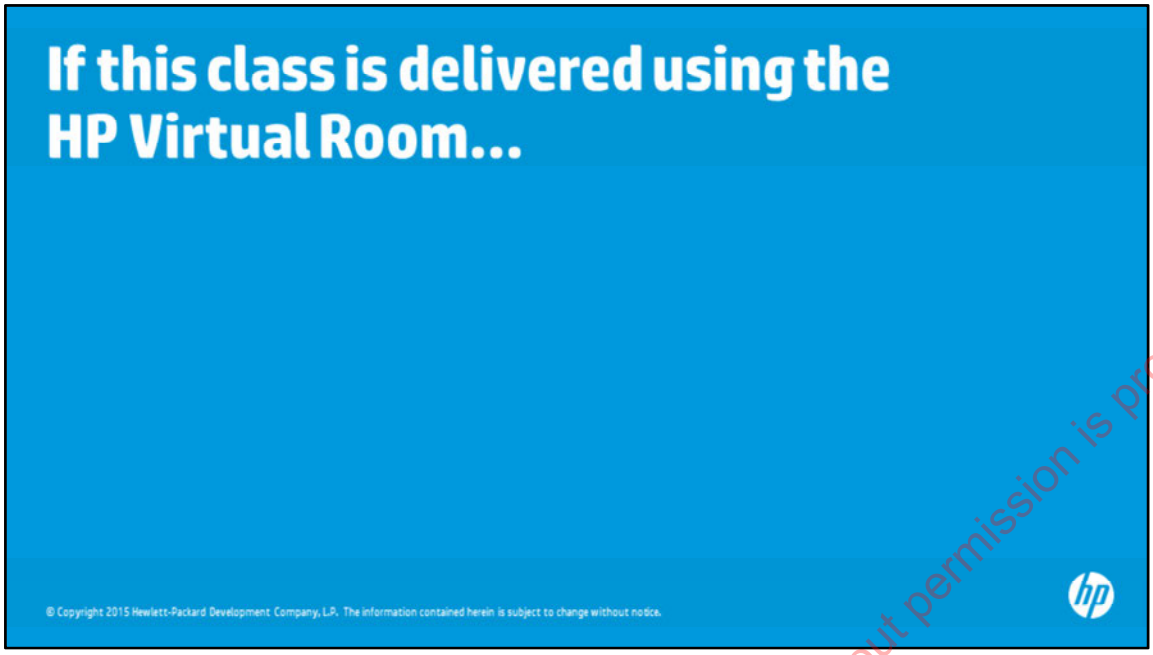
- Name
- Location
- Professional background
- Personal hobbies and interests
- Your goals for this class



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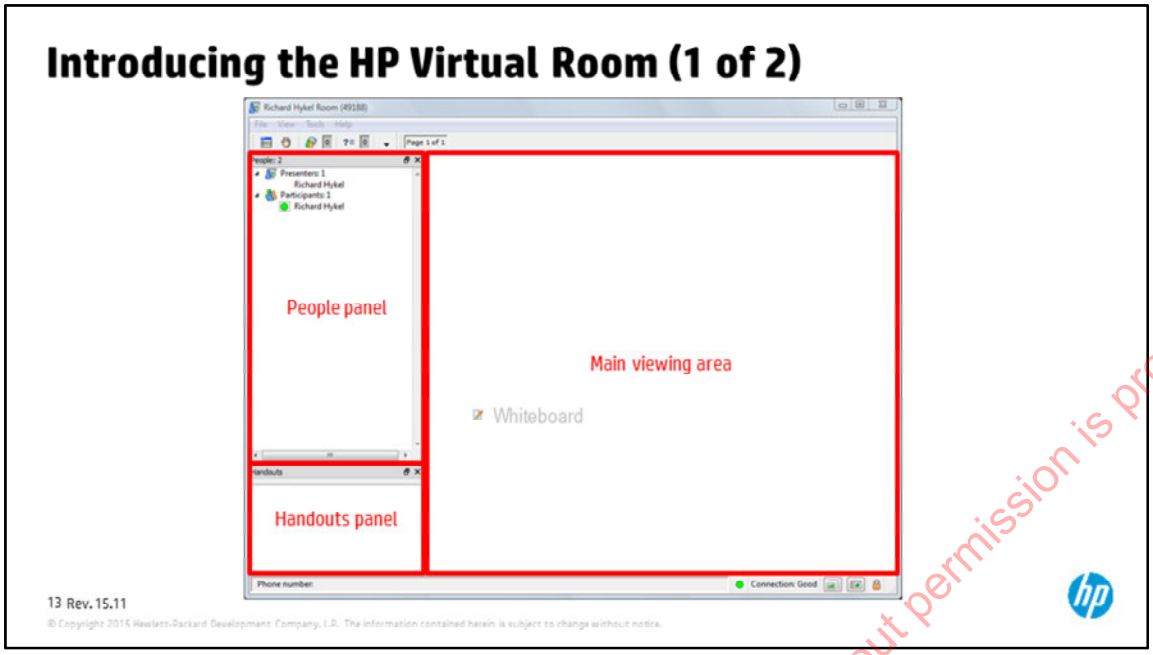
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The slides that follow should only be covered if you're delivering this class virtually, using the HP Virtual Room. Otherwise, skip the slides.

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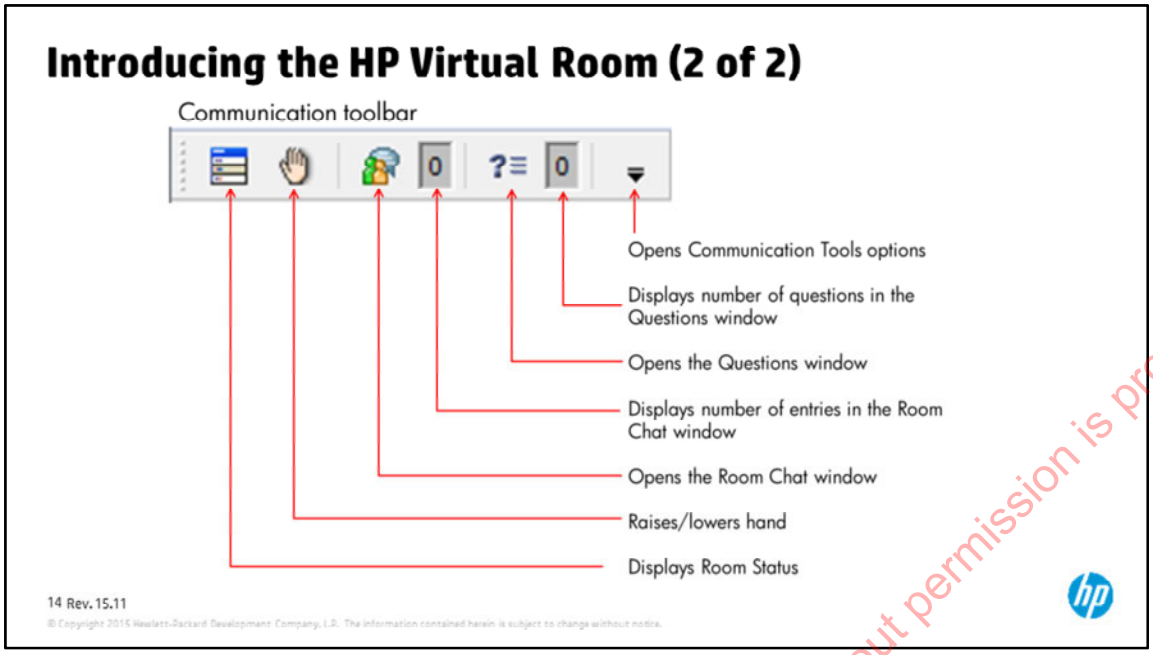


Introducing the HP Virtual Room (1 of 2)

If you are unfamiliar with the HP Virtual Room, note these areas, controls, and buttons:

- **Main viewing area** — is where you can view all slides, supported files, URLs, whiteboard pages, surveys, timers and lists.
- **People panel** — displays presenter(s) and participants. From the People panel, you can:
  - Get the number of users in the room.
  - Mark yourself offline (right-click).
  - Private chat with another participant or presenter (right-click).
  - Send files to another user (right-click).
- **Handouts panel** — enables you to save a copy of handouts made available by the presenter (right-click and Save As).

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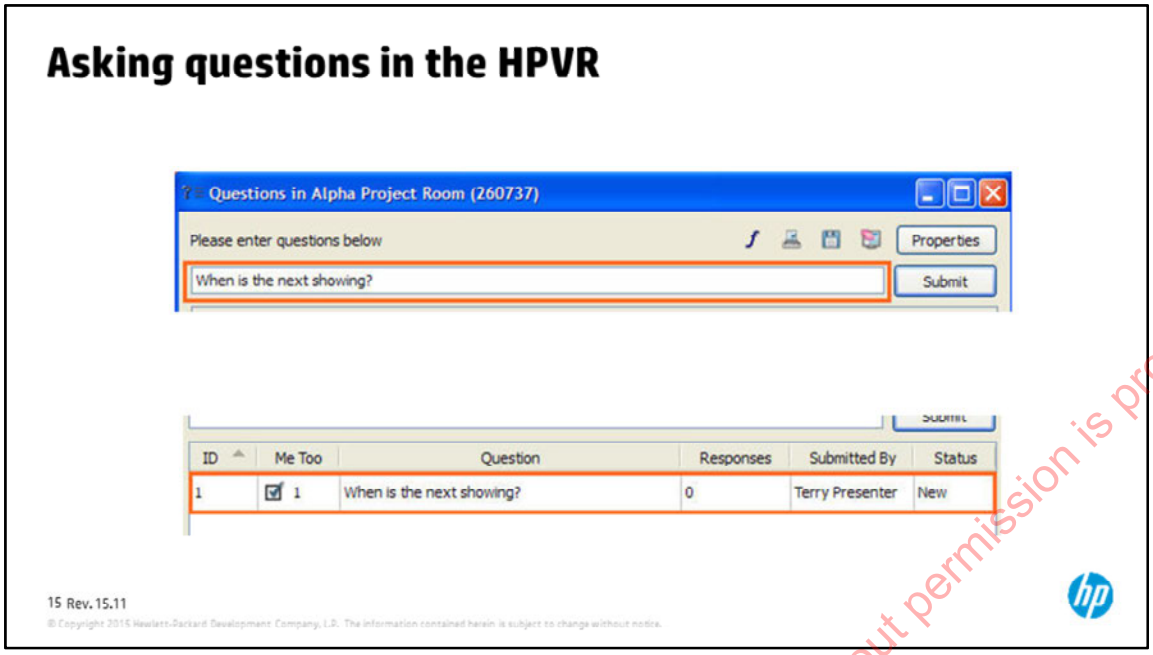


Introducing the HP Virtual Room (2 of 2)

Across the top of the HP Virtual Room, you will find the Communication toolbar with these controls:

- **Room Status** — displays room status.
- **Hand Up** — raises or lowers hand.
- **Show "Chat"** — opens the Room Chat window.
- **Show Questions** — opens the Questions window.
- **Customize Communication Toolbar** — opens Communication Tools options.

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Asking questions in the HPVR

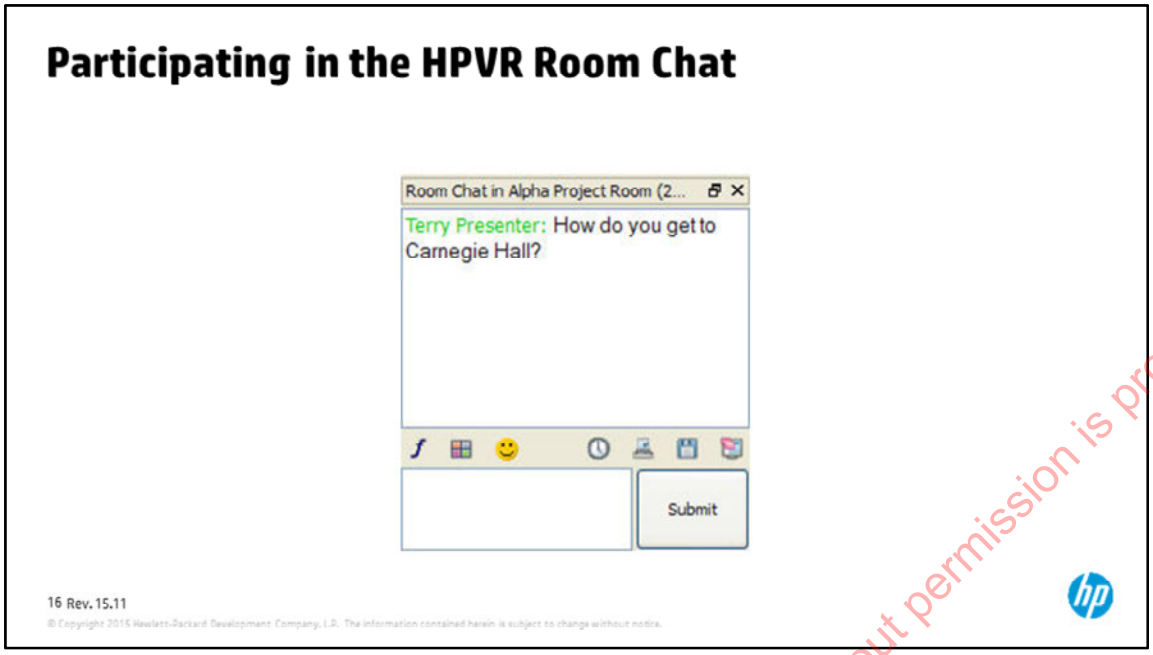
The Questions tool allows users to submit written questions to presenters. This is extremely useful during meetings with very large attendance, where a verbal question and answer session may not be appropriate. You can use the Questions tool for voting on topics, brainstorming, starting a frequently asked question list, and holding threaded topics.

Note: You can also raise your hand and ask a verbal question.

To submit a question, type in the box below the instruction located at the top portion of the Questions window. The default instruction is “Please enter questions below”. Click Submit or hit Return to enter your question. Your question appears in the middle portion of the Question tool, assigned with an ID number. It will also show the Me Too count, the number of responses to the question, who submitted the question, the status of the question, and the submission timestamp.

If an attendee enters a question while you do not have the Questions tool open, you still receive notification of the submitted question. The Questions tool icon on the Communication toolbar updates the number by one. Also, the taskbar button for your HP Virtual Room session will flash. A sound will play if you have configured this using Tools → Options.

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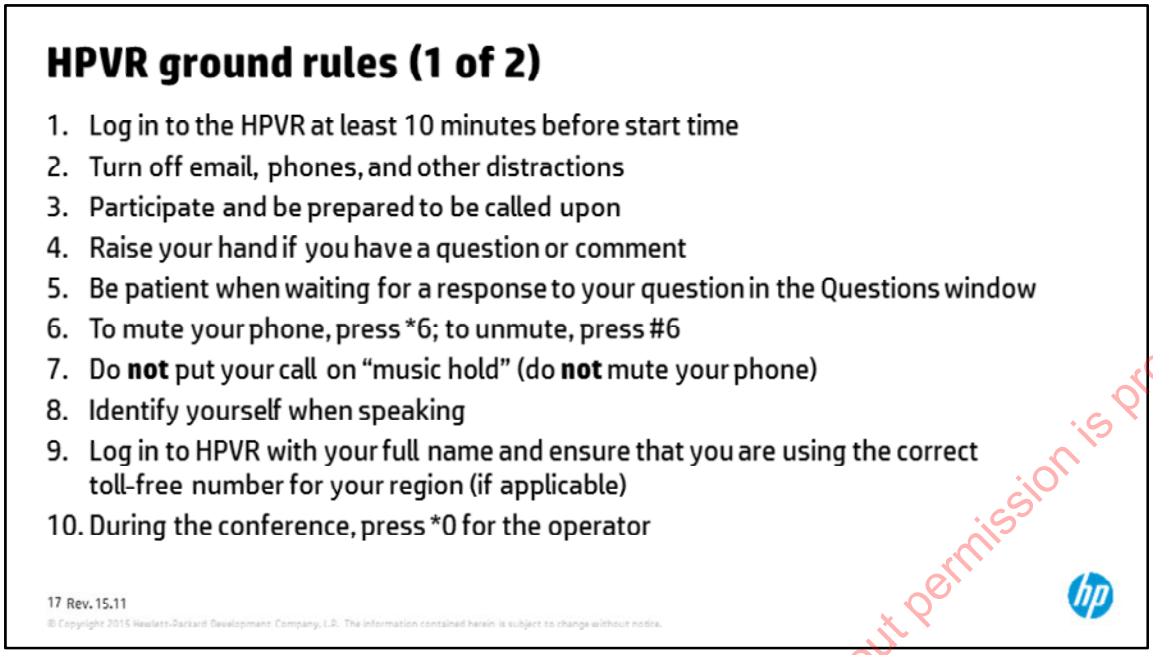


Participating in the HPVR Room Chat

Room Chat is a tool that allows any user to submit their text to a discussion that all users can view. You can use Room Chat for threaded discussions, brainstorming, or informal chatting for all users.

To submit text to Room Chat, type your text into the submission box at the bottom of the Room Chat window. Either hit the Return key or click “Submit” to submit your text to the Room Chat. Your text will appear in the main window of Room Chat, prefaced with your name.

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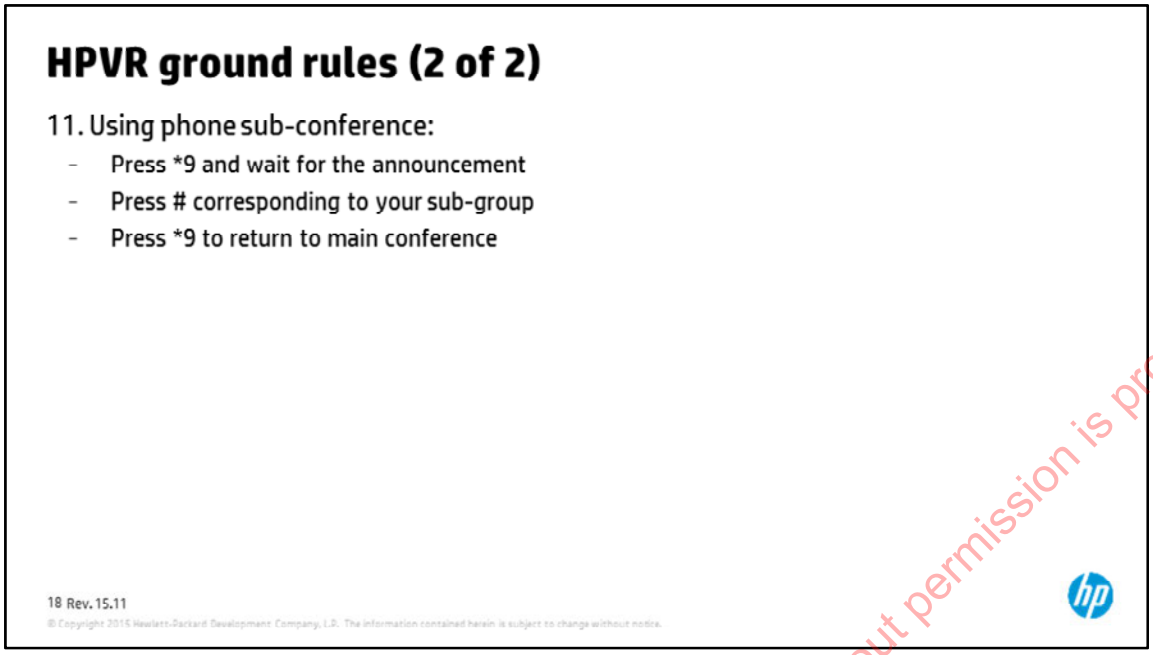


HPVR ground rules (1 of 2)

The HP Virtual Room (HPVR) ground rules to follow include:

1. Log into the HPVR at least 10 minutes before the start time to allow the class to start on time.
2. Turn off email, phones, and other distractions. It is helpful to set your "Out of Office" notification in Microsoft Outlook.
3. Participate and be prepared to be called upon by your instructor.
4. Raise your hand if you have a question or comment.
5. Be patient when waiting for a response to your question in the Questions window. Your instructor may take some time to respond to your written questions.
6. To mute your phone, press *6. To unmute your phone, press #6.
7. Do NOT put your call on "hold" because the music that might play while your phone is on mute is disrupting to the class.
8. Identify yourself when speaking or asking a verbal question.
9. If using a headset or mobile phone, ensure that their batteries are fully charged. Bad mobile phone connection can also be distracting to the class; therefore, use a landline with a headset whenever possible.
10. During the conference, press *0 for the operator.

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HPVR ground rules (2 of 2)

The HP Virtual Room (HPVR) ground rules to follow include (continued):

11. If your class uses phone sub-conferencing:
    - Press *9 and wait for the announcement, asking for a sub-conference number.
    - Press # corresponding to your sub-group.
    - Press *9 to return to the main conference.

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Review of the Navigating the Journey to Cloud course

Module 1

What's in this module for you?

After completing this module, you should be able to:

- Describe and explain the topics that were covered by the *Navigating the Journey to Cloud* course
- Answer a series of questions to move forward to the next module, or review foundational cloud and HP Helion topics

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Module 1 review: Converged Infrastructure and Cloud Fundamentals

Assessment question

1. Which characteristics must an IT infrastructure have to be the right foundation for a company to move toward cloud? (Select two.)
   a. It must become a service broker.
   b. It must be virtualized and automated.
   c. It must provide a self-service infrastructure.
   d. It must enable self-service applications with full lifecycle management.
   e. It must be standardized and consolidated.

Notes:

Assessment question

2. What are the essential characteristics of cloud computing? (Select three.)
   a. Guaranteed dedicated resources
   b. Scalable and elastic
   c. Delivered via network/Internet technologies
   d. No single point of failure
   e. Measured service
   f. Access to unlimited resources

Notes:

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Assessment question

3. Which statement best describes PaaS?
   a. Computer infrastructure and a solution stack are delivered as a service.
   b. Computer infrastructure, typically virtualized, is delivered as a service.
   c. Commercially available software applications are delivered as a service.
   d. Cloud assets are owned and operated by the provider.

Notes:

Assessment question

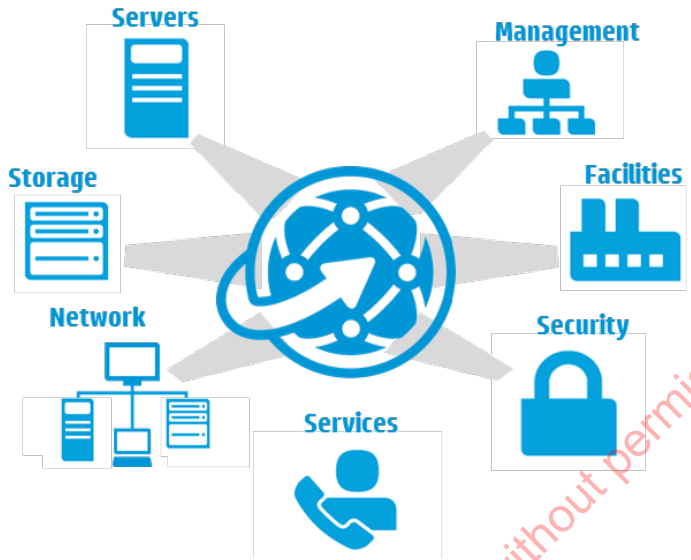
4. What is the main feature of orchestration?
   a. It plays a part in the process of provisioning and managing infrastructure and is the execution of a pre-defined workflow.
   b. Server, storage, network and application availability, and performance data are collected across physical and virtual infrastructures.
   c. Resources are returned to the pool of available resources when no longer required.
   d. Resources are sourced from internal and external providers.

Notes:

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What is a converged infrastructure?



A converged infrastructure can match the supply of IT resources with the demand for business applications in the most optimal way. To achieve this, everything must be simplified.

Simplifying the data center involves combining the IT silos into pools of virtualized assets that are shared by many applications and services. This involves the convergence of virtualized servers, storage, and network connections along with management tools and processes so resources can be managed in an integrated way. To tackle the growing complexity and cost of energy, there must be a synergistic link between power, cooling, and facilities with IT.

A converged infrastructure is thus an IT environment where servers, storage, and networking resources are standardized, virtualized, organized into, and managed as resources pools.

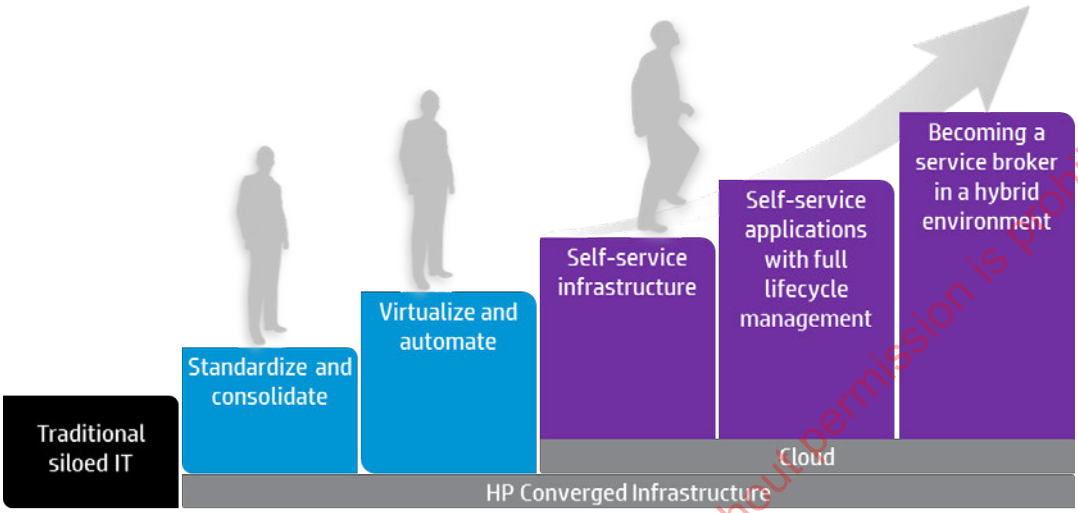
A converged infrastructure solves IT sprawl by reunifying business, application, and infrastructure functions for faster time to application value, simplified management, increased utilization, and lower power cost across an extensible scalable set of applications. This enables customers to realign traditional technology silos and bring IT resources together into adaptive pools that can be shared by any application, optimized and managed as a service.

A converged infrastructure helps businesses accelerate the delivery of application environments in a predictable, repeatable way that makes the most efficient use of IT, facility, and staff resources to drive business innovation.

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Converged infrastructure as foundation for cloud



Companies evolve to a converged infrastructure and even to cloud at different speeds. Generally, companies who have already virtualized significant parts of their infrastructure are the most ready for the private cloud, which is the next logical step in IT evolution.

Companies who are just starting to virtualize their infrastructure are probably not ready for private clouds. They need to first focus on standardization, consolidation, and virtualization of their environment. Gains in these areas lay the groundwork for cloud-based approaches.

The flexible HP approach to infrastructure convergence is a process that can fit the needs of different organizations. HP Converged Infrastructure solutions are built on modular building blocks that create a common IT foundation to support a range of needs—from virtualized environments to fully automated private clouds.

HP has a range of solutions that simplify converged infrastructure adoption, including a full line of integrated cloud solutions. These solutions range from prepackaged, turnkey cloud environments to comprehensive, extensible, global-scale solutions. HP also offers comprehensive cloud consulting services.

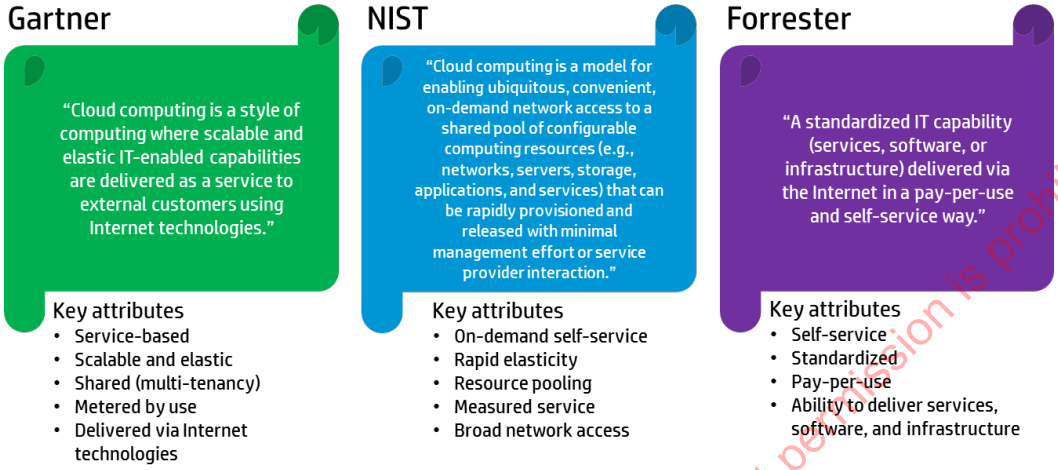
Whatever route you take to the cloud, you end up with the same overarching benefits:

- Provision the infrastructure in minutes with one-touch automated provisioning of servers, storage, and networking.
- Optimize the infrastructure confidently with built-in capacity planning and rebalancing tools.
- Protect the continuity of services with automated, cost-effective failover.

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What is the cloud and cloud computing?



Industry definitions and key attributes

There are several industry definitions of cloud computing; definitions from Gartner, NIST, and Forrester are included here.

Gartner

"Cloud computing is a style of computing where scalable and elastic IT-enabled capabilities are delivered as a service to external customers using Internet technologies."

Note
For the definition from Gartner, "IT Glossary > Cloud Computing," scan this QR code or right-click it and open the hyperlink:

To connect this definition to a real-life example, consider the Gmail service from Google. The key attributes of cloud computing, according to Gartner, are:

- **Service-based**—When users want to send or receive email, they do not have to think about the infrastructure that underlies the Gmail system. They do not need to install an email client on their computer or concern themselves with setting up the service. They simply log in to their Gmail account, click Compose message, write the message, and click Send.
- **Scalable and elastic**—The service can grow to accommodate new users and the storage space per user can be expanded virtually endlessly.
- **Shared**—The Gmail servers and storage systems are shared between multiple different users. This characteristic is referred to as "multi-tenancy."

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- **Metered by use**—The Gmail service is free (paid for by advertising), but if users were to run out of storage space, they could buy additional storage.
- **Delivered by Internet technologies**—The Gmail service is hosted on servers that are owned by Google, and the service is delivered over the Internet.

NIST

In many respects, the National Institute of Standards and Technology (NIST) defines cloud computing much as Gartner defines it. However, NIST uses slightly different terminology:

"Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (for example, networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."

Note
For the definition from Peter Mell and Timothy Grance, "The NIST Definition of Cloud Computing," page 2, scan this QR code or right-click it and open the hyperlink:

Notice that the NIST definition specifically includes applications and services.

The essential characteristics of cloud, according to NIST, are:

- **On-demand self-service**—A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.
- **Broad network access**—Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (for example, mobile phones, laptops, and workstations).
- **Resource pooling**—The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independent in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (for example, country, state, or data center). Examples of resources include storage, processing, memory, and network bandwidth.

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- **Rapid elasticity**—Resources can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time.
- **Measured service**—Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (for example, storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service.

Forrester

Forrester defines cloud computing as:

"A standardized IT capability (services, software, or infrastructure) delivered over the Internet in a pay-per-use and self-service way."

Note
For the definition from Forrester Research, "Cloud Computing," scan this QR code or right-click it and open the hyperlink:

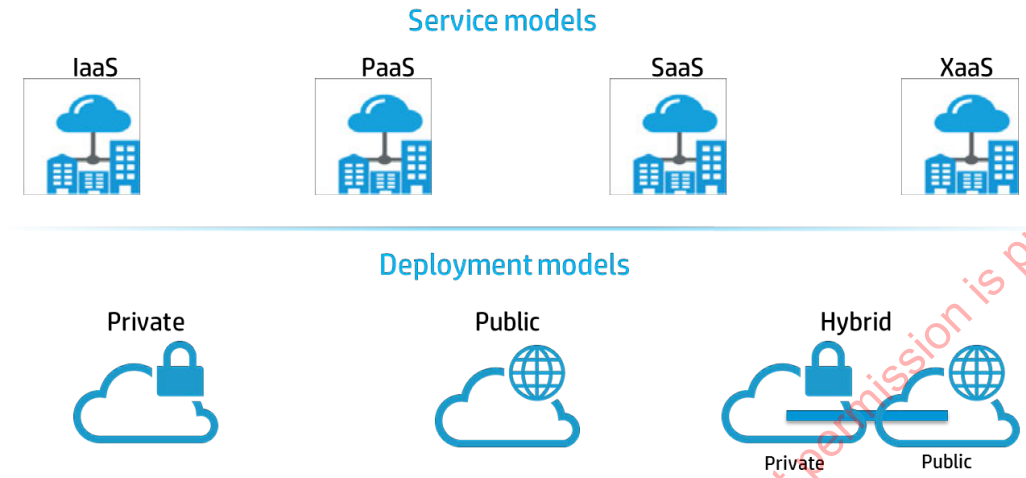
The Forrester definition identifies some important characteristics:

- **Self-service**—A fundamental characteristic of cloud computing, self-service allows users (service consumers) to choose the services that best suit their requirements.
- **Standardized**—Standardization brings many advantages, including operational cost savings and lower costs for provisioning services.
- **Pay-per-use**—Service consumers pay depending on how they use the service. Various payment models exist, and cloud service providers can even offer various payment models to match the differing needs of their customers.
- **Ability to deliver services, software, infrastructure**—Services, software, and infrastructure are all important IT components that service providers can deliver. Typically, the term "service" includes any type of service (including software and infrastructure), and this training will use "service" in that way.

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Cloud service and deployment models



Cloud implementations provide various services and are managed in various ways. When characterizing a cloud implementation, you should consider two dimensions: service models and deployment models.

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Service models

The service model determines the type of resources that are provided to the consumer. For example, do consumers receive an application (Software as a Service) or a platform on which to develop and run their own applications (Platform as a Service)? Or do consumers purchase access to a platform with an operating system but no installed applications (Infrastructure as a Service)? Details of these common service models include:

- **Infrastructure as a Service (IaaS)**

  The cloud infrastructure service model is probably the easiest to understand. IaaS delivers a computer infrastructure, typically a virtualized environment, as a service. Rather than purchasing servers, software, data center space, networking equipment, and power and cooling systems, users instead buy those resources as a service. The service is typically billed on a utility computing basis, and the cost is calculated based on the level of activity. Usually users can buy services by the hour, day, week, or month.

  Amazon Elastic Compute Cloud (EC2) is one example of an IaaS provider. It delivers a computing environment with an operating system, on which users install and run their own applications. EC2 is a central part of the Amazon.com cloud computing platform, Amazon Web Services (AWS). The HP Helion Public Cloud (**www.hpcloud.com**) is another example of IaaS.

- **Platform as a Service (PaaS)**

  Cloud platform services deliver a computing platform, solution stack, or both. PaaS enables companies to deploy applications acquired or created by users with provided programming languages and tools, without the cost and complexity of buying and managing underlying hardware and software layers. The consumer does not control the underlying infrastructure (networking, servers, operating systems, or storage) but does have control over the deployed applications. A virtual machine (VM) that supports Linux, Apache, MySQL, and PHP/Perl/Python (commonly known as the *LAMP stack*) is one example of PaaS. Google App Engine is another example of PaaS. It offers a full development stack for people who want to develop and host applications on Google's infrastructure. Google App Engine supports applications written in several programming languages.

- **Software as a Service (SaaS)**

  Cloud application services provide access to software applications over the Internet. Users do not need to develop an application or install and run a purchased application on their own computers. A company that uses SaaS does not need to be concerned with managing applications' underlying infrastructure—or the cost of providing the infrastructure in the first place.

The main difference between SaaS and PaaS is that with SaaS, service consumers do not develop the applications; instead, they simply access applications that have been developed by someone else. With PaaS, however, consumers develop and deploy their own applications using software development kits (SDKs) and programming languages.

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Deployment models

Deployment models characterize the cloud implementation based on who manages the resources that deliver the service.

- **Private cloud**—In a private cloud, services are provided to specific users such as members of departments within a company. Services are delivered over the network, but data remains private in that it stays behind the company firewall rather than being transmitted over the Internet. The solution might still feature multi-tenancy and shared underlying resources, but the multiple tenants are departments within the company. Although a private cloud requires an investment in infrastructure and incurs ongoing maintenance costs, it can be made to be highly available and flexible. Retaining data behind corporate firewalls can help to address common enterprise concerns regarding security, governance, availability, and control.
- **Public cloud**—In a public cloud (also known as an *external cloud*), all cloud assets that underlie the services are owned and operated by a provider, and users access the services over the Internet. (Of course, the Internet through which consumers reach the public cloud resources is not owned by the cloud provider.)

  Public clouds feature multi-tenancy, in which resources are shared by all users. Users pay for the services on a utility computing (pay-per-use) basis. Users do not have to invest in the acquisition and maintenance of the computer infrastructure. The users could be employees of different companies, located in different countries, legal jurisdictions, or time zones.

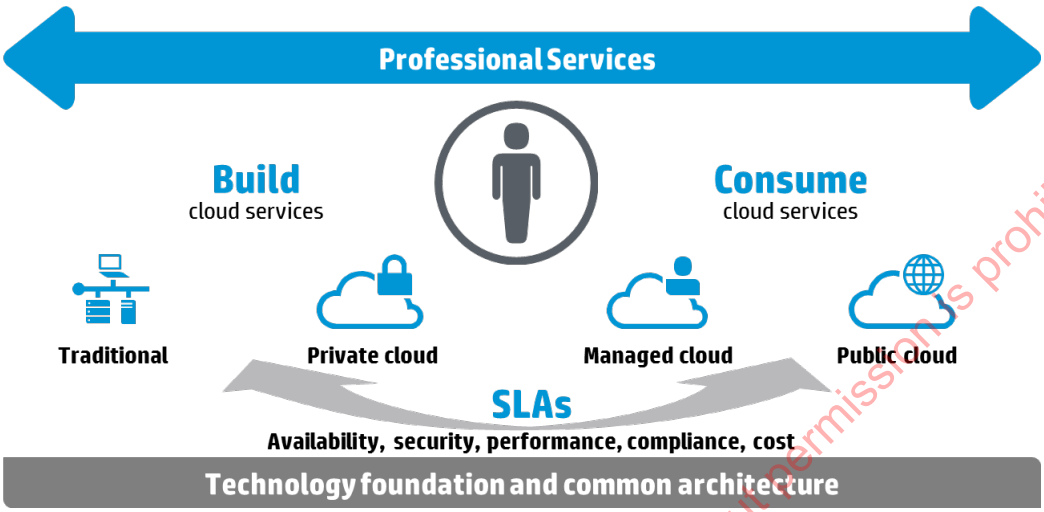
  Unlike a private cloud scenario, in which the data resides securely behind the company firewall, the public cloud requires users' data to travel over the public Internet and reside in an unknown location. This model clearly raises concerns for many enterprises regarding security, governance, availability, and control. Sensitive business data could be stored in a different country with a different legal system and potentially with barriers to remediation in the event of an outage or loss of data.

  The examples of IaaS, PaaS, and SaaS in the previous section were all public cloud solutions. The entire infrastructure is owned by the provider—Amazon (in the IaaS example), Google (in the PaaS example), or Microsoft/Salesforce.com (in the SaaS example). The services are delivered over the Internet, and users are charged for the services on a pay-per-use basis.
- **Hybrid cloud**—Cloud users sometimes believe that they have unlimited resources at their disposal, and, with the public cloud, this belief might be almost true. Providers such as HP, Amazon, and Google make a massive amount of resources available. In a private cloud, however, resources are limited. For example, a company with a private cloud solution might be limited to resources provided by that solution. Although the solution, when correctly sized and configured, can provide a large amount of resources, no private cloud can match the resources of the HP, Amazon, or Google data centers. To overcome this potential resource limitation, a hybrid cloud environment makes use of services sourced from internal and external providers.

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Hybrid approach to cloud



Most organizations moving toward the cloud should adopt a hybrid solution, leveraging the best of private cloud, managed cloud, and public cloud solutions, as well as a traditional IT infrastructure.

By embracing a hybrid cloud, you can address the service delivery challenges facing your IT organization in the most efficient and cost effective way. You can continue to leverage your traditional IT resources while also taking advantage of the capabilities offered across private cloud, managed cloud, and public cloud implementations. For example, with traditional IT, you might spend indefinitely without achieving your goals. With cloud implementations, SLAs guarantee that, for a negotiated cost, you receive a solution that meets your regulatory compliance requirements and provides set levels of availability, security, and performance.

To move toward a hybrid cloud, you must look at the portfolio of applications in your organization, segmenting them according to their respective SLA requirements. You must then align each type of application to the appropriate deployment models, thus optimizing the use of internal and external resources.

In this new hybrid world, the Chief Information Officer (CIO) and IT department expand their traditional role as the builders of services. They now become both builders and brokers, creating a seamless experience for users, independent of service sources.

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Modules 2 and 3 review: The HP Journey to the Cloud The HP View of the Future with OpenStack and HP Helion

Assessment question

1. HP Helion CloudSystem Foundation is best suited for which type of an environment?
   a. Virtualization and automation environments
   b. Starter Infrastructure as a Service
   c. Advanced Infrastructure as a Service
   d. Platform as a Service
   e. Software as a Service

Notes:

Assessment question

2. HP ConvergedSystems are used in which path to infrastructure convergence and cloud?
   a. Conventional
   b. Customized
   c. Step-by-step
   d. Fast-track

Notes:

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Assessment question

3. Which HP ConvergedSystems form a base of flexible and fixed HP Helion CloudSystem configurations? (Select two.)
   a. HP ConvergedSystem 100
   b. HP ConvergedSystem 300
   c. HP ConvergedSystem 500
   d. HP ConvergedSystem 700
   e. HP ConvergedSystem 700x

Notes:

Assessment question

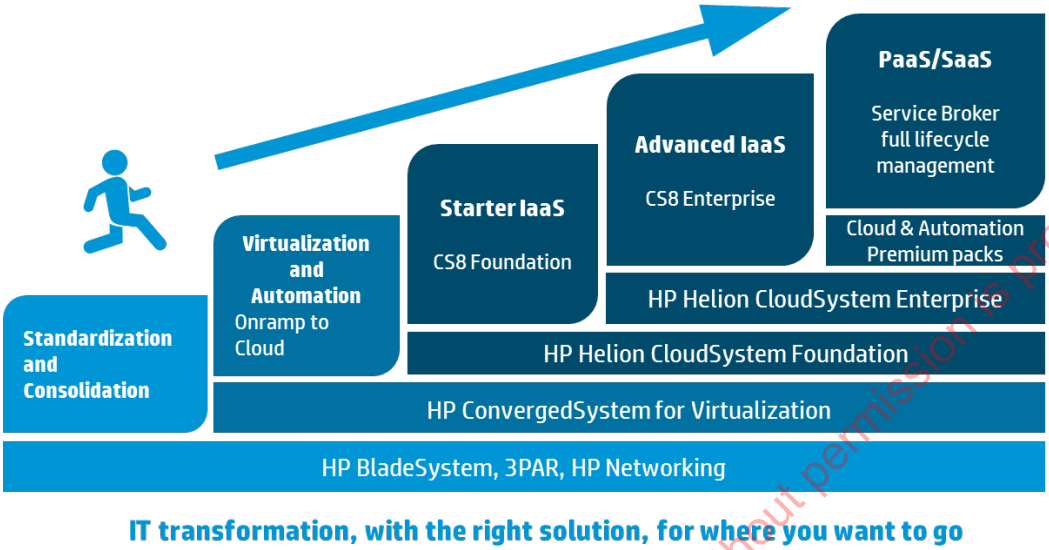
4. HP Helion OpenStack Community is a free-to-license and free-to-download OpenStack distribution from HP.
   ☐ True
   ☐ False

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The cloud journey



IT transformation, with the right solution, for where you want to go

The time to move toward infrastructure convergence is now. But the transition from a traditional data center to a converged infrastructure is a journey that does not happen overnight.

First, organizations need to standardize their configurations, which involves moving to a small number of approved standard configurations implemented in a consistent fashion with consistent management tools. They consolidate, or reduce their IT assets, by using more efficient technologies. And they virtualize some of their physical assets, such as servers, I/O, and storage. A virtual infrastructure is pooled and sharable.

Organizations also automate their IT infrastructure, transforming it to IT as a service. Key elements include self-service portals for IT help, automated infrastructure provisioning and policies, and more.

All these steps along the journey to cloud move the customer forward toward IT transformation. HP offers solutions that meet customer needs today while laying the groundwork for what is next.

HP understands that customers evolve to cloud at different speeds. Customers who are just starting to virtualize are probably not ready for private clouds. They need to first focus on standardization, consolidation, and virtualization. Gains in these areas lay the groundwork for cloud-based approaches. Generally, customers who have already virtualized significant parts of their infrastructure are the most ready for private cloud—the next logical step in IT evolution.

The most advanced customers are those who can understand the full vision of cloud and the possibility to broker services across many different delivery models. Most customers are not ready for that today, but they should understand that ultimate vision.

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Two paths for moving forward

There are two paths for moving forward:

- Step-by-step
- Fast track

The step-by-step approach

The step-by-step approach involves a methodical approach for those wanting to plan their journey to cloud in a more measured way. With step-by-step solutions built on an HP Converged Infrastructure, customers can build on their existing IT infrastructure with converged solutions that deliver value today while also preparing for tomorrow. HP Converged Infrastructure solutions enable customers to take a step-by-step approach with technologies engineered for convergence.

HP simplifies the step-by-step approach by providing blueprints that help customers plan and build their own solutions:

- **Cloud Maps for HP CloudSystem Matrix**—Are preconfigured infrastructure-to-application service definitions that ensure the accurate deployment, configuration, and sizing of cloud services within the service catalog.
- **Reference architectures**—Address key architectural and transitional issues. These topics include functional and technical design, organizational design, technology governance, and change management to enable a smooth transition across the entire organization.

Converged Infrastructure components include:

- Servers
  - HP Moonshot
  - HP BladeSystem
- Storage
  - HP 3PAR StoreServ storage systems
- Networking
  - HP FlexNetwork architecture
- Management
  - HP OneView
  - HP Virtual Connect
- HP Helion Professional Services

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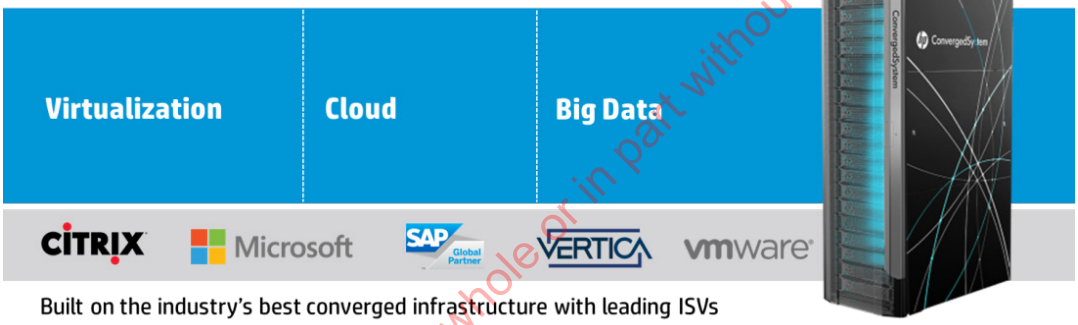
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The fast track approach

The fast track approach includes a wide range of ready-to-deploy solutions that allow an organization to move to the cloud more quickly. These solutions leverage the benefits of the cloud effectively with an end-to-end lifecycle approach.

- **HP ConvergedSystems**—Build a solution with the most-comprehensive portfolio of integrated systems available today. Each system is tested and designed to condense months of planning, procurement, and deployment into weeks. Each solution is optimized and ready to run top initiatives in cloud, virtualization, and collaboration from day one.
- **HP Helion CloudSystem 8**—Implement an integrated and open solution for building and managing clouds.

The HP ConvergedSystem portfolio



Taking IT simplicity and efficiency to new heights, HP ConvergedSystem is a portfolio of integrated systems optimized for critical workloads such as virtualization, cloud, and Big Data. Fully integrated, ConvergedSystems include all the servers, storage, networking, management, and software you need, in a system that is easy to procure and support, and managed as one.

Uniting market-leading HP Converged Infrastructure with decades of experience in solution design, ConvergedSystem offers a performance-optimized, total systems experience that dramatically simplifies IT. Through quick deployment, intuitive management, and system-level support, IT staff can rise to the position of business service experts.

ConvergedSystem does not present disparate technologies bolted together and called “converged,” which is the case with other solutions available from third parties. Instead, you receive components designed from the start with convergence in mind, coupled with workload optimization based on decades of expertise. The result is a single complete computing ecosystem.

Getting the most from IT systems means getting them up and operational as soon as possible. Offering out-of-the-box optimization, the HP ConvergedSystem portfolio is ready to run upon delivery. Performance-tuned for a particular application, these purpose-built systems are designed to handle key workloads.

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HP ConvergedSystem for Virtualization models

HP ConvergedSystem for Virtualization is available in three “right-size” configurations:

- ConvergedSystem 100 for Hosted Desktops—With Citrix XenDesktop
- ConvergedSystem 300 for Virtualization—With VMware vSphere
- ConvergedSystem 700 and 700x for Virtualization—With vSphere (700) and vSphere and Microsoft System Center (700x)

HP ConvergedSystems for Big Data

HP ConvergedSystem 300 for Microsoft Analytics Platform



100X
Faster query speed[1]

30%
Better scan rate[1]

50%
Lower cost per TB[2]

[1] Than previous generations
[2] Than competitive offerings

HP ConvergedSystem for SAP HANA



SAP HANA
Scale-up

SAP HANA
Scale-out

The dramatic increase in volume, velocity, variety, and vulnerability of information is transforming businesses and governments. HP is helping some of the most information-complex companies make sense of Big Data with software that supports informed decision. HP management software also streamlines information management and lowers the cost of running advanced, predictive, or real-time analytics. HP ConvergedSystem for Big Data enables analysis of many forms of data across traditional silos, inside and outside the enterprise.

ConvergedSystem for Big Data brings together structured, unstructured, and semi-structured data for advanced analytics. Customers can choose infrastructure platforms and deployment models for their specific workload and partner preferences.

Note
For more information about HP ConvergedSystem solutions for Big Data, scan this QR code or right-click it and open the hyperlink:

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In addition to HP ConvergedSystem for SAP HANA, HP solutions for Big Data include:

- **ConvergedSystem 300 for Microsoft Analytics Platform**—A Big Data solution optimized for business intelligence applications. This factory-integrated system is easy to buy, manage, and support and is the industry's only appliance that seamlessly integrates in-memory performance, massively parallel processing data warehouse, and Hadoop.
- **HP Hadoop, Autonomy/Idol, Vertica, Enterprise Security, and nApps platform (HAVEn)**—A visionary architecture that provides a complete approach to Big Data analytics. Including Hadoop, Autonomy, Vertica, and HP Enterprise Security, HAVEn is a technology stack that enables customers to handle their information.

The HP ConvergedSystem 300 solution for Microsoft Analytics Platform is purpose-built, factory-integrated, and optimized for data-intensive workloads generated by business intelligence (BI) applications. This solution seamlessly integrates in-memory performance, massively parallel processing data warehouse (MPP DW), and Hadoop into one appliance. It is built on Microsoft technologies that query both structured and unstructured data and on HP servers and HP storage. Customers can add additional compute and HDInsight data (scale units) to grow an existing HP AppSystem for Parallel Data Warehouse appliance. The updated HP Support Pack Utility Suite, a unique set of tools designed to reduce operational costs, includes tools to significantly simplify updates and several other maintenance tasks.

Note
HDInsight is an enterprise-ready, Hadoop-based distribution from Microsoft that brings a 100% Apache Hadoop solution to the data. Microsoft's integrated query tool, PolyBase, ties the worlds of relational and non-relational data together, so they operate seamlessly in a single appliance.

HP ConvergedSystem 300 for Microsoft Analytics Platform provides:

- 100x faster queries and 30% better scan rate, compared to the previous generation, HP AppSystem for Parallel Data Warehouse, based on HP and Microsoft performance benchmarks
- 50% lower cost per TB, as compared to enterprise data warehouse appliances from EMC, IBM, Teradata, and Oracle, per Value Prism Consulting's 2013 study



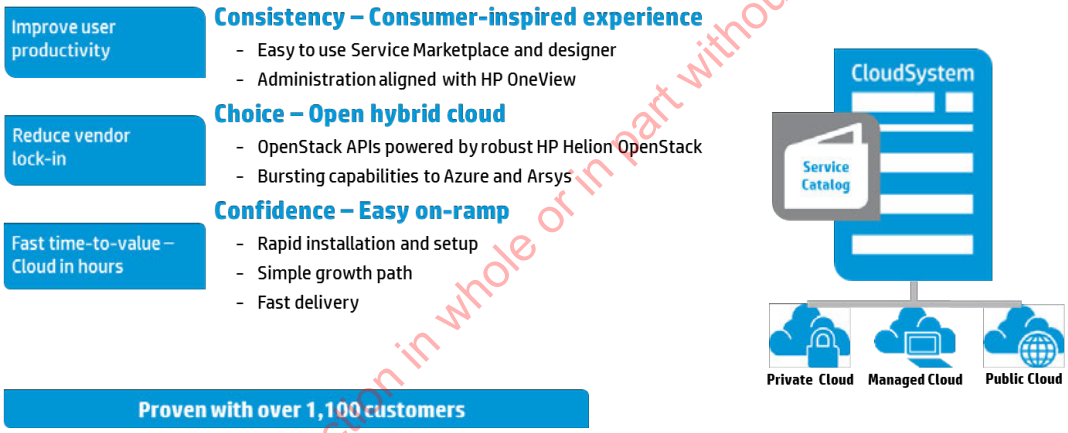
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ConvergedSystem for SAP HANA is optimized to deliver the highest levels of performance and availability for SAP HANA, delivering faster analytics, the industry's only automated failover, and unmatched scalability. In combination with HP Big Data management solutions and consulting services, ConvergedSystem for SAP HANA provides the most complete Big Data solutions in the market. This pre-integrated, turnkey solution brings together the hardware, software, and services that are needed to make the critical transition to connected intelligence and analytics-driven decision making faster, and with less risk.

In-memory technologies such as SAP HANA provide a common platform designed for faster big data analytics, a more scalable data warehouse and ability to migrate all business applications to one underlying data base. An optimized data management architecture should be deployed without disruption to unlock operational efficiencies and turn large amounts of data into real-time, actionable business insights.

HP ConvergedSystem for Cloud



Offering more consistency, choice, and confidence as you transform IT, Helion CloudSystem is HP's flagship solution for building and managing clouds. You can run services on premise in your private cloud, and you can manage off-premise services, creating a hybrid cloud.

Designed to meet the needs of enterprises and service providers, HP Helion CloudSystem redefines the face of cloud. It is based on a consumer-inspired experience that is designed to make all cloud users more productive.

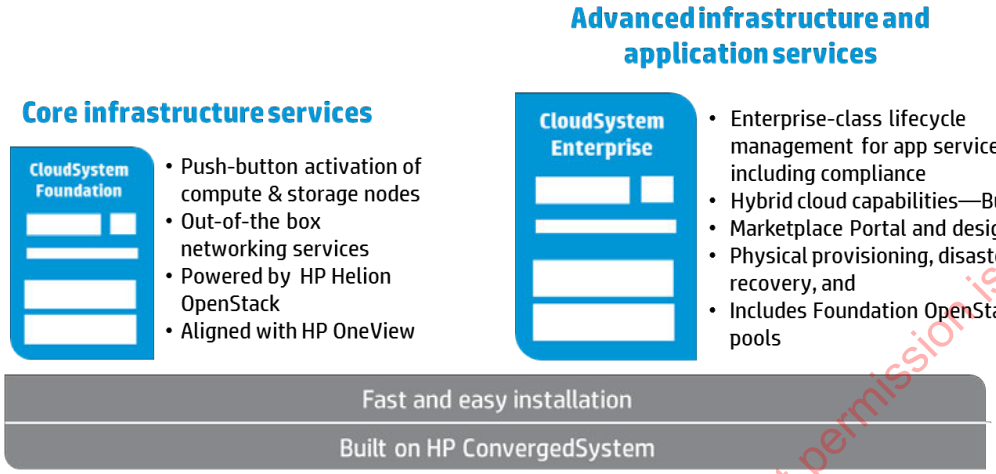
Helion CloudSystem enables your transition to cloud from previously virtualized non-cloud environments, or to start your journey from scratch with a new cloud environment. It leverages optimized HP Converged Systems that are easy to buy, manage, and support—accelerating your time-to-cloud value.

Leveraging the experience gained from more than 1,100 customers worldwide, the newest generation of HP Helion CloudSystem empowers your organization to deliver cloud infrastructure and application services. You can use Helion CloudSystem to get to the cloud quickly and cost effectively, while supporting future growth and flexibility.

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HP Helion CloudSystem 8 portfolio



Helion CloudSystem 8 is available in Foundation and Enterprise models. Both are powered by HP Helion OpenStack, a version of OpenStack that has been enhanced by HP to be more robust and enterprise-grade.

Helion CloudSystem Foundation features the following:

- Push-button activation of compute and storage nodes
- Out-of-the box networking services
- Alignment with HP OneView

Delivered on the ConvergedSystem platform, Helion CloudSystem Enterprise offers all the capabilities of Helion CloudSystem Foundation plus provisioning of advanced infrastructure and application services in minutes. It offers:

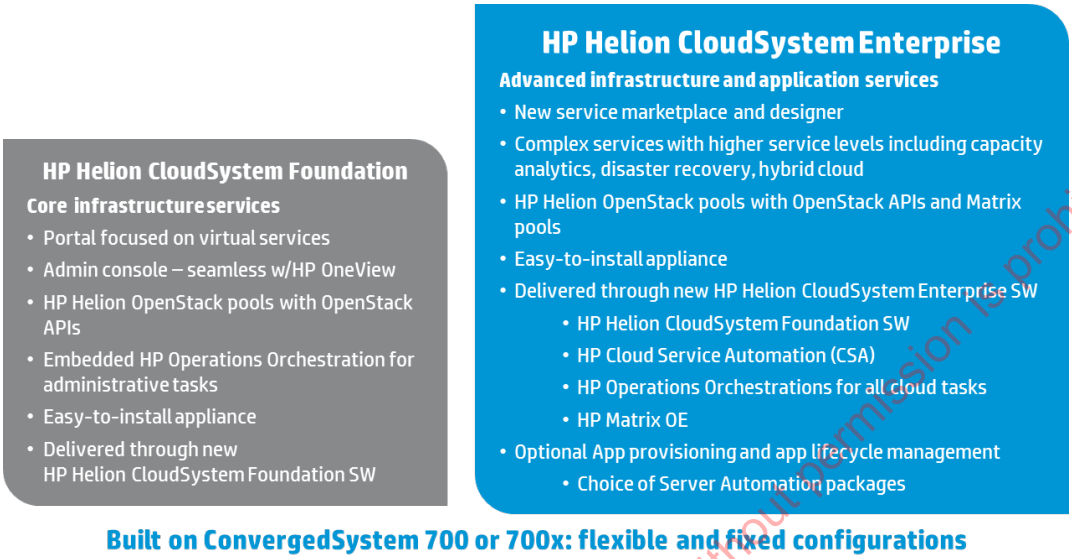
- Enterprise-class lifecycle management for hybrid cloud services
- Service Marketplace, making it easy for consumers to request cloud services through Cloud Service Automation
- Drag-and-drop designer for rapidly defining new multi-tier cloud services
- Pre-defined service catalog entries for popular applications, with more than 200 HP Cloud Maps
- Integrated capacity planning, disaster recovery, and consuming services from public clouds

In addition, Helion CloudSystem Enterprise ensures investment protection for CloudSystem Matrix users. They can manage new HP Helion OpenStack resources alongside existing CloudSystem Matrix resource pools from the same cloud management platform.

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HP Helion CloudSystem Foundation and Enterprise



If a customer's business or organization is just starting on the journey to the cloud, they can begin by deploying a platform that supports basic cloud infrastructure services, such as the easy-to-deploy HP Helion CloudSystem.

HP Helion CloudSystem Foundation

With Helion CloudSystem Foundation, customers benefit from:

- Delivery of simple infrastructure services within minutes, powered by HP Helion OpenStack
- Open APIs for administrative and cloud service functions, including OpenStack APIs, which enable highly automated cloud delivery
- Fast and easy installation with the software appliance delivery model
- Simple administration aligned with the HP OneView console
- Ability to seamlessly upgrade to HP Helion CloudSystem Enterprise

Helion CloudSystem Foundation incorporates a workflow engine to automate administration tasks that is based on HP Operations Orchestration. This is aligned with HP OneView, so administrators can manage cloud resources from a common, easy-to-use interface.

Helion CloudSystem Foundation also includes the following OpenStack service offerings:

- Nova (compute)
- Cinder (block storage volumes)
- Neutron (networking)
- Keystone (identity)
- Glance (image)
- Horizon (dashboard)

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HP Helion CloudSystem Enterprise

For customers who need a more comprehensive cloud solution, HP Helion CloudSystem Enterprise is a hybrid cloud platform designed to deliver advanced infrastructure services, in addition to platform and application services. The enterprise solution provides all the capabilities and value of Helion CloudSystem Foundation plus:

- Delivery of advanced infrastructure and application services in minutes
- Enterprise-class lifecycle management for hybrid cloud services
- Service Marketplace, making it easy for consumers to request cloud services through Cloud Service Automation
- Drag-and-drop designer for rapidly defining new multi-tier cloud services
- Pre-defined service catalog entries (HP Cloud Maps) for over 200 common applications
- Integrated capacity planning, disaster recovery, and consuming services from public clouds

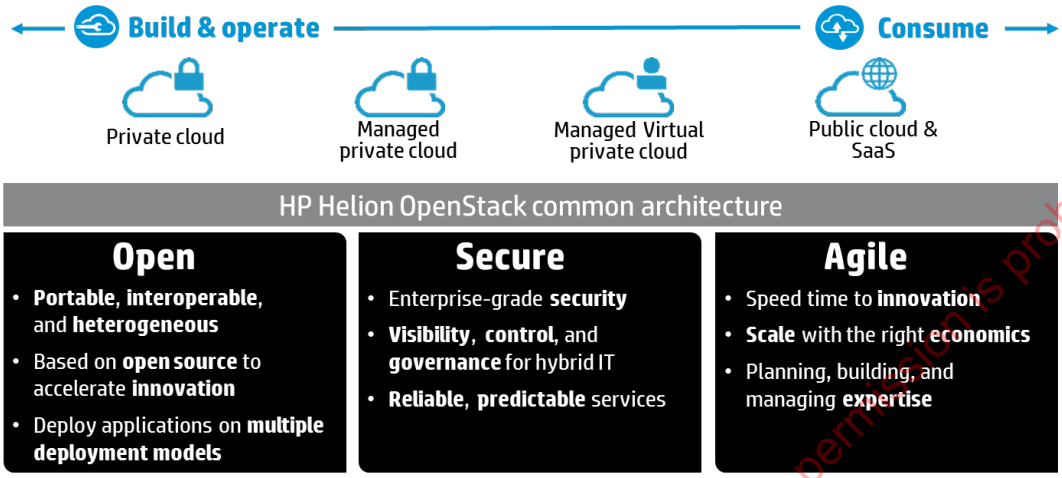
The optional Server Automation Virtual Appliance (SAVA) provides the ability to manage the entire lifecycle of servers including provisioning, update management, software deployment, and audit and compliance for up to 3,000 servers.

Helion CloudSystem can also be implemented as a software-only solution using the existing infrastructure. Whichever offering the customer chooses, they receive the same consistency, choice, and confidence that HP offers in its complete range of ConvergedSystem solutions.

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HP Helion is built on OpenStack



HP Helion presents a broad portfolio of products, solutions, and services, from both HP and trusted partners; you can help your customers deploy a private cloud, managed private cloud, a managed virtual private cloud, and use public and SaaS services.

This is all based on a common technology, OpenStack, which makes it easier for you to deploy, manage and operate cloud applications.

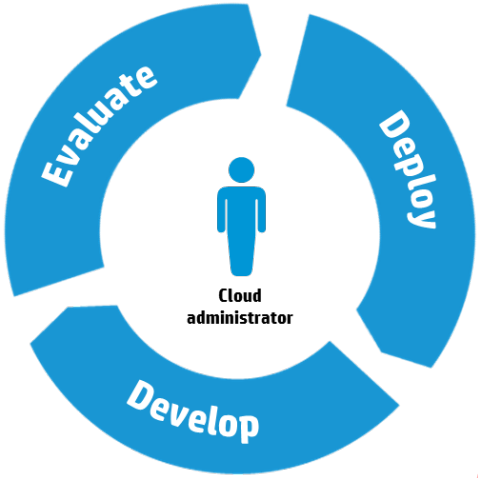
OpenStack is open, secure, and enables organizations to be more agile.

- **Open**—It is based on open standards and built on open source to deliver fast innovation. Openness enables the ability to move, integrate and deliver applications across IT environments. It means you can build your cloud, your way, without fear of proprietary systems or lock in.
- **Secure**—You are safe in knowing that all products and services provide the visibility, control and governance you need across a hybrid IT environment. You can also be secure in knowing you are in a safe pair of hands with HP as your partner.
- **Agile**—HP provides the fastest time to business outcome through the best economics across all delivery models and solutions. IT and business can respond to the latest market challenges and use technology as a strategic advantage. You can pay as you go for as much or as little as you need.

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HP Helion OpenStack Community



HP Helion OpenStack Community is a distribution for enterprises and cloud administrators interested in evaluating, developing, and deploying a private cloud based on OpenStack technology. It is a pure, free-to-license OpenStack distribution that accelerates deployment and simplifies the management of small-scale, open cloud environments and infrastructure services.

Helion OpenStack Community is pure OpenStack technology with no mix of proprietary or non-OpenStack tools. It is one of the first OpenStack distributions based on Icehouse release. It is free to download under an open source license with optional paid support contract.

Because Helion OpenStack Community is secure, easy to deploy, and easy to manage, building an OpenStack cloud is simple. What could have taken days now takes just minutes with a few automated steps.

Enjoy the latest in OpenStack innovation with an easy-to-use console to minimize administration time and automatic updates close to the OpenStack trunk.

Helion OpenStack Community is hardened and tested for performance and security. The full release of Helion OpenStack Community supports small-scale private cloud deployments of up to 30 nodes and up to 600 virtual machines.

Workloads can be migrated to Helion OpenStack Community, which adds features and capabilities needed for larger-scale deployments. Helion OpenStack Community delivers a common architecture across private, public, and hybrid clouds.

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Module 4 review: HP Helion CloudSystem 8 Foundation

Assessment question

1. Which OpenStack projects does HP Helion CloudSystem Foundation contain? (Select four.)
   a. Nova
   b. Swift
   c. Cinder
   d. Glance
   e. Heat
   f. Horizon
   g. Ceilometer

Notes:

Assessment question

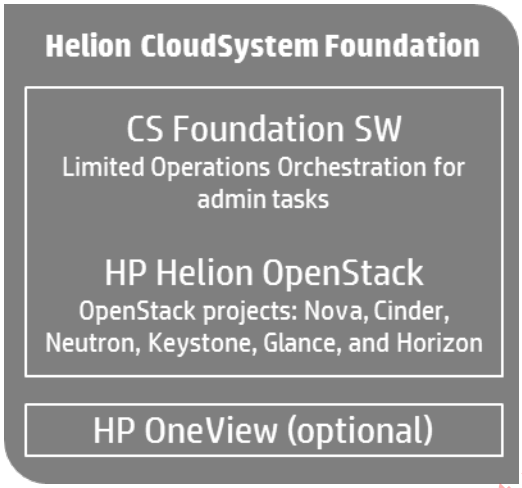
2. Which HP Helion Cloud storage type replicates data across three physically separated availability zones for maximum availability and durability?
   a. HP Cloud Object Storage
   b. HP Cloud Block Storage
   c. On-Instance Storage via HP Cloud Compute
   d. HP Helion RAID Storage

Notes:

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HP Helion CloudSystem Foundation



If a customer's organization is just starting the journey to cloud, they can begin by deploying a platform that supports basic cloud infrastructure services—such as the easy-to-deploy HP Helion CloudSystem Foundation. With Helion CloudSystem Foundation, they will benefit from:

- Delivering simple infrastructure services within minutes, powered by HP Helion OpenStack Community Edition, the enterprise-grade OpenStack cloud architecture from HP
- Open APIs for both administrative and cloud service functions, including OpenStack APIs, enabling highly automated cloud delivery
- Fast and easy installation with software appliance delivery model
- Basic HP Operations Orchestration software
- Simple administration aligned with the HP OneView console
- Ability to seamlessly upgrade to HP Helion CloudSystem Enterprise

Helion CloudSystem Foundation provides fine-grained, user control of the virtual infrastructure lifecycle. It incorporates a workflow engine to automate administration tasks that is based on HP Operations Orchestration. This is aligned with HP OneView, so administrators can manage cloud resources from a common, easy-to-use interface.

In addition, Helion CloudSystem Foundation includes the following OpenStack service offerings:

- Nova (compute)
- Cinder (block storage volumes)
- Neutron (networking)
- Keystone (identity)
- Glance (image)
- Horizon (dashboard)

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Integrated Helion CloudSystem storage and network management

Helion CloudSystem Foundation integrates storage and networking at the administration level, as well as at the architect and user levels. For administration, Helion CloudSystem Foundation leverages HP OneView Converged Infrastructure templates for management of storage and networking resources.

Within the Horizon-styled portal, customers can take advantage of OpenStack project-based Cinder (block storage) and Neutron (Software Defined Networking [SDN]) to dynamically allocate storage and networking resources for the services they want to deploy.

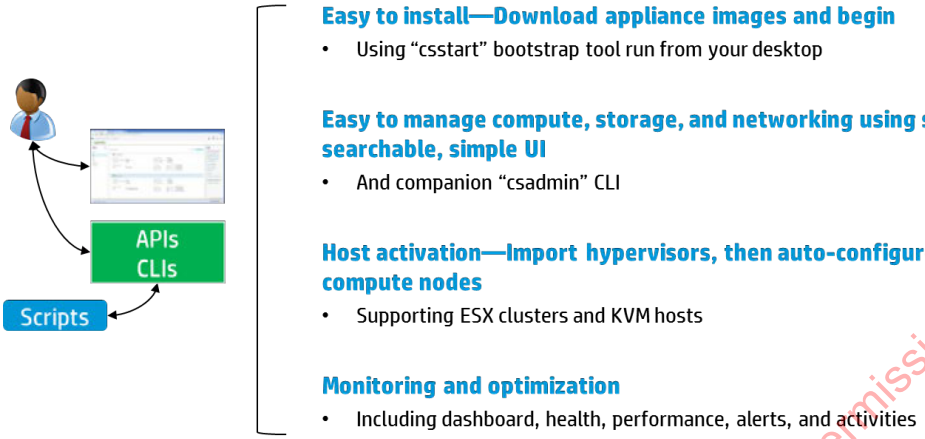
Features of the Integrated Helion CloudSystem storage and network management include:

- Integrated resource management with HP OneView
  - Administrators can create and manage storage and networking for cloud resources
  - Users can visually see storage and network resources and request required
- Optimized support for HP solutions allows heterogeneous environments over time
- 3PAR block storage for iSCSI and Fibre Channel
  - OpenStack Cinder drivers developed by HP
  - Enhanced storage support, emphasizing industry-leading HP 3PAR storage capabilities
- HP Networking for vLAN resources
  - OpenStack Neutron drivers developed by HP
  - Enhanced SDN and networking support

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HP Helion CloudSystem Foundation use cases



Helion CloudSystem Foundation enables rapid stand-up and streamlined on going operation. Helion CloudSystem Foundation is:

- Easy to install
  - Download appliance images and begin
  - Use the csstart bootstrap tool you run from your desktop
- Easy to manage
  - Simplify compute, storage, and networking through a scalable, searchable, simple UI
  - Alternatively, use the companion csadmin CLI

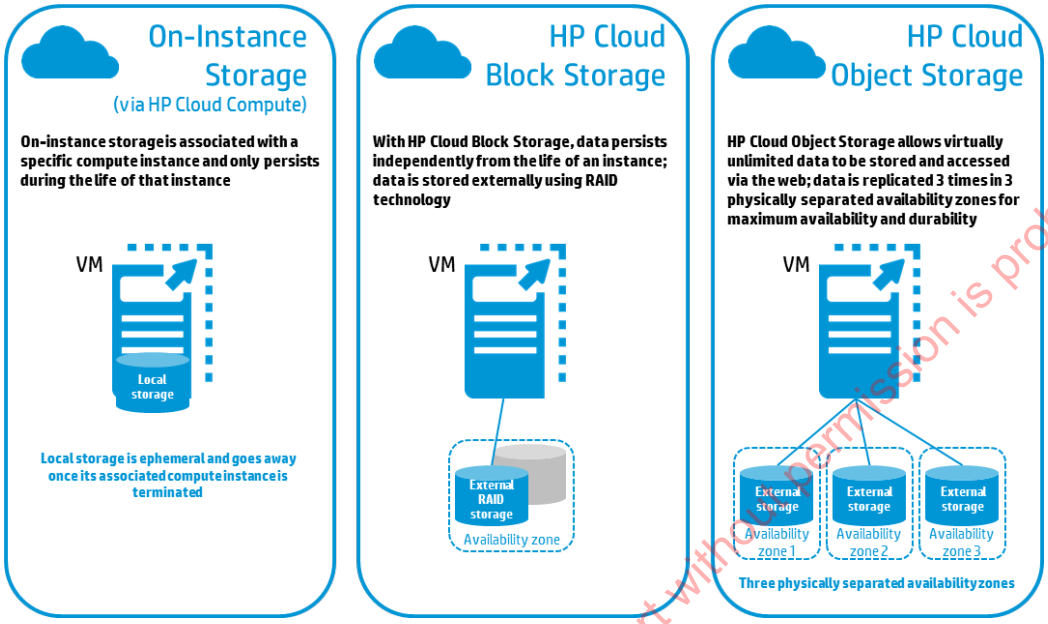
Administration use cases include

- Streamlined host activation
  - Import hypervisors, and then auto-configure them as compute nodes
  - Take advantage of support for ESX clusters and KVM hosts
- Simplified monitoring and optimization
  - Use the dashboard, health, performance, and alerts/activities

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Cloud storage types



HP Helion Public Cloud offers three flavors of cloud storage:

- **On-instance storage** is the storage that ships preconfigured with compute instances. Analogous to a server's built-in hard drive, this local storage only persists as long as the instance does.
- **HP Cloud Block Storage** delivers a durable, high performance, and persistent storage solution that acts like an external hard drive. A block storage volume exists independently of a compute instance.
- **HP Cloud Object Storage** acts like an FTP file server, in that it stores data without direct exposure of a file system. It offers scalable, reliable online storage that you can access on demand, and is perfect for data archiving or for storing static content through the web.

Typical use cases for HP Cloud Block Storage include:

- Workloads requiring long-term persistence of data
- Situations where the data frequently changes (such as frequent read/write)
- Use as the primary storage for a database or a file system
- Applications that need detailed updates with access to raw, unformatted block-level storage

Typical use cases for HP Cloud Object Storage include:

- Data storage back up and archiving, where highly durable and accessible storage is valued
- File sharing of information and quick accessibility across the world
- Website images to avoid storing them on local servers
- Static web-hosted content where bandwidth frequently fluctuates
- Websites hosting large user-generated data, such as photo and video sharing

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Module 5 review: HP Helion CloudSystem 8 Enterprise

Assessment question

1. Which capabilities does HP Helion CloudSystem Enterprise provide above and beyond HP Helion CloudSystem Foundation? (Select four.)
   a. Lifecycle management for hybrid cloud services
   b. Open APIs
   c. Drag-and-drop designer
   d. Pre-defined service catalog entries
   e. Integrated capacity planning, disaster recovery, and consuming services from public cloud
   f. Horizon-styled portal
   g. Integrated storage and networking provisioning

Notes:

Assessment question

2. What are the three CSA portal types available with HP Helion CloudSystem Enterprise?

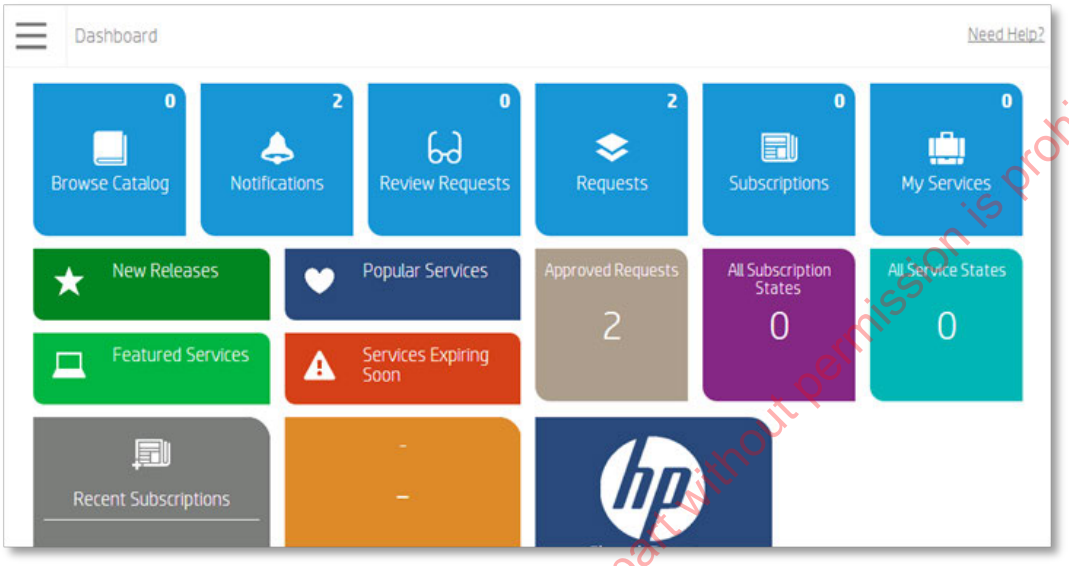
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Assessment question

3. Which HP Helion CloudSystem Enterprise interface is shown in the following graphic?



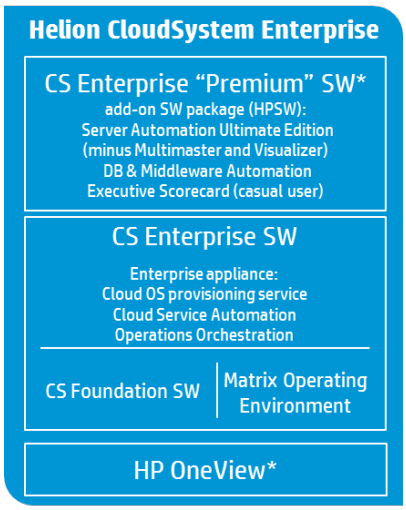
a. CSA Admin Console
b. CSA Marketplace Portal
c. HP Operations Orchestration Portal
d. Cloud Service Management Console

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HP Helion CloudSystem Enterprise



* Optional

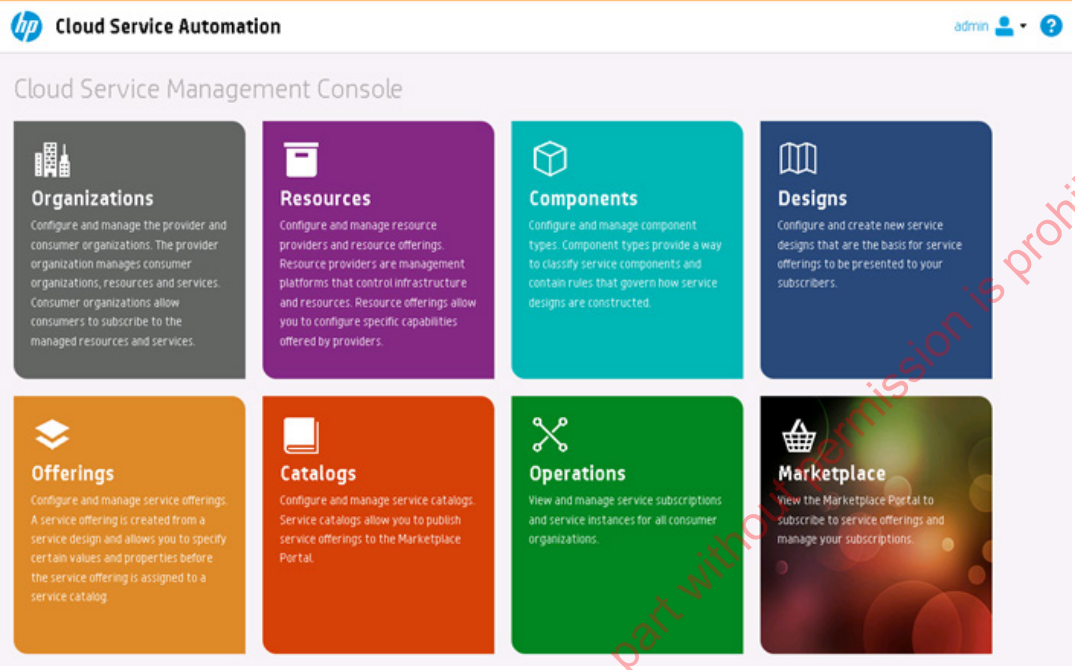
For customers who need a more comprehensive cloud solution, HP Helion CloudSystem Enterprise is a hybrid cloud platform designed to deliver advanced infrastructure services, as well as platform and application services. The Enterprise solution provides all the capabilities and value of Helion CloudSystem Foundation plus:

- Delivering advanced infrastructure and application services in minutes
- Enterprise-class lifecycle management for hybrid cloud services
- Service Marketplace, making it easy for consumers to request cloud services through Cloud Service Automation
- Drag-and-drop designer for rapidly defining new multi-tier cloud services
- Pre-defined service catalog entries for 200+ common applications
- Integrated capacity planning, disaster recovery, and consuming services from public clouds

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Helion CloudSystem Enterprise features



The Helion CloudSystem Enterprise package begins with Helion CloudSystem Foundation and ships standard with the HP Matrix Operating Environment (OE) and Cloud Maps.

The Enterprise Appliance includes HP Cloud Service Automation. There are two optional server automation options:

- Server Automation Virtual Appliance (S.A.V.A.) enables you to manage the entire lifecycle of servers including provisioning, patch management, software deployment and audit and compliance for configurations up to 3,000 operating system instances.
- Server Automation Enterprise with Database and Middleware Automation (DMA) for large-scale environments. DMA enables automation of time-consuming manual administrative tasks for lowered costs, improved efficiency, and scaling. Together, they support application and server provisioning and lifecycle management for up to tens of thousands of servers.

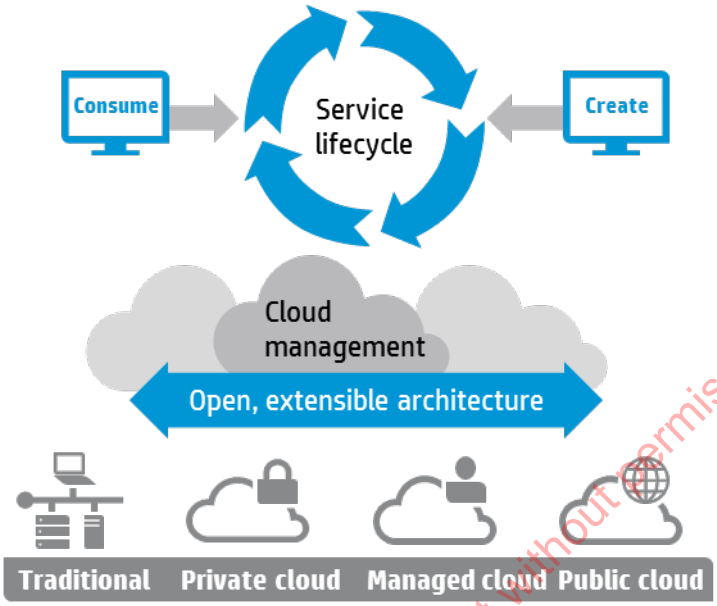
Note
Existing Helion CloudSystem Enterprise customers can upgrade directly to Helion CloudSystem Enterprise with Server Automation Enterprise and DMA.

Helion CloudSystem can also be implemented as a software-only solution using the existing infrastructure.

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HP Cloud Service Automation



HP Cloud Service Automation (CSA) software offers the industry's most automated cloud application lifecycle management, for customers who want to deploy a private cloud or a hybrid cloud.

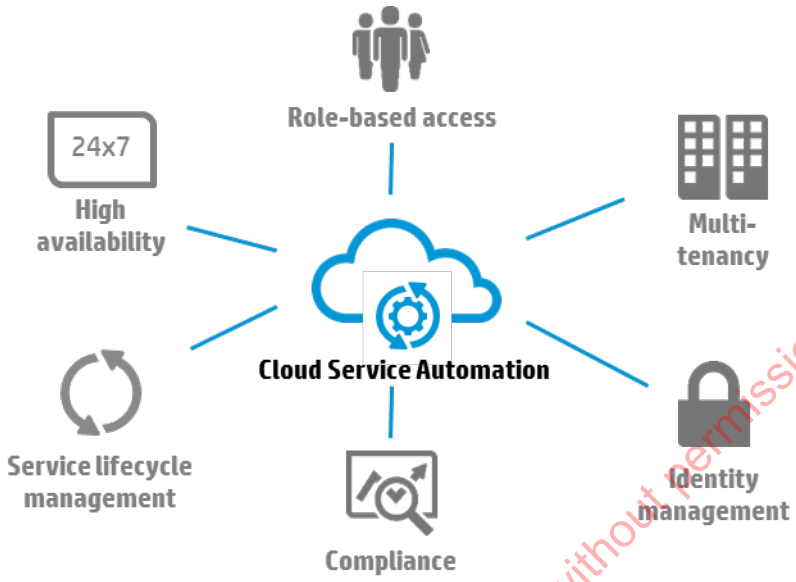
CSA has three primary feature sets:

- Highly automated service lifecycle management
  - Easy-to-use, self-service portal
  - Multi-tenant catalogs
  - Application services: software as a service (SaaS), platform as a service (PaaS), and infrastructure as a service (IaaS)
- Comprehensive, unified service management
  - High availability and security
  - Intelligent resource utilization, monitoring, and compliance
- Open, extensible architecture
  - Multi-hardware
  - Multi-hypervisor
  - Public cloud services
  - Out-of-the-box integration with HP products
  - Application programming interfaces (APIs) for third-party integration

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CSA features



CSA is based on industry-leading HP operations management software, providing a solid, proven solution that has been deployed in hundreds of companies around the world.

CSA core features consist of platform-level core capabilities such as self-service portal, service designer, and role-based access.

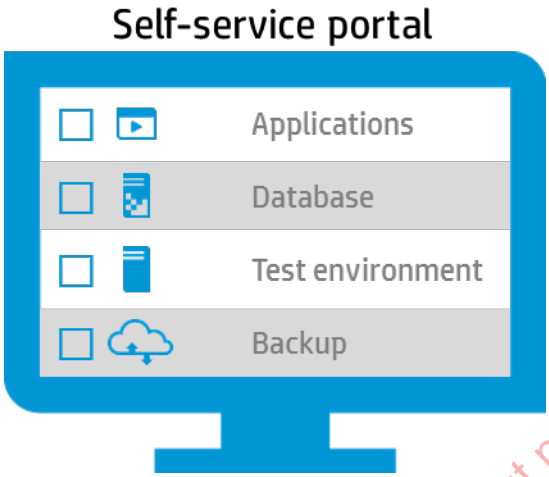
- **Modern user experience**—Use highly customizable Service Marketplace for ordering services and managing own service instances. Responsive, auto-adjusting UI fits perfectly on screens of different sizes and device types.
- **Advanced service modeling tools**—Build sophisticated services for the entire stack (IaaS, PaaS, SaaS) or simplified topology-based infrastructure services for HP Helion OpenStack.
- **Open, flexible, and extensible cloud**—Build a cloud that supports heterogeneous environments, hybrid delivery, and HP Helion OpenStack. Choose from a vast library of out-of-box integrations with other products to expand your solution.

CSA is a cloud platform that can meet customer needs today, as well as in the future. The platform is highly scalable, both from a capacity viewpoint and capability viewpoint. For example, you might initially want to provide IaaS services for development use, and then in the future provide PaaS or SaaS services to support a mission-critical application. In this scenario, the initial deployment would typically support a few hundred virtual machines (VMs) with a minimum amount of monitoring. In the future, you might be supporting thousands of VMs with end-to-end service level management in a secure environment. CSA allows you to increase the number of VMs and add more features over time.

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Three easy-to-use CSA interfaces



CSA provides three easy-to-use interfaces for infrastructure and application provisioning:

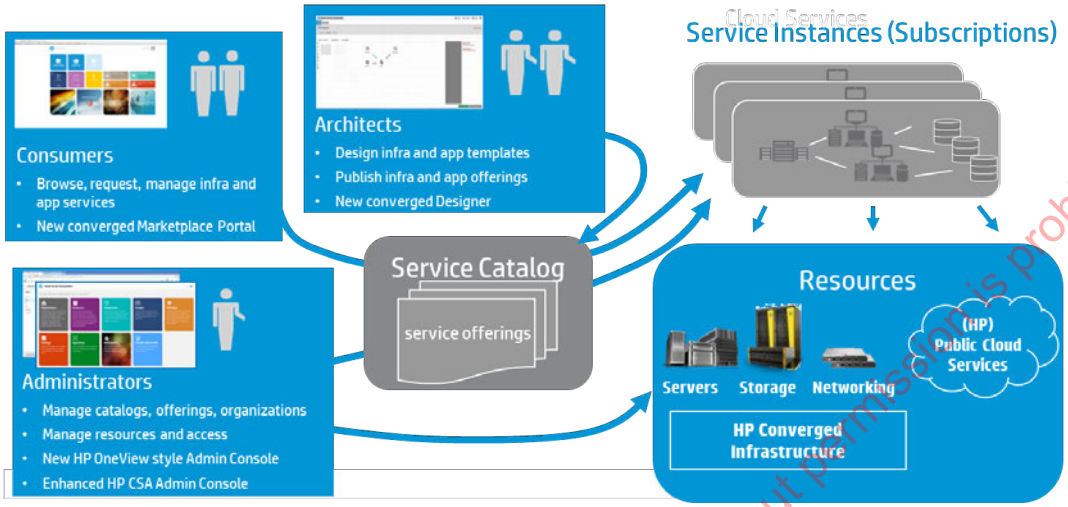
- A service design consoles that platform and application designers use to create cloud service offerings; these include the Topology and Sequenced Designers which are accessible via the Cloud Service Management Console's Design menu
- A service management console that a service business manager uses to make those offerings available through a customer catalog; this is the Cloud Service Management Console
- A self-service portal that customers use to browse the service catalog and order services. The self-service portal enables customers to improve their service offerings across multiple platforms and employ a highly automated lifecycle approach to delivering advanced cloud services. With its open, extensible architecture, the self-service portal can be customized with added capabilities such as end-to-end service level management, public cloud management, and security. This is the Marketplace Portal.

Together, these three interfaces form a complete management environment with the same tools employed across private cloud, public cloud, and traditional IT infrastructures, thus accelerating the creation of cloud services.

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Helion CloudSystem service catalog

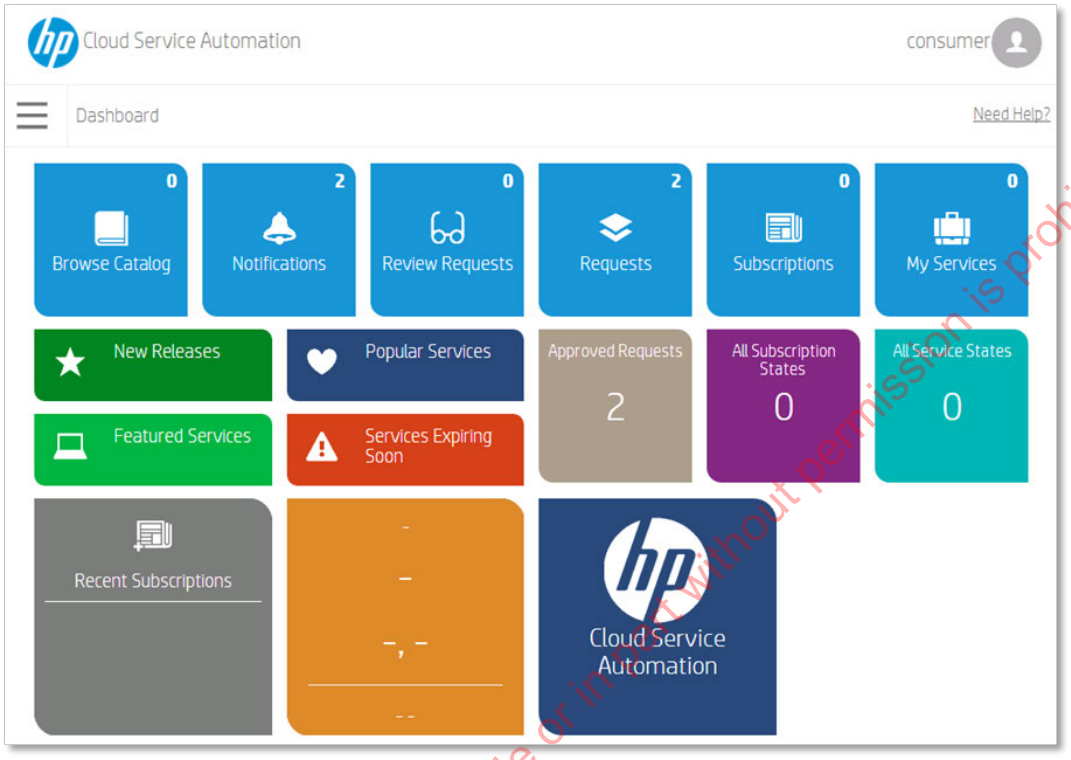


The Helion CloudSystem self-service portal has a built-in service catalog to unify all applications under IT control. The portal enables you to design, provision, and manage complex services to fast-track the development of a cloud service catalog with pre-defined templates for popular business applications.

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CSA Marketplace Portal



The CSA lifecycle framework, and its features for leveraging resources, help you map cloud fulfillment infrastructure into reusable automated resource offerings.

The CSA Marketplace Portal provides a customer interface for requesting new cloud services and for monitoring and managing existing services. Subscriptions are available at multiple price points, as defined by the subscription owner.

The Topology Designer and Sequential Designer are the HP CSA graphical service design and content portability tools. The designs created through both designers are presented as service offerings that Marketplace Portal users can select and provision.

Topology Designer is used to create infrastructure service designs. Topology Designer also supports HP Operations Orchestration (OO) callouts for pre- and post- compute node provisioning. Topology Designer uses OpenStack Oasis Topology and Orchestration Specification for Cloud Applications (TOSCA) for describing a service design.

Sequential Designer is used to create more complex application service designs.

CSA Service Designer enables service creation with a hierarchy of service components. Within a service component hierarchy, a service composite contains an infrastructure service, which includes a server group and a virtual network. A CSA service design describes service provisioning and a hierarchy of service components. You can develop service designs from prebuilt components and build service designs with supporting, underlying components.

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Module 6 review: Moving Forward on the Journey to the Cloud

Assessment question

1. Software as a Service (SaaS) applications should be implemented in which type of a cloud deployment model?
   a. Private cloud
   b. Managed cloud
   c. Public cloud
   d. Community cloud

Notes:

Assessment question

2. _____ is most useful in a what-if scenario, typically to compare one new system against another.
   a. ROI
   b. TCO
   c. CI-CM
   d. CI-MM

Notes:

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Assessment question

3. What are the stages that a customer environment needs to pass to be ready for cloud?

   1. _____

   2. _____

Notes:

_____

_____

_____

_____

_____

Assessment question

4. What do the following statements describe?

   - Provide template solutions for architecture for particular domains
   - Explain the components needed for various cloud implementations
   - Provide a common vocabulary with which to discuss them

   a. HP Cloud Maps
   b. HP ConvergedSystems
   c. HP reference architectures
   d. HP application templates for Helion

Notes:

_____

_____

_____

_____

_____

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Assessment question

5. A customer is looking for a ready-to-deploy cloud solution that features:
   - A workflow engine
   - Physical server provisioning for cloud services
   - Integration with HP OneView
   - Disaster recovery
   - Application provisioning and lifecycle management

Which HP solution meets these customer requirements?

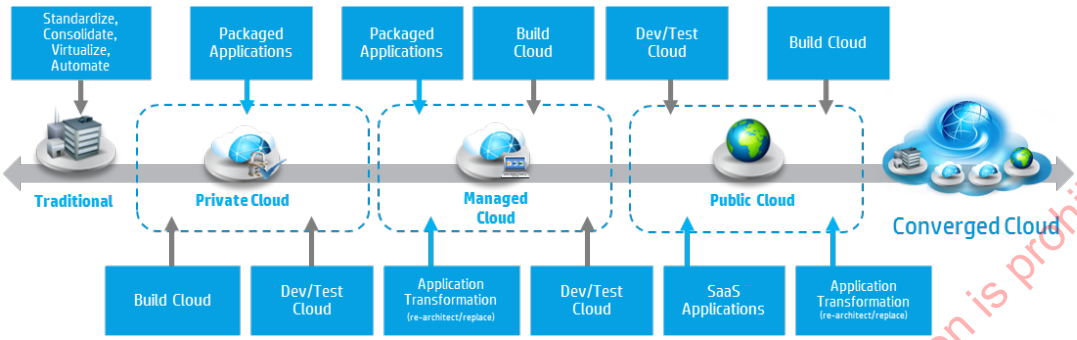
a. CloudSystem Matrix
b. Helion CloudSystem Enterprise
c. Helion CloudSystem Service Provider
d. Helion OpenStack

Notes:

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The pace of the journey



Customers evolve to the cloud at different speeds:

- Customers who are just starting to virtualize
- Customers who have already virtualized

Customers have different budgets, needs, and concerns:

- Capital expenses (CapEx)
- Operating expenses (OpEx)

Customer assessment tools

The first step in determining which path will be best for the customer is to assess the current and future states of their IT, and align their plans with business goals.

Customers might want to transform IT in order to react quickly to major positive or negative changes in the business environment, however they need to be able to reliably assess revenue gains and cost savings from proposed investments in new technologies and services (such as mobile applications, use of cloud services, and Big Data analytics).

HP has made significant investment along with partners to create accurate and customizable calculators for many HP server products. In addition, HP partners typically offer their own tools to create customer assessments.

HP provides tools to enable you to help customers with these assessments. HP financial calculators help you to engage intelligently with the customer, providing context and suggested values for intangibles and criteria the customer might not have considered. More people are involved in the IT purchase decisions than previously, requiring different proof points for solutions. HP calculators are used to further the conversation and discover the financial influencers and decision makers, not force the HP point of view.

- Total cost of ownership (TCO) and return on investment (ROI) calculators exist for many of the products across the HP portfolio.
- Where possible, you can provide insight from research companies.

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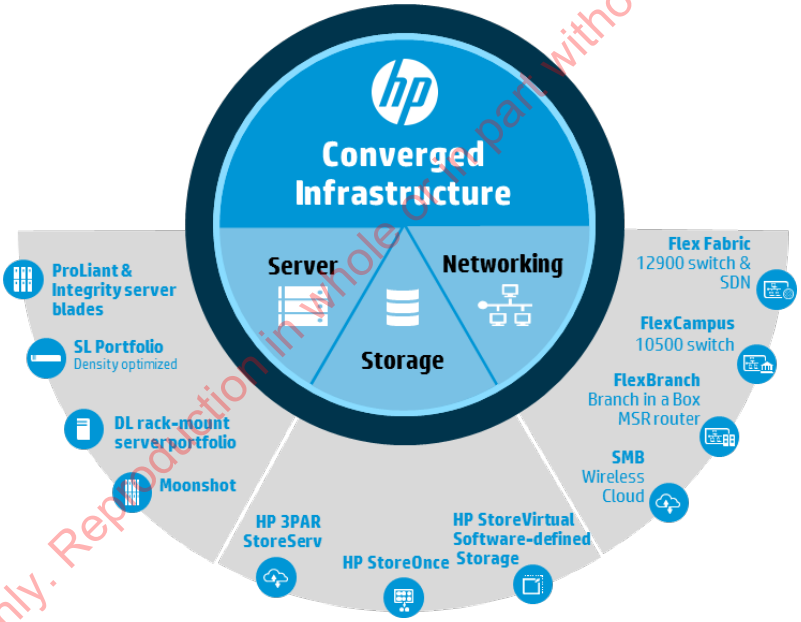
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- According to IDC, when customers are making an IT decision, the two most valued inputs from a vendor are:
  - Interaction with vendor's technical teams
  - Consumption of vendor content, particularly if that content contributes to a financial justification for an IT solution

Total cost of ownership (TCO) is the measurement of the total cost of an IT investment over its lifetime to the organization. It measures the costs to operate, manage, and maintain the entire infrastructure. TCO is most useful in a what-if scenario, typically to compare one new system against another.

Return on investment (ROI) is the ratio of gain or loss on an investment relative to the amount invested. It is the profitability of the investment, and is normally expressed as a percentage, over a fixed period. ROI is normally considered in a legacy migration/upgrade scenario.

Taking the step-by-step approach



An HP Converged Infrastructure comprises HP BladeSystem, HP Networking, HP 3PAR storage, and HP OneView, but if a customer wants to take a step-by-step approach, they can arrive at a Converged Infrastructure at their own pace, and still achieve the benefits of infrastructure convergence.

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Stages in the step-by-step approach

The stages in the step-by-step approach to move the current IT environment to infrastructure convergence are:

1. **Standardization and consolidation**—Helps to make the move away from compartmentalization, to increase the quality and speed of IT service delivery with lower cost of operations and more efficient management. This step could include moving to a small number of approved standard configurations that are based on industry standards, with reusable components, and implemented in a consistent fashion with consistent management tools. This results in a more standards-based, modular, and reusable infrastructure. Consolidation increases utilization of server assets.
2. **Virtualization and automation**

   Virtualization helps to make the move from physical server, storage, and networking environments to virtualizing the entire data center. Virtualization increases the quality of service and begins to make IT more responsive and align it with the needs of the business. This step includes server virtualization as well as:

   - I/O virtualization to deliver connection capacity and flexibility needed to accommodate the wide range of workloads and applications
   - Storage virtualization, not just within an array, but across the entire storage environment to scale up and out, and continually load balance performance and capacity
   - Network virtualization and the creation of VLANs with the goal of improving the network efficiency and increasing flexibility to quickly allocate required bandwidth

   Automation helps IT run as a service, fully aligning with the business requirements and enabling IT to run at the speed of business. The key elements of an automated IT infrastructure include:

   - A self-service portal, where users can quickly request and procure IT service
   - A service catalog of infrastructure deployment best practices
   - A resource pool that includes compute, storage, and networking resources
   - Automated infrastructure provisioning that delivers a service in minute, not months
   - Capacity planning and management tools to keep the resources and services healthy and optimized

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Blueprints to guide the step-by-step approach

For companies who want to develop their own converged infrastructures, HP has developed two kinds of blueprints to standardize the design and align it with best practices for quick deployment and maximum efficiency. These blueprints help customer customize their data centers

- **HP Cloud Maps for CloudSystem Matrix**—Pre-configured infrastructure-to-application service definitions that ensure the accurate deployment, configuration, and sizing of cloud services within the service catalog.
- **HP reference architectures**—Provides a template solution for an architecture for a particular domain. It also explains the components needed for various cloud implementations, and provides a common vocabulary with which to discuss them.

  HP reference architectures include:

  - Converged infrastructure Reference Architecture
  - Cloud Reference Architecture
  - Reference Architecture for Big Data

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Should customers choose Helion CloudSystem Foundation or Enterprise?

	Helion CloudSystem Foundation	Helion CloudSystem Enterprise
Supported hypervisors	✓Red Hat KVM and VMware	✓Red Hat KVM, VMware and through Matrix: Hyper-V , Integrity VMs
Workflow engine (embedded Operations Orchestration)	✓ Specific use cases with limited content packs	✓
Simple IaaS(VMs) request portal (Horizon)	✓	✓
Infrastructure service monitoring	✓	✓
APIs	✓ (incl. OpenStack APIs)	✓ (incl. OpenStack APIs and Matrix APIs)
Admin console	✓	✓
HP OneView (CI management)	✓ (optional)	✓ (optional)
Supported hypervisors	✓Red Hat KVM and VMware	✓Red Hat KVM, VMware and through Matrix: Hyper-V , Integrity VMs
App provisioning and lifecycle management		✓ (optional CS Enterprise Premium add-on package)
Disaster recovery		✓ (through Matrix)
Capacity analytics		✓ (through Matrix)
Designers (topology and sequential)		✓ (through embedded CSA)
Consumer portal: Marketplace Portal		✓ (through embedded CSA)
Using hybrid cloud resources		✓
Physical server provisioning for cloud services		✓ (through Matrix)

Customers who are new to cloud solutions and need simple VM provisioning should start with Helion CloudSystem Foundation. For customers with more advanced cloud requirements, including complex infrastructure and application provisioning, Helion CloudSystem Enterprise would be a better fit.

For existing customers who want to keep using their CloudSystem Matrix solution for complex infrastructure provisioning, data recovery, and analytics, Helion CloudSystem Enterprise is the best choice. For customers who want to maintain cloud services in CloudSystem Matrix, and explore and build new cloud services in new architecture, Helion CloudSystem Enterprise is the right way to go.

Note
CloudSystem Matrix versions supported in Helion CloudSystem 8 are 7.x, recommendation is 7.2 and 7.3.

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HP cloud offering comparison

This table compares private, managed, and public cloud offerings in terms of who operates the cloud, the funding model, and where the equipment is located, among other factors. Helion Virtual Private Cloud forms the foundation for global availability, communications, collaboration, and SaaS applications.

	Private cloud	Helion Managed Private Cloud	HP Helion Managed Virtual Private Cloud	Helion Public Cloud
Operated by	Customer	HP	HP	HP
CapEx/ OpEx	CapEx	CapEx or Lease	OpEx	OpEx
Facility site	Client location	Location options	Multiple HP options	HP selected locations
Elasticity	Client-funded elasticity	Client-funded elasticity	Base and hybrid cloud elasticity	Fully elastic
SLAs	Internal customer SLAs	Negotiated SLA contracts	Negotiated SLA contracts	Published SLA
Order type	Hardware and software purchase order	Hardware, software, and managed service purchase order	Managed service purchase order	Credit card Internet transaction or PO
Minimum unit	Product SKU	Product SKU + service commit charged monthly	Base commit charged monthly + daily usage	Hourly
Workloads				
Enterprise applications	✓	✓	✓	✓
New applications	✓	✓	✓	✓
Development and test	✓	✓	✓	✓
Hybrid target			✓	✓

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Module 7 review: Strengths of HP Converged Infrastructure and Cloud Solutions

Assessment question

1. Which competitive offering competes with HP ConvergedSystem for Virtualization?
   a. ExaLogic Elastic Cloud from Oracle
   b. PureApplication/PureData from IBM
   c. FlexPod Select from NetApp and Cisco
   d. vBlock from VCE

Notes:

Assessment question

2. HP Helion is an open, standard-based approach that spans private cloud, managed cloud, and public cloud, but does not support traditional IT.
   ☐ True
   ☐ False

Notes:

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Competitive landscape

Vendor/ Portfolio	Pre-Integrated Virtualization Appliance	Iaas/Cloud	Workload/Application Dedicated
HP/ ConvergedSystem	HP ConvergedSystem for Virtualization	HP Helion CloudSystem	HP ConvergedSystem for Microsoft Analytics Platform, Hosted Desktops, HP AppSystem for SAP HANA
VCE (EMC + Cisco)/ *Vblock*	vBlock	vBlock + VMware vCloud (or other)	Vblock Specialized Systems
NetApp + Cisco *FlexPod*	FlexPod Express/Datacenter	FlexPod + CIAC/UCS Director (or other)	FlexPod Select
IBM *PureSystems*	PureFlex System	PureFlex + IBM SmartCloud SW	PureApplication/PureData
Dell/ *Active Systems*	Active Systems	Active Systems + Dell Multi Cloud Mgr (Enstratius)	Active Solutions
EMC *VSPEX*	VSPEX	VSPEX for Private Cloud	VSPEX for Microsoft, Oracle, etc
Oracle *Engineered Systems*	Virtual Compute Appliance	ExaLogic Elastic Cloud	Exadata
	Converged Infrastructure (servers-storage-network, management + virtualized)	IaaS -> SDDC (private/hybrid cloud)	Dedicated/Vertically Integrated Big Data, Hadoop, SAP, Microsoft, etc.

In the competitive landscape, there are three broad categories.

- **Pre-integrated systems**—These are systems of servers, storage and network hardware that are integrated to provide shared infrastructure for virtualization. These are ordered as a complete system and usually pre-integrated at the factory or partner facility. This is the category that the HP ConvergedSystems for Virtualization resides in.
- **IaaS and cloud**—Systems that add software to enable IaaS or cloud services that build upon the converged system. The HP offering here is HP Helion CloudSystem.
- **Application/workload-specific systems**—Converged systems that are optimized for a specific workload like big data, SAP HANA, and hosted desktops. HP ConvergedSystems has new offerings here as well.

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HP Helion cloud solution value propositions



The HP approach to cloud solution design aims to eliminate the fragmented, siloed environment that can grow out of the traditional approach, where different management and security tools are required for each of the deployment models (traditional IT and private, managed, and public cloud). HP Helion is integrated by design for business and governments. It delivers three fundamental value propositions:

- **Choice**—HP Helion is an open, standard-based approach that spans not only private cloud, managed cloud, and public cloud, but also brings traditional IT into the mix. This is an important point because HP understands that for many customers, traditional IT will be a critical part of their operating environment for many years. Helion supports multiple hypervisors, operating systems, development environments, and third-party infrastructure.

  HP has a long history of working with a wide spectrum of business partners, from independent software vendors (ISVs) to service providers to distributers to value added resellers (VARs) to system integrators to outsourcing providers. Helion embraces this extensible partner ecosystem.

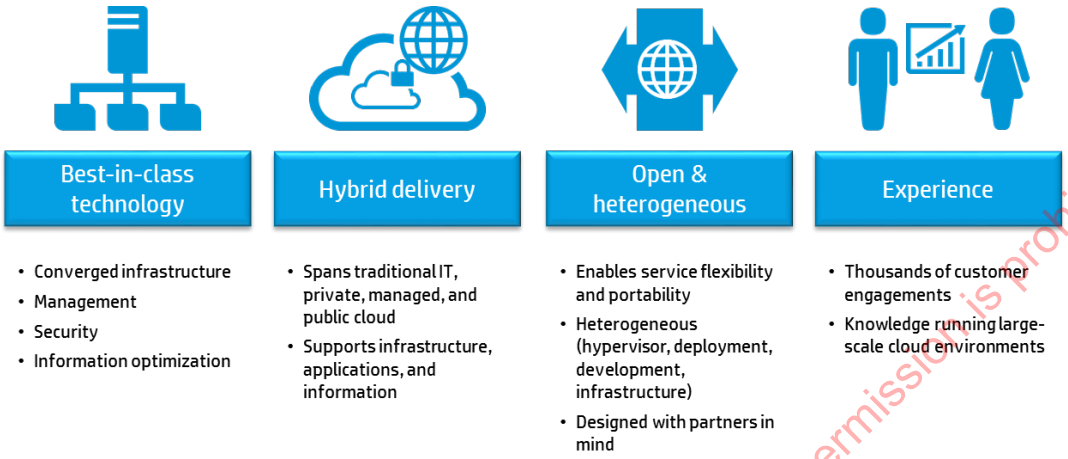
- **Confidence**—Management and security are major concerns for many customers, and Helion instills confidence by delivering management and security solutions that span not only the traditional IT and private, managed, and public cloud deployment models, but also information, applications, and infrastructure.

- **Consistency**—Helion is built on a single common architecture across all delivery models, which enables portability across models. Helion CloudSystem is integrated by design with one consistent strategy, for a single consumption experience.

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HP unique differentiators



HP has the industry's most complete portfolio with best-in-class technology and integrated solutions. HP believes that to be successful in cloud computing, vendors need to deliver integrated systems that offer several key characteristics:

- Support for traditional IT, private, public, and hybrid cloud environments
- The ability to include a broad range of business applications, all leading hypervisors, and multiple operating systems
- Unified delivery and control of services across both cloud and traditional IT environments
- Automated lifecycle management of applications and infrastructure
- End-to-end security
- Scalability to meet unpredictable business demands

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Open and heterogeneous

HP Helion is based on open standards and supports multivendor, heterogeneous software and hardware. Helion CloudSystem is the choice for organizations of any size that want to deploy a cloud environment with the most open architecture and the richest set of cloud enablement software among cloud vendors in the market today. Support for heterogeneous resources and multiple hypervisors provides customers with choice today and the flexibility of deployment options going forward. Helion CloudSystem provides the fastest road to the cloud.

Compute capabilities at the core of cloud services can be built on a wide range of server types and vendors. The combination of server types and vendors present in a customer environment is important to understand because it can have a critical impact on which software or combination of software products to position.

The Helion portfolio of cloud products and services creates an open ecosystem with a common management structure, and it integrates easily into existing infrastructures through a wide range of delivery models, providing an open, secure, and agile environment that becomes the very fabric of an enterprise.

HP Helion OpenStack Community does not mix proprietary or non-OpenStack tools and it is one of the first OpenStack distributions based on Icehouse release.

Note
To download HP OpenStack for free, under an open source license with optional paid support contract, scan this QR code or right-click it and open the hyperlink:

The HP cloud architecture is built with partners in mind, allowing HP to leverage an already thriving partner ecosystem and deliver the broadest set of solutions in the industry. Close-to-trunk releases of HP Helion OpenStack Community will supply customer environments with the latest capabilities of OpenStack technology.

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What's in this module for you?

After completing this module, you should be able to:

- Describe OpenStack and its core technologies
- Use OpenStack terminology correctly
- Draw and discuss the OpenStack conceptual and functional architecture Explain how HP is involved with OpenStack and how it contributes to OpenStack projects

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OpenStack overview

What is OpenStack?





OpenStack is a nonprofit foundation comprising a growing number of industry leaders with the expressed purpose of developing, testing, and documenting the software required to produce and maintain massively scalable public and private infrastructure as a service (IaaS) clouds.

Open Source Cloud Computing platform software is designed to produce and maintain a massively scalable public and private IaaS cloud on standard hardware. It is free open source (Apache license) software governed by a nonprofit foundation called the *OpenStack Foundation*.

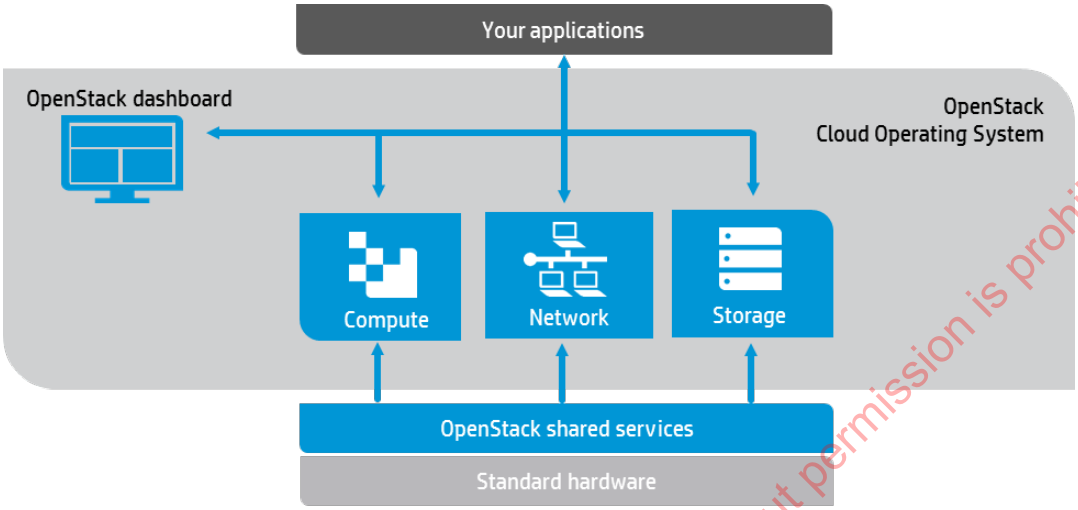
OpenStack began as a project jointly launched by NASA and Rackspace. The initial code was provided from the NASA Nebula platform and the Rackspace Cloud Files platform. Ongoing, significant code contributions continue to be received from several industry leaders, including HP.

INTERNET For more information on OpenStack, scan this QR code or right-click it and open the hyperlink:

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OpenStack technology



OpenStack is a cloud operating system that controls large pools of compute, storage, and networking resources throughout a data center. It is all managed through a dashboard that gives administrators control while empowering their users to provision resources through a web interface. OpenStack is architected to provide flexibility as you design your cloud, with no proprietary hardware or software requirements and the ability to integrate with legacy systems and third-party technologies. It is designed to manage and automate pools of compute resources and can work with widely available virtualization technologies, as well as bare metal and high-performance computing (HPC) configurations.

- **Compute**—Administrators often deploy OpenStack Compute using one of multiple supported hypervisors in a virtualized environment. Linux KVM and Citrix XenServer are popular choices for hypervisor technology and recommended for most use cases. Linux container technology such as LXC is also supported for scenarios where users want to minimize virtualization overhead and achieve greater efficiency and performance. In addition to different hypervisors, OpenStack supports ARM and alternative hardware architectures.
- **Storage**—In addition to traditional enterprise-class storage technology, many organizations have a variety of storage needs with varying performance and price requirements. OpenStack supports object storage and block storage, with many deployment options for each, depending on the use case. Object storage is ideal for cost-effective, scale-out storage. It provides a fully distributed, API-accessible storage platform that can be integrated directly into applications or used for backup, archiving and data retention. Block storage allows block devices to be exposed and connected to compute instances for expanded storage, better performance and integration with enterprise storage platforms.

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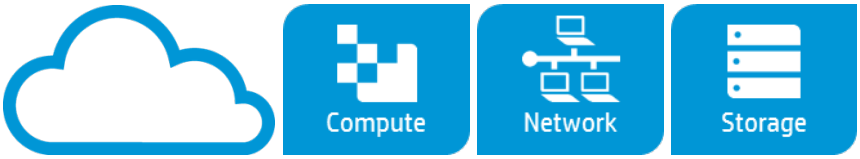
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- **Network**—Today's data center networks contain more devices than ever before— including servers, network equipment, storage systems and security appliances—many of which are further divided into virtual machines and virtual networks. The number of IP addresses, routing configurations and security rules can quickly grow into the millions. Traditional network management techniques fall short of providing a truly scalable, automated approach to managing these next-generation networks. At the same time, users expect more control and flexibility with quicker provisioning. OpenStack Networking is a pluggable, scalable and API-driven system for managing networks and IP addresses. Like other aspects of the cloud operating system, it can be used by administrators and users to increase the value of existing datacenter assets. OpenStack Networking ensures the network will not be the bottleneck or limiting factor in a cloud deployment and gives users real self service, even over their network configurations.
- **Dashboard**—The OpenStack dashboard gives administrators and users a graphical interface to access, provision and automate cloud-based resources. The extensible design makes it easy to plug in and expose third party products and services, such as billing, monitoring, and additional management tools. The dashboard is also brandable for service providers and other commercial vendors who want to make use of it. The dashboard is just one way to interact with OpenStack resources. Developers can automate access or build tools to manage their resources using the native OpenStack API or the EC2 compatibility API.

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OpenStack features

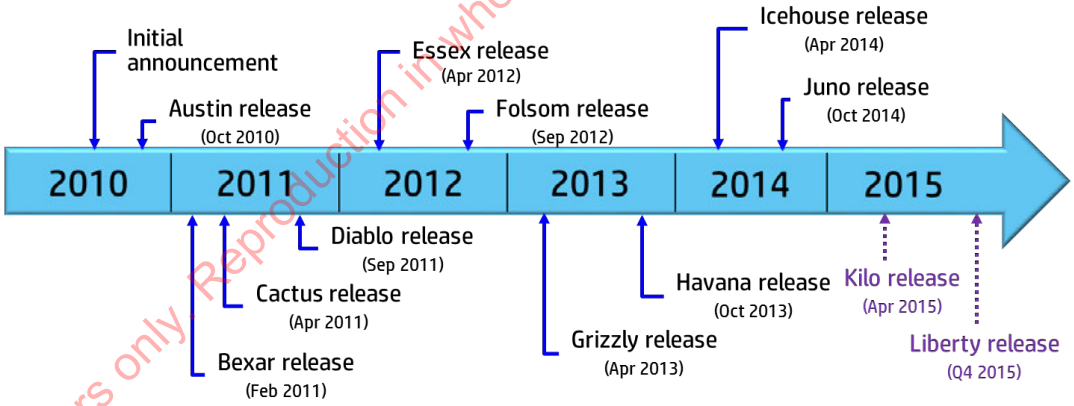


OpenStack's mission is to produce an Open Source Cloud Computing platform that will meet the needs of public and private clouds regardless of size, by being simple to implement and massively scalable.

OpenStack is:

- Massively scalable cloud operating system that controls large pools of compute, storage, and networking resources
- Community open source with contributions from more than 2,000 developers and more than 180 participating organizations
- Open web-based API programmatic IaaS
- Modular and plug-in based architecture, allowing different hypervisors, block storage systems, network implementations, hardware, and so forth
- Fastest growing and rapidly adopted Open Source project

OpenStack release history



OpenStack began as the Nebula project, which was the initial Nova code at NASA in 2009. Rackspace contributed the Swift (object storage) code to a joint effort in 2010. OpenStack Foundation was founded from the joint project with more than 25 contributors in mid-2010. The Austin release of OpenStack was released three months after OpenStack was formed.

The release schedule is currently set at six-month intervals, with the releases shown in the preceding graphic.

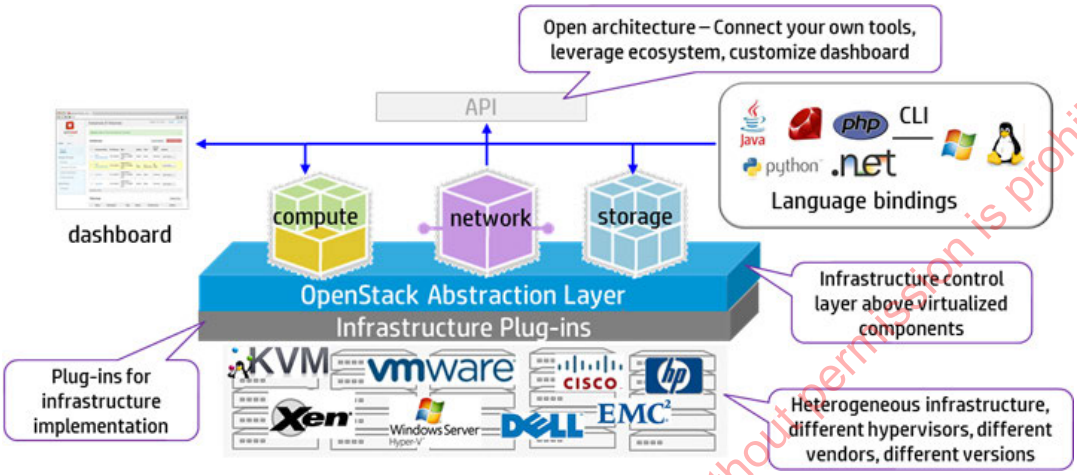
Note
OpenStack releases are scheduled every six months and named alphabetically.

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OpenStack architecture

OpenStack high-level architecture



The compute, network, and storage figures in the preceding graphic represent the major components of OpenStack. The graphic shows how storage, networking, and hypervisors from various vendors can be incorporated into OpenStack through the OpenStack abstraction layer.

Several infrastructure plug-ins for that abstraction layer already exist for some of the more common services, and the OpenStack APIs enable you to easily develop plug-ins for the growing number of cloud components to be integrated with OpenStack.

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OpenStack projects (Havana release)

As of the Havana release, OpenStack comprises several projects. Nova is the initial project, developed by NASA, for deploying cloud compute solutions. When combined with Swift from Rackspace, it was the initial release of OpenStack.

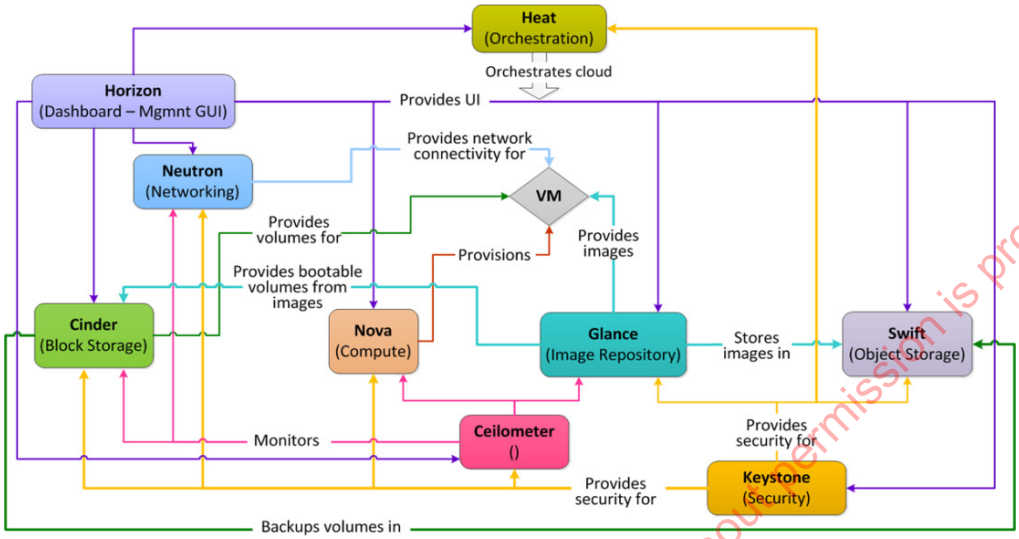
From the beginning, it was apparent that Nova was becoming extremely complex. It provided several major functions that could be better managed as separate services, so in subsequent releases these separate services became separate projects, known as:

- **Keystone (security)**—For authentication and authorization for all OpenStack services
- **Horizon (dashboard)**—A web-based user interface for most of the OpenStack services where users can perform most cloud operations
- **Neutron (networking)**—The networking between the hardware components of OpenStack
- **Cinder (block storage)**—Persistent block storage for guest virtual machines (VMs)
- **Ceilometer (metering)**—Metering of the various aspects of OpenStack deployments
- **Heat (orchestration)**—A template-based orchestration solution for provisioning the resources required to deploy a cloud
- **Nova (compute)**—Virtual servers upon demand
- **Swift (object storage)**—Object (file) storage that is API accessible and referenced using a URL
- **Glance (image repository)**—A catalog and repository for virtual disk images

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OpenStack conceptual architecture



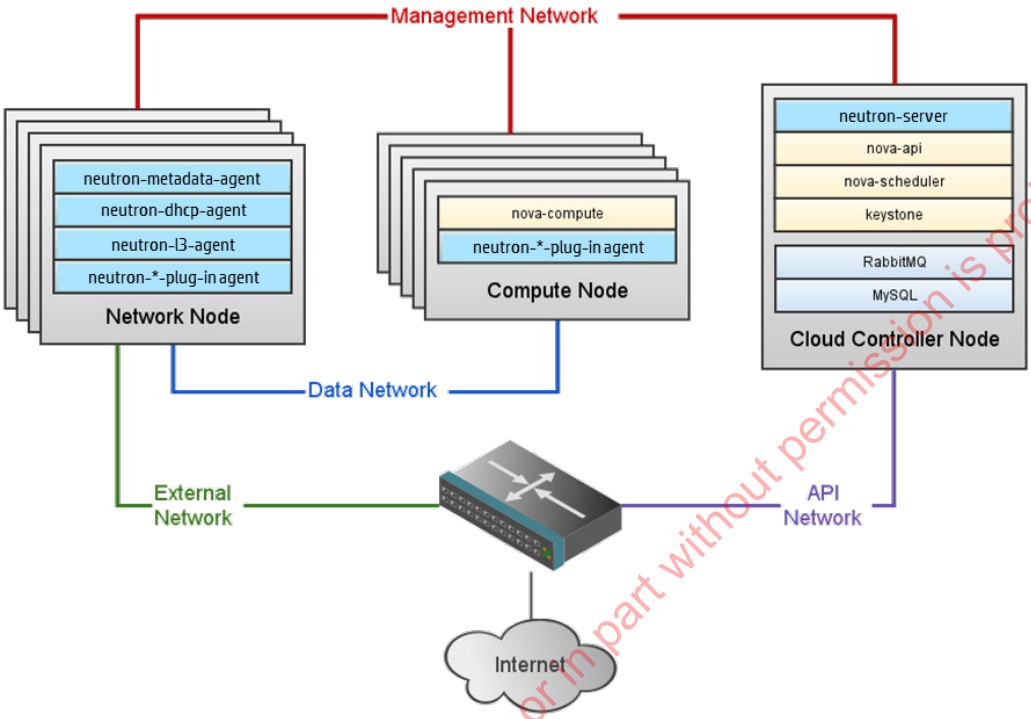
The preceding conceptual architecture graphic shows how the primary core components of OpenStack are interconnected.

- **Swift** provides object storage. It allows you to store or retrieve files (but not mount directories like a file server). Several companies provide commercial storage services based on Swift, including KT, Rackspace, and Internap. Swift is also used internally at many large companies to store data.
- **Glance** provides a catalog and repository for virtual disk images. These disk images are mostly commonly used in OpenStack Compute. Although this service is technically optional, any cloud of size will require it.
- **Nova** provides virtual servers upon demand. Rackspace and HP provide commercial compute services built on Nova, and it is used internally at companies such as Mercado Libre and NASA (where it originated).
- **Horizon** provides a modular, web-based user interface for perform most cloud operations, such as launching an instance, assigning IP addresses, and setting access controls.
- **Keystone** provides authentication and authorization for all OpenStack services. It also provides a service catalog of services within a particular OpenStack cloud.
- **Neutron** provides "network connectivity as a service" between interface devices managed by other OpenStack services (most likely Nova). The service works by allowing users to create their own networks and then attach interfaces to them. OpenStack Network has a pluggable architecture to support many popular networking vendors and technologies.
- **Cinder** provides persistent block storage to guest VMs.
- **Ceilometer** provides metering of the aspects of OpenStack deployments.
- **Heat** is a template-based orchestration solution for provisioning the resources required to deploy a cloud.

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Basic OpenStack physical components



The preceding graphic shows a sample three-node configuration with the basic components of an OpenStack installation. All basic components can exist on the same device or horizontally distributed, with multiple networks, compute, and controller nodes.

OpenStack is designed to be massively horizontally scalable, which allows all services to be distributed widely. However, to better conceptualize the primary functional components of OpenStack, the diagram and much of the available OpenStack literature commonly groups OpenStack into three primary functional components:

- **Cloud controller**—A functional unit that provides the OpenStack Nova, Keystone, Glance, Cinder, Swift, and Dashboard services and hosting of the databases and message queue services
- **Network node**—Generally provides the virtual bridging, DHCP server, virtual routing services, and plug-in agents for the associated network hardware
- **Compute node**—Provides the hypervisor, communicates with the cloud controller node, and uses the Neutron plug-in agent to communicate with the network node

Note
The HP CloudSystem architecture introduces a Neutron plug-in encapsulated in a separate Software Defined Networking (SDN) node.

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There are four types of functional networks:

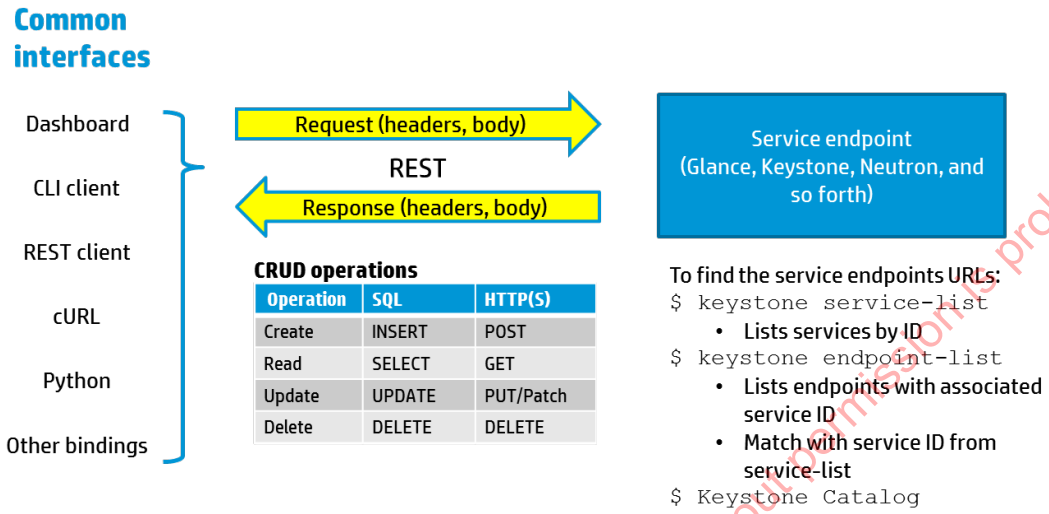
- **Management network**—Provides communications between and to the OpenStack services
- **API network**—Supports the standard CRUD operations
- **Data network**—Provides the data stream between the network nodes and the compute nodes.
- **External network**—Provides external user access to the OpenStack cloud services

All of these functional components can exist on a single server or they can be distributed throughout the cloud across multiple servers.

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OpenStack API interfaces



As shown in the preceding graphic, OpenStack supports several API interfaces through which requests can be made to and responses received from service endpoints, such as Glance, Keystone, and Neutron. The interfaces include:

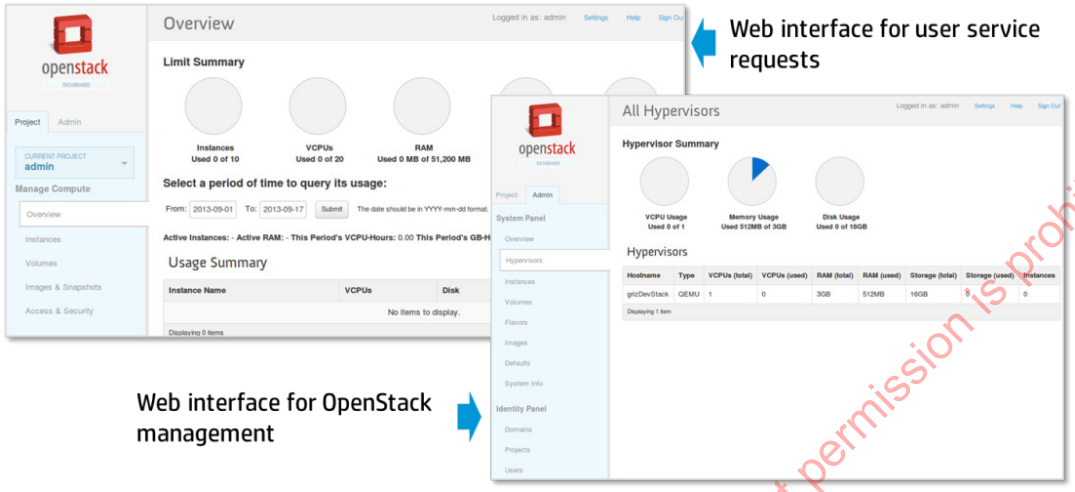
- Horizon
- Command line interface (CLI) client
- Representational State Transfer (REST) client
- cURL
- Python code
- Other applications, such as database workbenches

The OpenStack API supports the standard Create, Read, Update, and Delete (CRUD) operations, which are from an HTTPS perspective known as Post, Get, Put, and Delete.

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OpenStack Horizon (dashboard) UI



There are several ways to interface with OpenStack. One of the easiest is through Horizon, the OpenStack web-based management GUI.

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OpenStack CLI client



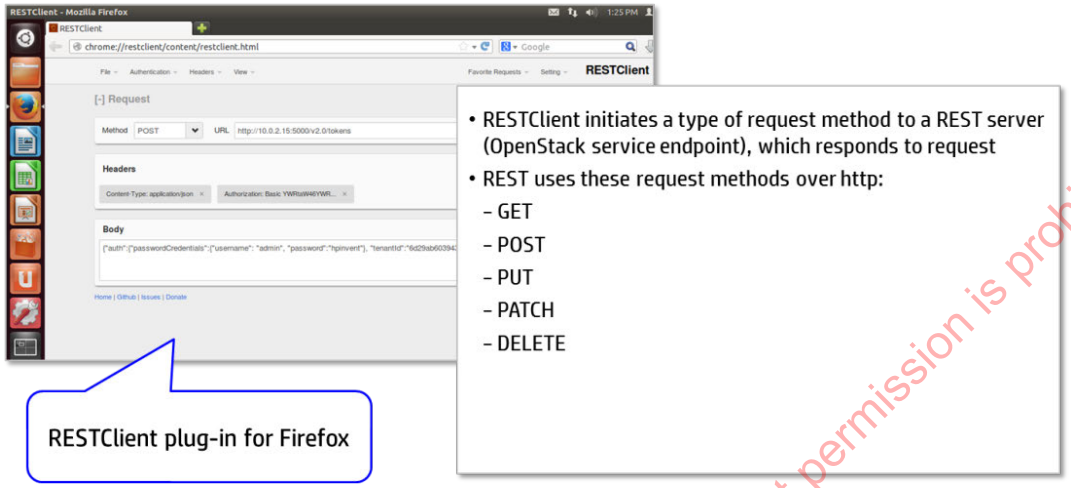
Another common method for accessing and using OpenStack is through the OpenStack CLI client. Commands are executed from a terminal session command line.

OpenStack has an extensive help system that you can access by entering an OpenStack service name followed by the word `help`, which displays the syntax for the available commands and any associated arguments. The preceding screenshot shows the output of the Keystone `help` command.

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RESTClient



RESTClient is a useful utility that allows you to construct and send custom HTTP requests to an OpenStack endpoint service API.

- **Client/server**—A uniform interface separates clients from servers.
- **Separation of concern**—Clients are not concerned with data storage, which remains internal to each server, so the portability of client code is improved. Servers are not concerned with the user interface or user state, so servers can be simpler and more scalable. Servers and clients can be replaced and developed independently, if the interface between them is not altered.
- **Stateless**—The client/server communication is further constrained by no client context being stored on the server between requests. Each request from any client contains all of the information necessary to service the request, and session state is held in the client. Important to note is that the session state can be transferred by the server to another service such as a database to maintain a persistent state for a period of time and allow authentication.
- **Cacheable**—As on the World Wide Web, clients can cache responses. Responses must therefore, implicitly or explicitly, define themselves as cacheable, or not, to prevent clients from reusing stale or inappropriate data in response to further requests. Well-managed caching partially or completely eliminates some client/server interactions, further improving scalability and performance.

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- **Code on demand (optional)**—Servers can temporarily extend or customize the functionality of a client by the transfer of executable code. Examples of this might include compiled components such as Java applets and client-side scripts such as JavaScript. "Code on demand" is the only optional constraint of the REST architecture.
- **Uniform interface**—The uniform interface between clients and servers simplifies and decouples the architecture, which enables each part to evolve independently.

> **Note**
> These REST constraint details were extracted and modified from: Fielding, Roy T.; Taylor, Richard N. (2002-05), "Principled Design of the Modern Web Architecture" (PDF), ACM Transactions on Internet Technology (TOIT) (New York: Association for Computing Machinery) ISSN 1533-5399

Applications conforming to these REST constraints are called *RESTful*. If a service violates any of the required constraints, it cannot be considered RESTful.

Complying with these constraints, and thus conforming to the REST architectural style, enables any kind of distributed hypermedia system with desirable emergent properties, such as performance, scalability, simplicity, modifiability, visibility, portability, and reliability.

OpenStack users, tenants, and roles

There are three types of Keystone objects:

- **User** is someone or something that can gain access through Keystone. Users have credentials that can be checked like passwords or API keys.
- **Tenant** represents what is called the project in Nova, meaning something that aggregates the number of resources in each service. For example, a tenant can have some machines in Nova, a number of images in Swift/Glance, and a few networks in Neutron. Users are bound to a tenant by assigning them a role on that tenant.
- **Role** represents the number of privileges or rights a user has or actions they are allowed to perform. For example, a user who has an admin role can take admin actions like view all tenants. Users can be added to any role either globally or in a tenant. In the first case, the user gains access implied by the role to the resources in all tenants; in the second case, user access is limited to resources of the corresponding tenant. For example, the user can be an operator of all tenants and an admin of his own playground.

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Common Nova terminology

Term	Description
Server (instance)	A virtual machine (VM) or bare metal system onto which an OS can be installed.
Flavor	An available hardware configuration for a server. Each flavor specifies a combination of disk space, memory capacity and priority for CPU time.
Image	A collection of files used to create or rebuild a server. Operators provide a number of pre-built OS images by default.
Reboot	• With *soft* reboot, the operating system is signaled to restart, which allows for a graceful shutdown of all processes. • *Hard* reboot simply restarts the system.
Rebuild	Removes all data on the server and replaces it with the specified image. The server ID and IP addresses remain the same.
Resize	Converts an existing server to a different flavor.

Some of the more common Nova terms used in the documentation as well as in the lab guide are listed the preceding table.

- **Server**—A system that is being deployed within OpenStack and generally referred to as an *instance*.
- **Flavor**—A resource template that specifies disk space, base memory, and CPU priority time requirements. It is specified during the creation on an instance so OpenStack knows which resources to provide to the instance. A default set of flavors is included in a standard setup, but like most parameters in OpenStack, additional flavors can be created.
- **Reboot**—OpenStack supports both a soft and hardware reboot of the server. In a soft reboot, the operating system is signaled to restart, which allows for graceful shutdown of all processes. A hard reboot simply restarts the system.
- **Rebuild**—A process that removes all data on the server and replaces it with the specified image. The server ID and the IP addresses remain the same for the rebuilt instance.
- **Resize**—A feature of Nova that allows you to convert the flavor of an existing server to a different flavor.

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Learning check

1. List and describe the types of functional networks between the OpenStack network, compute, and cloud controller nodes.

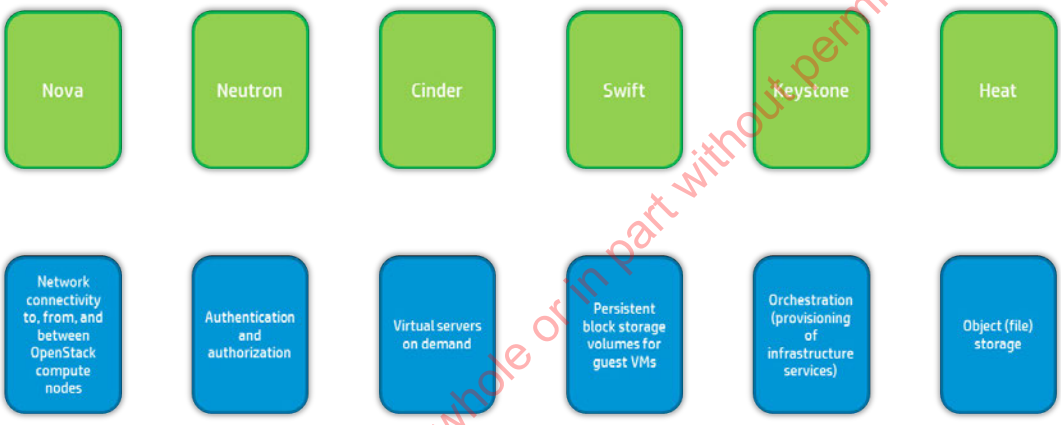
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2. Match the OpenStack project card with its corresponding definition card.



3. Which OpenStack component provides the Nova, Keystone, Glance, Cinder, Swift, and Dashboard services?
   a. Network node
   b. Compute node
   c. Cloud controller
   d. Management network

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HP is a leading contributor to OpenStack projects

HP is the leading contributor to the OpenStack project, with this level of participation and recognitions:

- Platinum membership
  - Platinum member of OpenStack Foundation
  - Two board members
  - Elected Technical Committee representation
  - Committee membership (Legal Affairs Committee, Incubation Committee, Election Committee, Compensation Committee, Training Committee, and DefCore Committee)
- Top community contributor
  - Second largest employee contributor overall for Icehouse (112 employees contributed) and largest employee contributor overall for Havana (100 employees contributed)
  - Top contributor (second-largest contributor to Icehouse; second-largest contributor to Havana; fourth-largest to Grizzly [by number of contributions/commits])
  - HP employs four project technical leads of the official OpenStack projects (Horizon, TripleO, Ironic, Trove)
  - Five of the top 20 reviewers across the OpenStack project in Havana were from HP, including Clark Boylan, who was the top code reviewer
  - HP employs 22 core reviewers across 11 official projects (core reviewers determine what code contributions are included in each project)
  - Leadership through presentations and blueprints

Note
Statistics are based on gitdm data script as of Icehouse release.

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- Leading hybrid cloud offerings
  - HP named “Leader” in Forrester Wave for Private Cloud Solutions (November 2013) which is built on OpenStack
  - HP runs one of the largest OpenStack public cloud infrastructure in the world (behind Amazon and Rackspace)
  - CloudHarmony ranked the performance of an HP Cloud Compute server 70% better than a similarly configured Amazon server

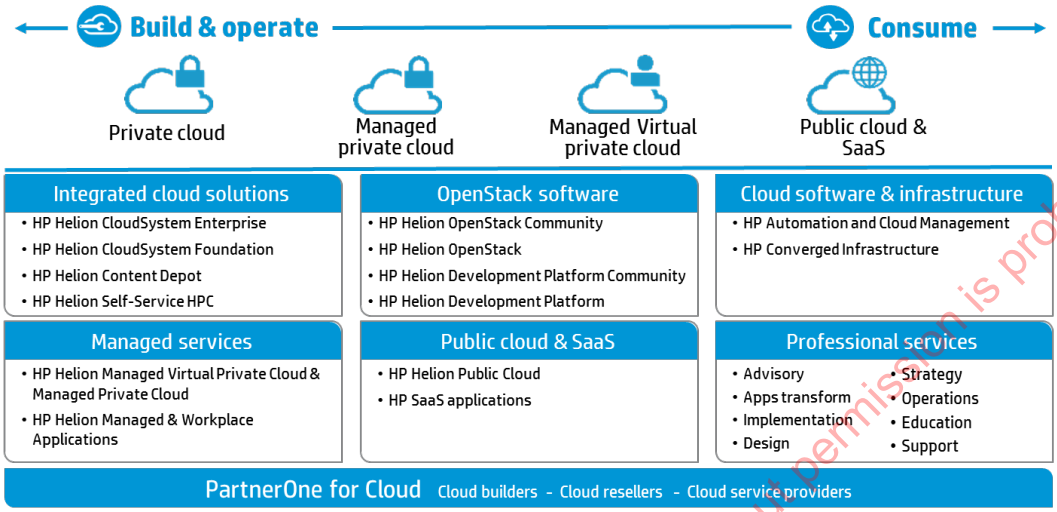
INTERNET To read the ranking, visit http://cloudharmony.com/benchmarks and select **Performance Benchmarks→Summary Benchmarks (New)→Summary Server Performance→Amazon EC2 –eu-west [5→m1.medium (1)→HP Cloud Compute – region-a.geo-1[4]→standard.medium (1)→Bar Chart & Sortable Table→Get Benchmark Results**

- Dedicated staff
  - Leader and provider of the majority of staff for HP Converged Infrastructure project (continuous integration and automation)
  - Only group, outside the Foundation, with full-time staff dedicated to infrastructure
  - Provided hardware for TripleO continuous deployment environment
  - Contributing resources (servers, DC, power, bandwidth, employees), including Public Cloud accounts that run the majority of the build nodes in OpenStack's elastic build farm

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HP Helion



HP Helion is a portfolio of products and services that make it easier for you to build, manage, and consume workloads in a hybrid IT environment. It brings together all the benefits and agility of cloud computing, all the possibilities and interoperability of open source, and all the security and reliability enterprises need to move forward with confidence.

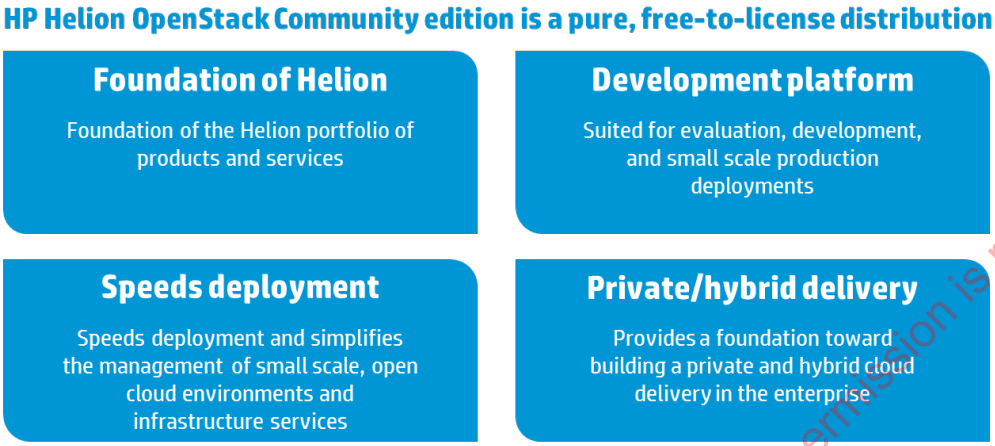
The HP Helion portfolio includes products, software, and services that span HP. The portfolio includes HP CloudSystem 8, Cloud Service Automation (CSA) software for managing hybrid IT environments, HP Public Cloud, HP Managed Enterprise Services (including VPC, private cloud, and managed cloud application services), and a range of professional services. With this broad portfolio of products, solutions, and services, from both HP and HP partners, HP can help organizations deploy a private cloud, managed private cloud, or managed virtual private cloud, and use public and software as a service (SaaS) services:

- All HP solutions are based on a common technology, OpenStack, making it easier to deploy, manage, and operate cloud applications.
- Helion is open and secure and enables organizations to be more agile.
- Helion is based on open standards and built on open source to deliver fast innovation. Openness enables organizations to move, integrate, and deliver applications across IT environments without fear of proprietary systems or lock in.
- All products and services provide the visibility, control, and governance needed across a hybrid IT environment.
- HP provides the fastest time to business outcome through the best economics across all delivery models and solutions. IT and business can respond to the latest market challenges and use technology as a strategic advantage. Customers can pay as they go for as much or as little as they need.

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HP Helion OpenStack Community edition



HP Helion OpenStack Community edition is the industry's first OpenStack free-to-license distribution designed for hybrid cloud and business. Helion OpenStack Community edition:

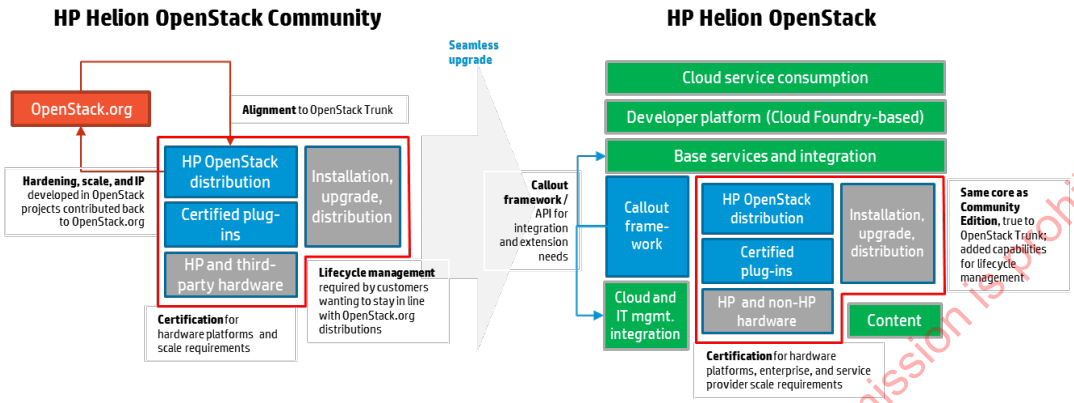
- Is the foundation of the Helion portfolio of products and services
- Provides a platform for building a private and hybrid cloud delivery in the enterprise
- Is ideally suited for evaluation, development, and small scale production deployments
- Speeds up deployment and simplifies the management of small scale, open cloud environments and infrastructure services

INTERNET For further information about HP Helion OpenStack Community edition, scan this QR code or right-click it and open the hyperlink:

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HP Helion and OpenStack



HP Helion value-added contributions specific to OpenStack includes:

- **Security**—Hardening and security testing of the releases.
- **Integrated high availability and scalability support**—Cloud failover across all infrastructure services, such as Nova, Cinder, controller services, scale-out reference architecture, software defined large-scale network segmentation via VXLAN overlay networks and block storage scale-out.
- **Added lifecycle management capabilities**—Configuration, compatibility, and inventory management in support for installation, setup tasks, and upgradeability of releases.
- **Cloud orchestration and automation**—Multi-tier infrastructure service design and orchestration capabilities, leveraging other standards-based initiatives aligned to OpenStack, such as the use of OASIS Topology and Orchestration Specification for Cloud Applications (TOSCA) with OpenStack Heat).
- **Hybrid cloud support**—Integrated VPN functionality to connect network fabrics, resource pool extension across cloud providers, hybrid provisioning, and optional CSA integration support.
- **Specific IHV and ISV plug-ins**—Certified hardware and infrastructure technologies used in OpenStack deployment (for example, HP Moonshot), these are plug-ins for specific hardware platforms or virtualization technology and are built to the plug-in architecture and APIs defined in OpenStack.
- **Indemnification**—HP offers indemnification for Helion OpenStack Community edition customers, subject to basic eligibility requirements, including execution of an indemnification agreement with HP and a current support contract in place with HP. The HP indemnification program has no monetary cap and covers third-party patent, copyright, and trade secret infringement claims directed to OpenStack code alone or in combination with Linux code, whether asserted against direct customers of HP or an authorized HP reseller.

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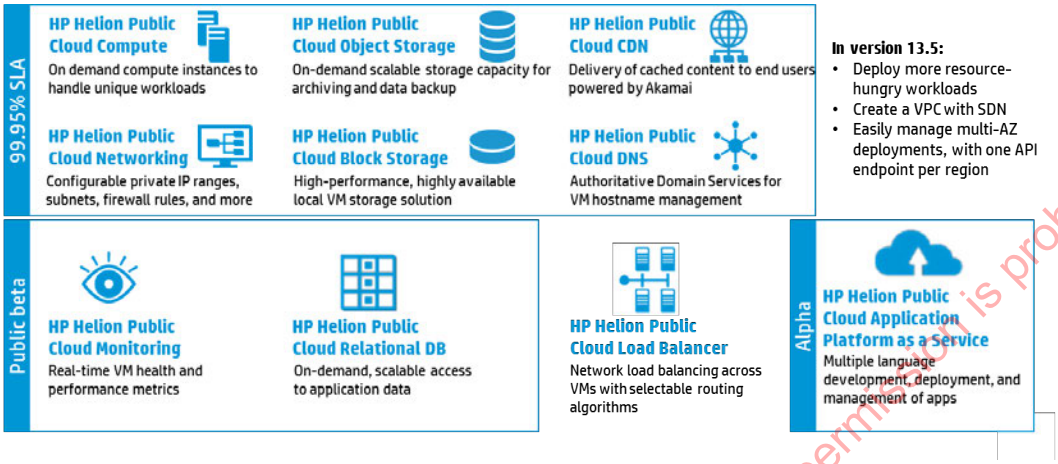
HP value-added technology specific to the base services and integration includes:

- **Call out framework**—For integration to external cloud and IT management needs of enterprise and service providers, such as compliance and audit needs, or billing integration for chargeback
- **Extension services**—Functionality required to support use cases in enterprise and service provider deployments, such as a meta data service (being contributed back to the community, openstack.org) for tagging of cloud assets and entities, template repository services for model based provisioning
- **Base services**—Infrastructure extensions as a service, such as DNS as a service, load balancing as a services (these are being developed with the community and new projects and blueprint submissions for contributions back to openstack.org)

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HP Helion Public Cloud portfolio



HP Helion Public Cloud is a transparent, enterprise-grade public cloud based on OpenStack technology.

It includes:

- HP Helion Public Cloud Compute
- HP Helion Public Cloud Object Storage
- HP Helion Public Cloud Block Storage
- HP Helion Public Cloud CDN
- HP Cloud Relational Database for MySQL
- HP Cloud Application Platform as a Service
- HP Cloud Load Balancer
- HP Cloud DNS
- HP Cloud Monitoring

Note
For more information about each of these cloud services from the HP Helion Public Cloud, scan this QR code or right-click it and open the hyperlink:

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Learner activity

1. In your own words, describe and differentiate between:
   - Cloud object storage
   - Cloud block storage

   Use the Internet if needed to prepare your answers.

2. Access the HP Helion Public Cloud website at http://www.hpcloud.com. Then, using the information available on this site, answer these questions:
   a. What does *CDN* stand for and what is its use/purpose?

   b. How does HP charge for this service?

3. What is the naming pattern for OpenStack releases?

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Summary

OpenStack is a nonprofit foundation comprising a growing number of industry leaders with the expressed purpose of developing, testing, and documenting the software required to produce and maintain massively scalable public and private infrastructure as a service (IaaS) clouds.

Storage, networking, and hypervisors from various vendors can be incorporated into OpenStack through the OpenStack abstraction layer. OpenStack APIs enable you to develop plug-ins easily for the growing number of cloud components to be integrated with OpenStack.

OpenStack comprises several interconnected projects, including Nova, Horizon, and Neutron, among others. OpenStack is designed to be massively horizontally scalable, which allows all services to be distributed widely.

HP is the leading contributor to the OpenStack project, and offers a portfolio of cloud products, solutions, and services to help you deploy a private cloud, managed private cloud, or managed virtual private cloud, and use public and SaaS services. All HP solutions are based on OpenStack, which makes it easier for you to deploy, manage, and operate cloud applications.

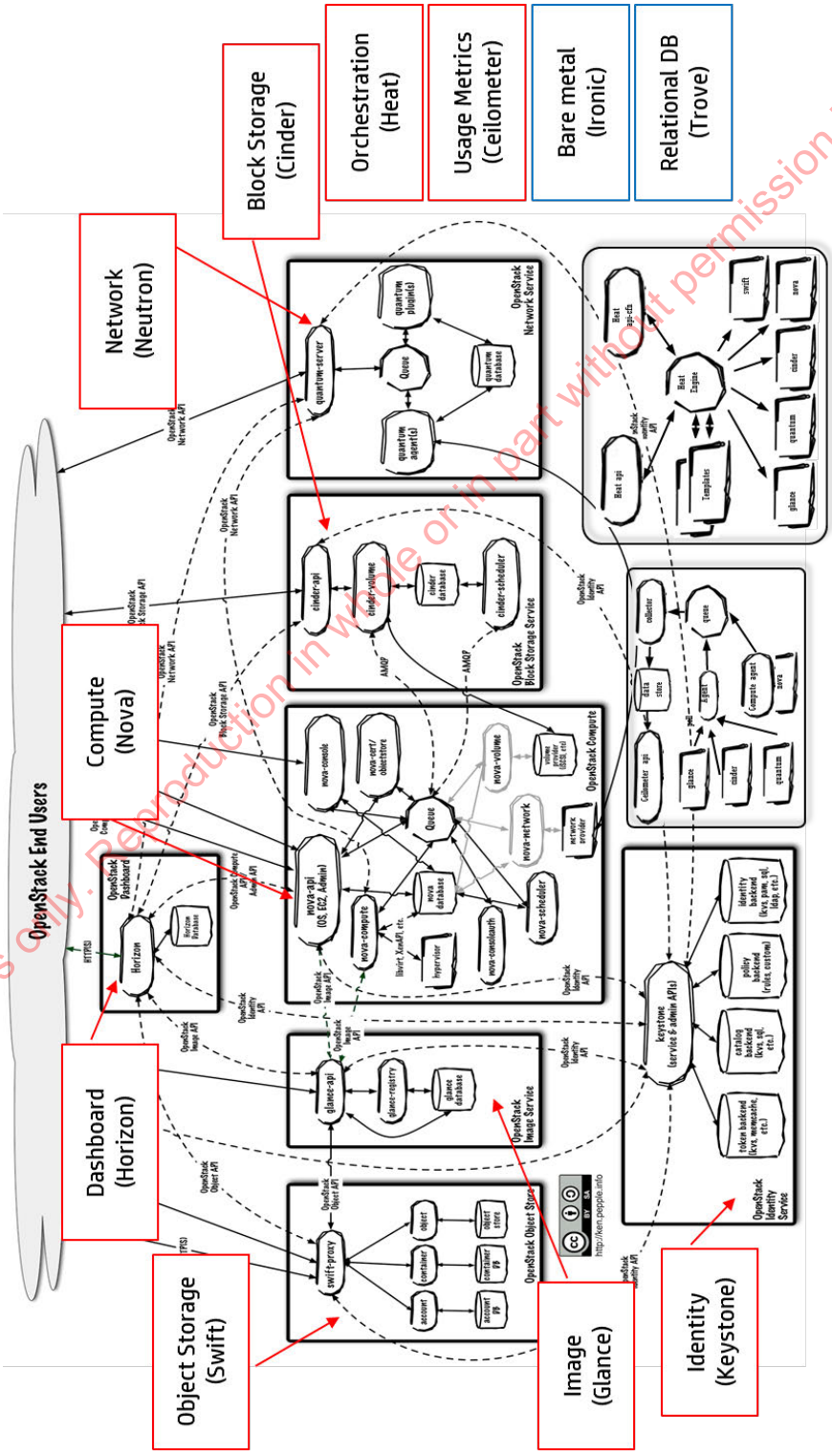
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Additional information

OpenStack programs

- 13 integrated programs; two supporting programs (Ironic and Trove)
- 13 packages with 200+ configuration items



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HP Helion OpenStack 1.1 and HP Helion Development Platform 1.1

HP Helion platform software consists of two offerings:

- HP Helion OpenStack (Open Source IaaS)
- HP Helion Development Platform (Open Source PaaS)

On March 2, 2015, HP announced version 1.1 of these software offerings. For the press release, scan this QR code or right-click it and open the hyperlink:

Note
This announcement is also included in the appendix of your student guide.

For what's new in HP Helion OpenStack and Development Platform in 1.1, scan this QR code or right-click it and open the hyperlink:

Furthermore, you can watch these recorded webinars, both accessible on the Learning Center. These self-paced courses are part of the Cloud learning plans, and by completing them, you will also receive a credit for completing the respective learning plan entry.

- HP Helion OpenStack v1.1 – What is New – 24 February 2015
  - Course ID: 00987028
  - Duration: 1 hour
  - Description: Come learn about the new features and updates being introduced as part of our second product release of HP Helion OpenStack under the version of 1.1. The main theme for this minor release is stability.
  - URL (scan the QR code or right-click it and open the hyperlink):

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- HP Helion OpenStack v1.1 and Development Platform Sales Training – 17 Feb 2015
  - Course ID: 00984447
  - Duration: 1 hour
  - Description: Come learn about the new features and updates being introduced as part of our second product release of HP Helion OpenStack under the version of 1.1. The main theme for this minor release is stability.

    HP Development Platform—refresh your understanding of the HP Helion Development Platform and the relationship with HP Helion OpenStack. Understand why this product matters to customers and learn about new features for version 1.1.
  - URL (scan the QR code or right-click it and open the hyperlink):



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HP Reference Architectures

Module 3

What's in this module for you?

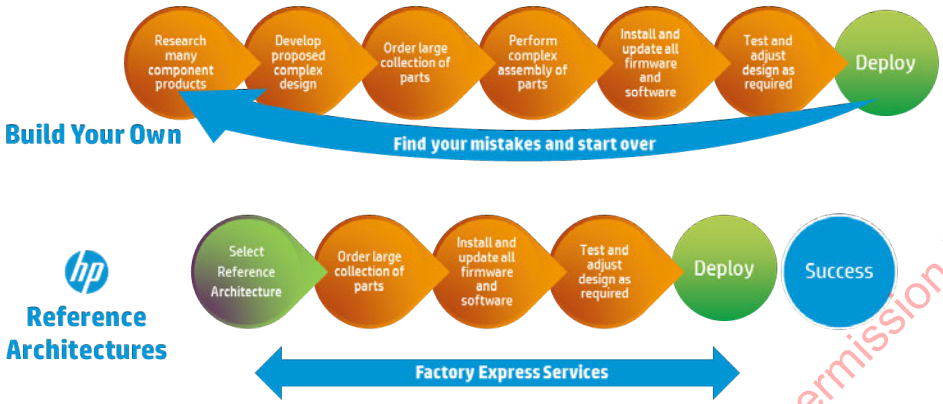
After completing this module, you should be able to:

- Define what an HP reference architecture is and describe the function it provides
- Explain how HP client virtualization reference architectures simplify the complexities inherent in client virtualization
- Describe the Hadoop reference architectures and list their benefits
- Explain how to visit the HP ActiveAnswers website to find HP reference architectures

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HP reference architectures



HP works to profile and understand many common IT solutions from a performance, scalability, and applicability perspective. The results are “blueprints” that detail specific configurations and deliver operational characteristics defined as reference architectures.

Reference architectures are documents or templates that outline a concrete infrastructure configuration specifically designed for integration that details the required infrastructure components and method of assembly. They explain how to build a complete system based on leading modular, standards-based technologies designed for convergence, but includes a fair amount of flexibility in the configuration.

HP provides a comprehensive set of reference architectures that allow customers to design infrastructure and applications solutions—all built on HP Converged Infrastructure. Two of these reference architectures, which are complete bundles of solutions, products, and services produced by HP, are ConvergedSystem and Helion CloudSystem.

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The HP set of reference architectures for a Converged Infrastructure includes IT building blocks that are assembled to address key enterprise workloads. HP Converged Infrastructure architectures can be deployed as follows:

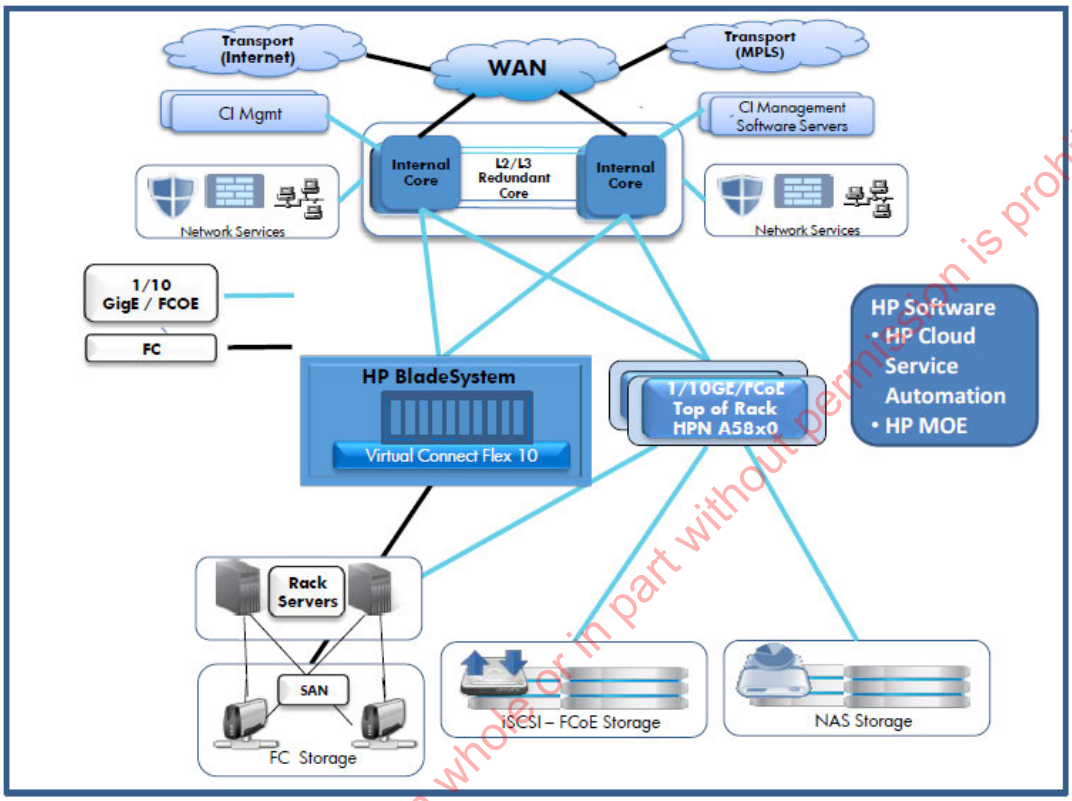
1. Start from existing investments, whether from HP or others.
2. Extend those investments with standards-based components and building blocks from HP that are designed to support management from a single console.
3. Pool those resources for allocation as needed, when needed, adjusting to business requirements.
4. Converge the infrastructure while maintaining priorities. HP works with major vendors to verify that their applications, operating systems, and virtualization products can be managed and optimized.

HP Converged Infrastructure relies on a common set of components, associated with a comprehensive set of service definition, deployment, and management tools. Infrastructure components can be deployed, and redeployed, to meet business needs. These common components can be used in part or in whole, to create a platform on which to build IT solutions. These components provide a “core” for solution deployments and enhance the maturity and agility level of the entire IT environment.

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HP Converged Infrastructure Reference Architecture building blocks



Converged Infrastructure functional components in actual solution architecture

The building blocks of a reference architecture provide a common approach to implementing solutions based on HP Converged Infrastructure. Sizing and other IT objectives must be considered for context, and the particular solution architecture adapted to meet IT needs.

These building blocks include:

- **HP FlexFabric**—A technology layer in the HP Converged Infrastructure, this open architecture uses industry standards to provide high performance, secure, multiprotocol connectivity to storage and server resources using a single network fabric and wire-once simplicity. FlexFabric combines intelligence at the server edge with an advanced orchestration and management layer to enable virtualization-aware networking, predictable performance, and rapid, secure, business-driven provisioning of data center to avoid problems of latency and network contention.
- **HP Matrix Operating Environment** (HP Matrix OE; for solutions shipped before availability of HP OneView and HP Helion CloudSystem 8) or **HP OneView** (for current solutions)—the common and unified converged infrastructure management software.

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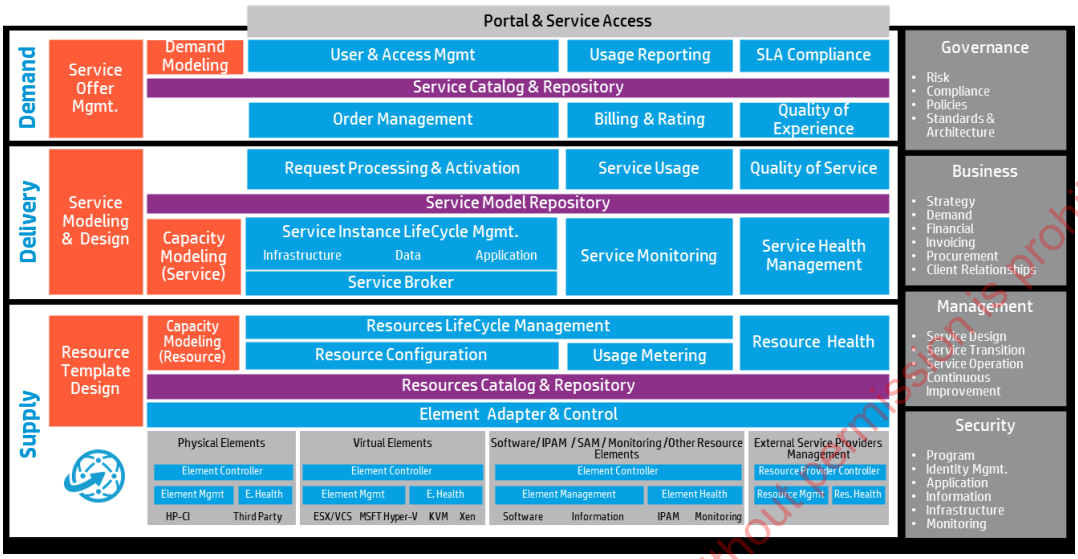
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- **Virtual resource pools**—A common modular infrastructure enables the creation of shared capacity that can be combined, divided, and repurposed to match application demand more effectively. Using HP Converged Infrastructure, IT organizations can support business users through a common pool of virtualized resources that can are configured quickly for different needs, such as core business, shared services, mission critical, cloud, and high-performance computing (HPC) applications. HP virtual resource pools leverage the innovative capabilities of servers, storage, mission-critical systems, and scale-out technologies across the HP ProLiant, Integrity, Integrity NonStop, and Storage portfolios. The resources can be provisioned to support third-party virtualization environments such as VMware and Microsoft, as well as HP solutions such as HP Integrity Virtual Machines (VMs).
  - **Servers**—Pools of servers (typically in BladeSystem enclosures with ProLiant or Integrity server blades) are maintained with HP Virtual Connect, providing an IO abstraction for connectivity to networking and storage.
  - **Storage**—Disparate heterogeneous storage resources based on HP or other third-party disk arrays can be combined into seamless scalable pools of storage through the use of storage virtualization technologies from HP. Flexible storage access mechanisms can be used to connect to the storage including traditional Fibre Channel, iSCSI, Fibre Channel over Ethernet, and Serial Attached SCSI (SAS).
  - **Network**—A traditional hierarchical data center network built on heterogeneous network switches and routers are used to connect the application instantiations within the infrastructure resource pools to the WAN backbone. Technologies such as HP Networking intelligent resilient framework (IRF) enable network backbone resources and capacity to be dynamically scaled by grouping switches together.
- **HP Data Center Smart Grid**—A data center is a highly complex ecosystem filled with IT hardware and racks, connected by miles of wires and cables, with complex relationships between hardware and software. It intersects with another complex system, the data center facility itself, which delivers power, cooling and floor space for IT. For reliability and availability, both infrastructure and the facility are usually over-provisioned. A fixed energy and cooling buffer is usually allotted to make sure that critical peaks of IT usage do not result in IT meltdowns. Power and cooling is fixed, usually supplying a constant amount to IT, regardless of the data center status or workload.

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HP Cloud Functional Reference Architecture



The HP Cloud Functional Reference Architecture is the conceptual model or framework for addressing organizational and technical changes required to progress along the journey to cloud. It is different from the other HP reference architectures, which consist of specific hardware components that are integrated and tested.

The HP Cloud Functional Reference Architecture defines the many functions required to manage a cloud and how these functions work together.

The preceding graphic introduces key concepts using a governance and management plane (labeled *Governance, Business, Management, and Security*) and a cloud operations plane (containing the demand, delivery and supply layers).

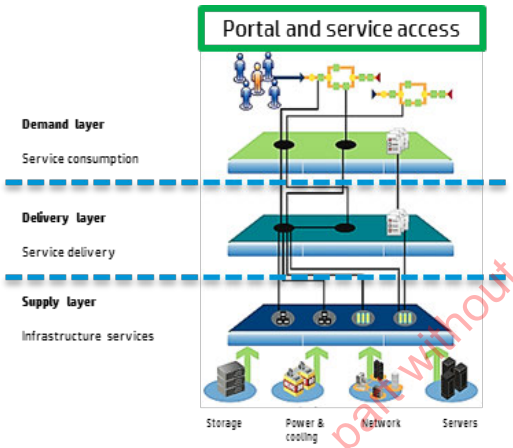
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HP Cloud Functional Reference Architecture functional blocks

Drilling a little deeper into the HP Cloud Functional Reference Architecture exposes functional blocks describing the functionality that exists in each of the three cloud-specific layers of the architecture.

Cloud operations plane



Portal and service access

The cloud operations plane of the Cloud Functional Reference Architecture defines the way users gain access to services, which is known as *portal and service access*.

The portal provides role-based access mechanisms and interfaces (GUIs) to access functions delivered through the cloud environment. It supports the needs of different types of users, and provides web access from different client access devices (for example, PC, tablet, and smart phones).

The portal gives users role-based access to the administration and control of the services. It also provides access to all relevant functions concerning the cloud services, regardless of whether they are delivered through the cloud operations or the governance and management plane.

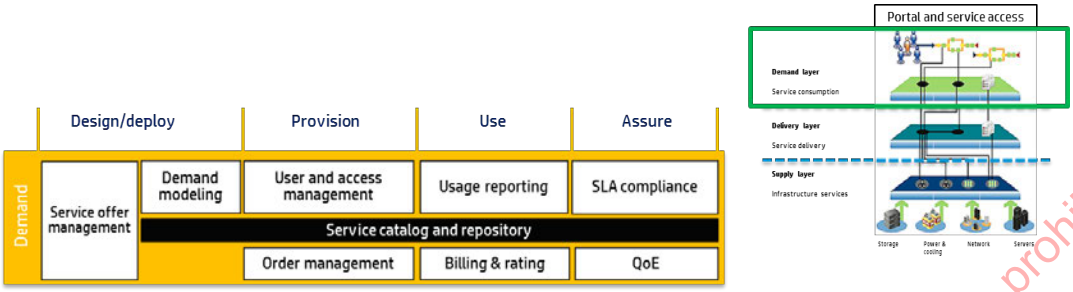
Services can also be accessed using application programming interfaces (APIs). APIs provide programmatic access to the cloud functionality from another cloud service or from any other source for functions, including:

- Authentication and authorization of requests
- Automatic provisioning and de-provisioning of services
- Usage of the provisioned functionality
- Reporting

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Demand layer



Demand layer

The demand layer contains the self-service portals and is where services are ordered and monitored by users or subscribers. The demand layer manages all interaction with users—either physical (through the portal) or programmatic (through APIs). This layer is responsible for:

- Maintaining a catalog describing the services that are available for users for ordering and consuming
- Authenticating users to determine their capabilities in creating or modifying services
- Providing role-based access to the service catalog, depending on credentials
- Initiating requests to create and modify services
- Presenting both internal services (provided by the delivery layer) and external (aggregated) services
- Providing service billing and settlement information
- Monitoring customer quality of experience and compliance with service level agreements (SLAs)

Functions provided by each block include:

- **Service offer management**—Supports the introduction of new services, modification of existing services, and retirement of services from the services presently active in the service catalog. Service offer management helps cloud providers develop service offers from one or more services elements. It can deal with directly implemented (through the delivery layer) service elements as well as service elements supplied by external service providers (through aggregation). Service offer management defines all aspects of the service as it relates to the user, including SLA terms, pricing, and regional availability.
- **Demand modeling**—Defines models for the expected demand of new and existing service offers. Together with service capacity modeling (delivery layer), it predicts when demand will exceed current supply. It also provides links to external enterprise functions such as capacity planning, financial modeling, and procurement.

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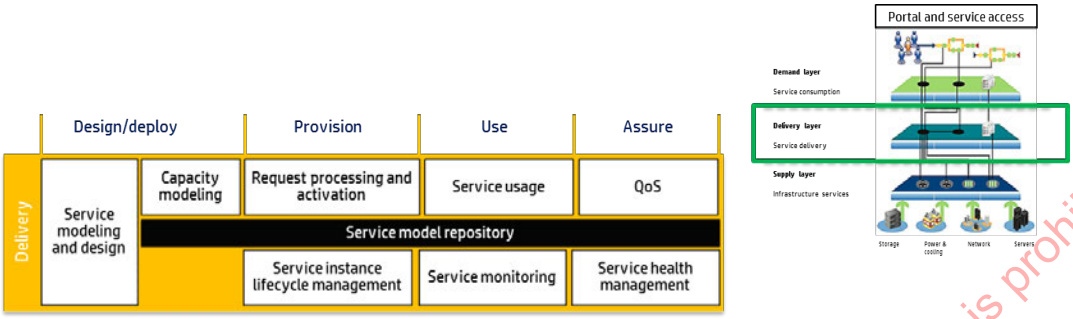
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- **User and access management**—Performs user authentication and authorization. It uses the identity management functions supplied by the security function in the governance and management plane, which enables the use of a single enterprise directory service for traditional IT and the cloud environment.
- **Order management**—Receives orders placed in the portal or through an API. It validates that the order is correct and adheres to policy (including entitlement). Based on the service catalog, the order is divided into its service elements. Order management then determines which services are provided directly (through the delivery layer) and which are provided by external suppliers (through aggregation). Then the service request is directed to the delivery layer or to external suppliers. Status is provided and remediation is initiated in case of failure. Order management uses the service catalog to determine what services can be offered and which services a customer has ordered.
- **Usage reporting**—Monitors and logs user activity and, in case of events such as breaches of security, notifies the user. Usage reporting also translates internal usage data to customer/consumer usage data.
- **Billing and rating**—Combines consumer/customer service usage information with the associated price of the service. It can present rated usage information to an external billing system (through the Business function in the governance and management plane). It supports several billing models including chargeback, pre-paid, postpaid, trial, and pay-per-use. Mechanisms are provided for disabling access when funds run out or charges exceed limits set by policy.
- **SLA compliance**—Is responsible for aggregating and reporting the SLAs between the service provider and the customers/consumers as well as between the service provider and suppliers. It calculates, in near real-time, SLA compliance, and provides access to SLA reports.
- **Quality of experience (QoE)**—Provides a view on how the services are performing from the consumer's perspective. It uses probes, analytics, and other mechanisms to monitor the end-to-end service as seen by the consumer. QoE can monitor both internal services (implemented by the infrastructure) as well as external services (delivered by external suppliers). If service quality falls below prescribed levels, QoE, along with quality of service (QoS) tools (delivery layer), allow for identification of the root cause of the quality degradation. QoE can provide information to an external customer experience management system through the Business function in the governance and management plane.
- **Service catalog and repository**—Stores information relating to the internal and external services that are being offered. This information includes the composition of the services (the service elements that make up the service), agreed-to terms (for example, price and SLA), entitlement and role mapping (which services can be ordered by which user), and which services have been ordered by each user.

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Delivery layer



Delivery layer

The delivery layer provides deployment and configuration of the service instance. For example, HP Cloud Service Automation (CSA) software enables and manages the delivery of the requested cloud service. The delivery layer brings together the customer-facing service and is responsible for:

- Combining all elements for the customer-facing service
- Orchestrating and automating the combination of multiple service elements (from one or more supply layers) into a single service
- Selecting the appropriate supply layer, based on policy, demand layer request and supply layer availability (including hybrid functionality)
- Monitoring and calculating service usage by the consumer
- Maintaining information mapping service to service elements and supply layer resource pools

Additional functions are:

- **Service modeling and design**—Is responsible for defining how a service or service element is implemented according to the policies. It coordinates the design of service templates and automation workflows, provides revision management for services, and feeds information into the service model repository. Service modeling and design enables new resource pools to be added through multiple instances of the supply layer.
- **Capacity modeling (service)**—Exists in both the delivery layer and the supply layer. The delivery layer's capacity modeling function is concerned with capacity modeling for the service. The supply layer function is concerned with capacity modeling for the resources. Service capacity modeling receives the forecasting and trending of service capacity requirements (from the demand layer), receives the resource inventory and projections from the supply layers, and models whether the demand can actually be delivered by the supply layers. It interfaces with the Governance function in the governance and management plane to make decisions on how to address current and future shortfalls.
- **Request processing and activation**—Processes the service requests for internally delivered services. It interfaces with the order management function in the demand layer to take the service request and process it based on SLA and security/business policies, availability and performance of resources, and the service configuration model.

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- **Service instance lifecycle management**—Uses information in the service model repository to define how the service elements are to be delivered by the supply layers. It orchestrates the activation/de-activation, usage setup, and population of the service status into the repository. It uses a workflow that manages the provisioning of all components of the service. The workflow supports rollback, which can be called on to release resources in the event of a failure. Service instance lifecycle management communicates with the supply layers to manage provisioning of the required service elements. It also orchestrates the lifecycle of the service using resource managers (in the supply layer) to make any modifications to the service elements that comprise the service. It provides the link between the demand layer services and the supply layer resources that implement the services.
- **Service usage**—Collects usage and metering data records and processes them into per consumer/customer, per-service usage records. The metering data records are also known as Charge Data Record (CDR) and represent the information gathered for each potentially chargeable event. They provide the basis for billing. Service usage also logs user activities for security and audit (compliance) purposes.
- **Service monitoring**—Collects real-time event, security, and performance data for service health management as well as aggregation into the QoS function for continuous service level assessment and dynamic resource reassignments. Based on the collected data, service monitoring can issue a request to service instance lifecycle management to consider re-provisioning services using different supply layers. Real-time updates are written into the service model repository.
- **Quality of service (QoS)**—Interfaces with service monitoring to receive service and resource health and performance data for continuous service level assessment and dynamic resource reassignments. It also provides near real-time and historical reporting of operational service levels and feeds data to customer SLA compliance.

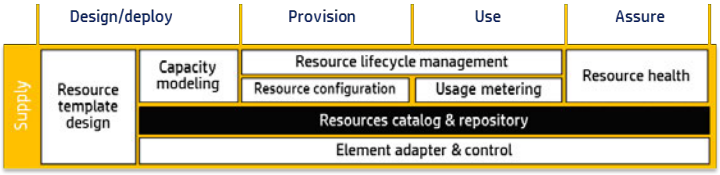
> **Note**
> QoS measures technical metrics such as CPU utilization, memory utilization, and ping time, whereas QoE (demand layer) measures the end-to-end customer experience.

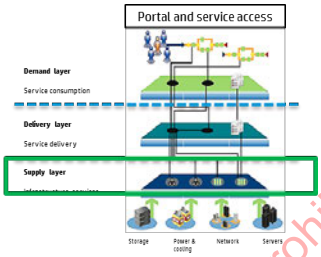
- **Service health management**—Collects and correlates resource events and identifies whether they result in a service incident. It maintains a view of the service status and can initiate an incident with a service desk (also known as *trouble ticketing*) by interfacing with the Management function of the governance and management plane.
- **Service model repository**—Contains information relating to the defined service hierarchy. This information includes the mapping between the customer facing service and the underlying resources, configuration templates, activation/de-activation and automation workflows (for patch management, upgrade, snapshot, backup, and reconfiguration). Real-time status updates are stored in the repository.

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Supply layer





Supply layer

The supply layer is where the physical and virtual assets reside. It manages all infrastructure services for the cloud and provides service delivery of infrastructure elements such as compute, network, storage, and other resources, both physical and virtual. These infrastructure elements may be physical or virtualized, or they may be provided by a customer's existing infrastructure or by third parties, including public clouds. It is also responsible for:

- Providing the necessary governance and orchestration to ensure that the resources deliver the desired customer-facing service
- Optimizing the utilization of the resources within the resource pools (for example, load balancing)
- Monitoring utilization of the resources and generating usage data records for events that may be billable
- Assuring the health of the resources
- Maintaining a resource pool catalog and describing the physical and logical resource repository

Additional functions are:

- **Resource template design**—Is responsible for infrastructure resource design and modification of specific resource pool types based on the customer-facing service defined in the service design, configuration, and capacity modeling modules from the delivery layer. It also manages the design of the resource pools management workflow among resource configuration, provisioning, workload management, and automation for customer-facing services.
- **Capacity modeling (resource)**—Interfaces with service capacity modeling (delivery layer) for resource consumption forecasting and trending. It provides capacity and performance real-time and historical reporting for the resource pools. Resource capacity modeling also coordinates resource configuration, provisioning, workload management, and monitoring functions (supply layer) to model delivery requirements.
- **Resource lifecycle management**—Receives capacity and performance requests from resource capacity modeling and resource template design and determines the number and type of resource pools required based on service capacity and performance configuration requests. It manages resource pools and resource pool consumption using information from usage metering and resource health, performs dynamic resource management (load balancing), and intelligently allocates resources based on requests from the delivery layer.

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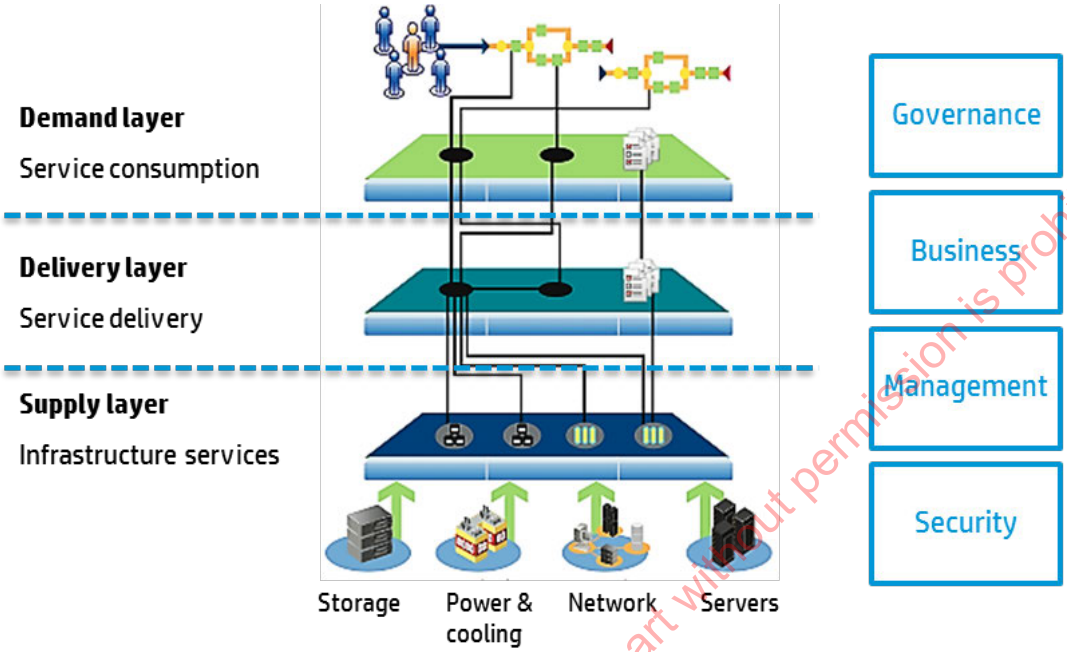
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- **Resource configuration**—Receives resource capacity configuration information from resource lifecycle management and orchestrates resource pools components for delivering service workloads. It also sets configuration parameters for each workload. Resource configuration is also responsible for providing resource configuration information to the resources catalog and repository, and for configuring and provisioning resources (through element adapter and control). Resource security configuration and management requests are executed as instructed by the security and management functions in the governance and management plane.
- **Usage metering**—Tracks the consumption of resource pools components for a specific user/service through resource lifecycle management. It provides usage reports to the service usage and service monitoring functions in the delivery layer. It also monitors resource pools components availability (information provided by resource health) and consumption level, and communicates with resource lifecycle management if pool resources are or will be oversubscribed (this could initiate consumption from hybrid cloud resources if appropriate). Usage metering provides resource pool usage and metering data to service usage (delivery layer). It also communicates with service monitoring and quality of service (delivery layer) and to element adapter and control.
- **Resource health**—Provides service health management (delivery layer) with information about faults within the resource pools that could affect the delivery of services. If a resource fails, autonomous recovery/failover can be initiated. Resource health also maintains real-time aggregate event management reports on resource pools components availability and hardware failure from information provided by element adapter and control. Any resource pool component-level security threats are reported to the governance and security functions of the governance and management plane. An example could be threats linked to the usage of the resources as a result of malware infection.
- **Resources catalog and repository**—Contains a federated view of the supply layer resource pools resource component and consumption data. It services real-time updates to be captured by resource health and resource capacity modeling functions. Resource lifecycle management uses the real-time resource status to balance workloads across the resource pools. Resources catalog and repository maps service delivery models to resource pool components, and is responsible for managing resources including software licenses, and network parameters (IP addresses and vLANs).
- **Element adapter and control**—Discovers resource elements and pools (servers, storage, network, software). It provides an abstract mediation layer for resource pools physical components to be configured, provisioned, managed, and monitored by configuration and workload management functions in layers above it. It also enables multiple hypervisor managers to be used. Element adapter and control provides real-time status updates and consumption information for resource pool physical hardware, virtual machines and software components. It provides this information to the resources catalog and repository, usage metering and resource health functions. Element adapter and control receives workload configuration requests from the resource lifecycle management function.

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Governance and management plane



In addition to the demand, delivery, and supply layers, the architecture defines a governance and management plane that contains overall enterprise functionality used in the management and operation of both cloud and traditional (non-cloud) environments. This functionality has been present in data centers for many years and has been expanded to support cloud environments.

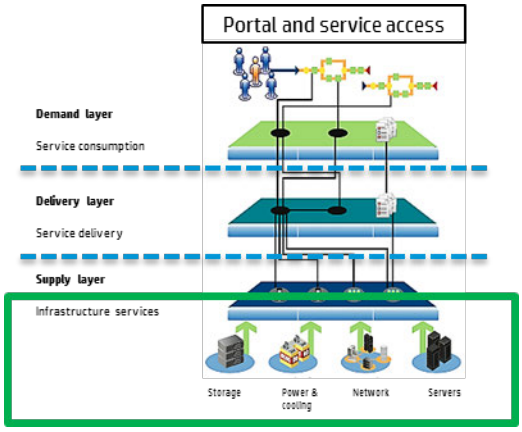
Functions in the governance and management plane include:

- **Governance**—Ensures that IT assets generate business value and seeks to mitigate the risks that are associated with IT. This is accomplished by implementing an organizational structure with well-defined roles for the responsibility of information, business processes, applications, and infrastructure. Governance includes risk management, compliance, policies, standards, and architecture.
- **Business**—Focuses on the business management of the enterprise environment and includes strategy, demand, financials, invoicing, procurement, and client relationships.
- **Management**—Handles operations of the enterprise environment and includes service design, service transition, service operation, and continuous improvement. Management makes extensive use of Information Technology Infrastructure Library (ITIL).
- **Security**—Focuses on the risk management profile of the business. It is based on a program that defines security controls and methods to ensure the security of the enterprise environment. It includes identity management, application security, information security, infrastructure security, and monitoring.

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Infrastructure



Infrastructure

The supply layer directly drives the infrastructure, which includes servers, storage, networking (physical and virtual), software licenses for delivering specific services (for example, an Oracle database license), IP addresses, monitoring, power and cooling, management software, information, and applications.

Resources provided by external service providers (for example, HP Helion Public Cloud services, Amazon EC2, Salesforce.com) are managed through the external service provider function block. This functionality enables the external resources to be included seamlessly into the service that is delivered to the consumer.

- **Physical elements**—Manage physical, non-virtualized infrastructure components. It interfaces with element adapter and control (supply layer) for providing configured, provisioned, managed, and monitored physical infrastructure elements. Management of multiple physical infrastructure types is possible.
- **Virtual elements**—Manage virtual infrastructure components. It interfaces with element adapter and control (supply layer) for providing configured, provisioned, managed, and monitored virtual infrastructure elements. It enables management of multiple hypervisor managers including VMware vCenter and Microsoft Hyper-V.
- **Software licenses/monitoring/other resource elements**—Manage abstracted resources that are required to deliver a service. These resources include a license entitlement needed for delivering a specific service (for example, an Oracle database license) delivered by a software asset management resource, an IP address delivered by an IP asset management resource, and a monitoring resource for a specific service.
- **External service providers management**—Interfaces with the element adapter and control function for delivering services provided by third-party IaaS/PaaS/SaaS providers including HP Helion Public Cloud services, Amazon EC2, and Salesforce.com. This function includes a resource manager, which links with the third party and uses the third-party API to fulfill the required actions on the external resources.

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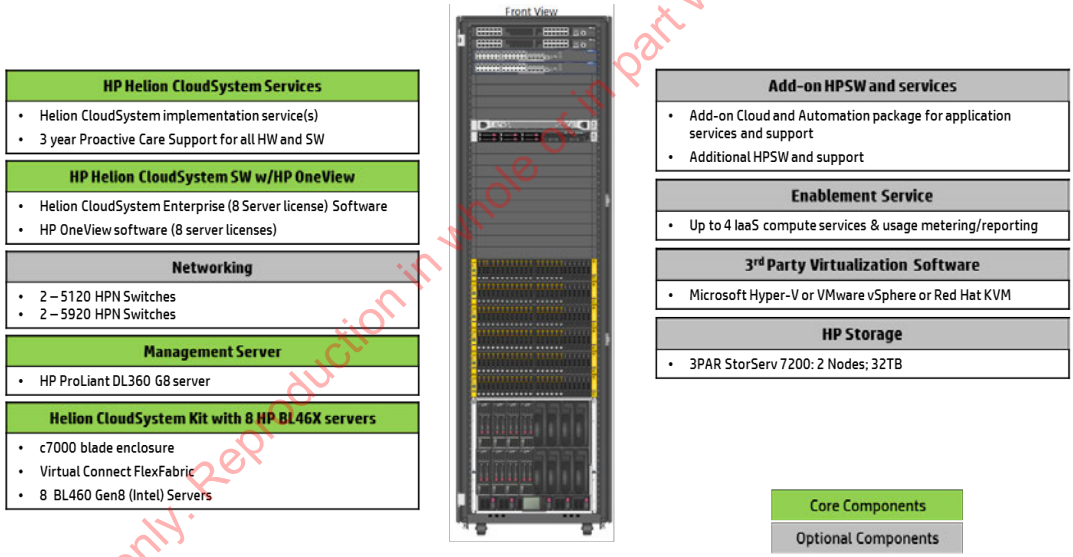
HP Helion CloudSystem built on HP Converged System 700x reference configurations

The Helion CloudSystem built on ConvergedSystem 700x offers different cloud software options to address specific needs from simple to advanced infrastructure cloud services as well as application cloud services along with lifecycle management.

To purchase a Helion CloudSystem, customers start by ordering a Helion CloudSystem built on ConvergedSystem 700x Starter Kit, which contains the infrastructure needed for a fully working environment that supports up to 16 ProLiant half-height server blades.

Customers then add additional kits, now or in the future, to expand their HP Helion CloudSystem built on ConvergedSystem 700x infrastructure with additional infrastructure and blades. The central management server (CMS) host implemented with the first kit simply extends its domain to manage additional infrastructure that might be added with additional Helion CloudSystem kits.

HP Helion CloudSystem built on HP ConvergedSystem 700x *Small*



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HP Helion CloudSystem built on HP ConvergedSystem 700x *Medium*

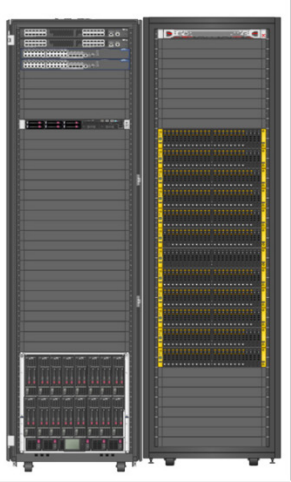
HP Helion CloudSystem Services
- Helion CloudSystem implementation service(s)
- 3 year Proactive Care Support for all HW and SW

HP Helion CloudSystem SW w/HP OneView
- Helion CloudSystem Enterprise (2x8 Server license) Software
- HP OneView software (16 server licenses)

Networking
- 2 – 5120 HPN Switches
- 2 – 5920 HPN Switches

Management Server
- HP ProLiant DL360 G8 server

Helion CloudSystem Kit with 16 HP BL46X servers
- c7000 blade enclosure
- Virtual Connect FlexFabric
- 16 BL460 Gen8 (Intel)



Add-on HPSW and services
- Add-on Cloud and Automation package for application services and support
- Additional HPSW and support

Enablement Service
- Up to 4 IaaS compute services & usage metering/reporting

3rd Party Virtualization Software
- Microsoft Hyper-V or VMware vSphere or Red Hat KVM

HP Storage
- 3PAR StoreServ 7400: 4 nodes; 65TB

Core Components
Optional Components

HP Helion CloudSystem built on HP ConvergedSystem 700x *Large*

HP Helion CloudSystem Services
- Helion CloudSystem implementation service(s)
- 3 year Proactive Care Support for all HW and SW

HP Helion CloudSystem SW w/HP OneView
- Helion CloudSystem Enterprise (8x8Server license) Software
- HP OneView software (64 server licenses)

Networking
- 4 – 5120 HPN Switches
- 4 – 5920 HPN Switches

Management Server
- 1 HP ProLiant DL360 G8 server

Helion CloudSystem Kit with 64 HP BL46X servers
- c7000 blade enclosure
- Virtual Connect FlexFabric
- 64 BL460 Gen8 (Intel)



Add-on HPSW and services
- Add-on Cloud and Automation package for application services and support
- Additional HPSW and support

Enablement Service
- Up to 4 IaaS compute services & usage metering/reporting

3rd Party Virtualization Software
- VMware vSphere

HP Storage
- 3PAR StoreServ 10800: 6 nodes; 253TB

Core Components
Optional Components

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Learning check

Your facilitator will lead a class discussion to capture key insights and challenges from this section of the module. To prepare for the discussion, answer the following questions about HP reference architectures. Record your answers here and be prepared to share them with the group.

1. List the three building blocks of the HP Converged Infrastructure reference architecture.

2. What are some of the key benefits of offering three sizes of HP Helion CloudSystem built on HP ConvergedSystem reference configurations?

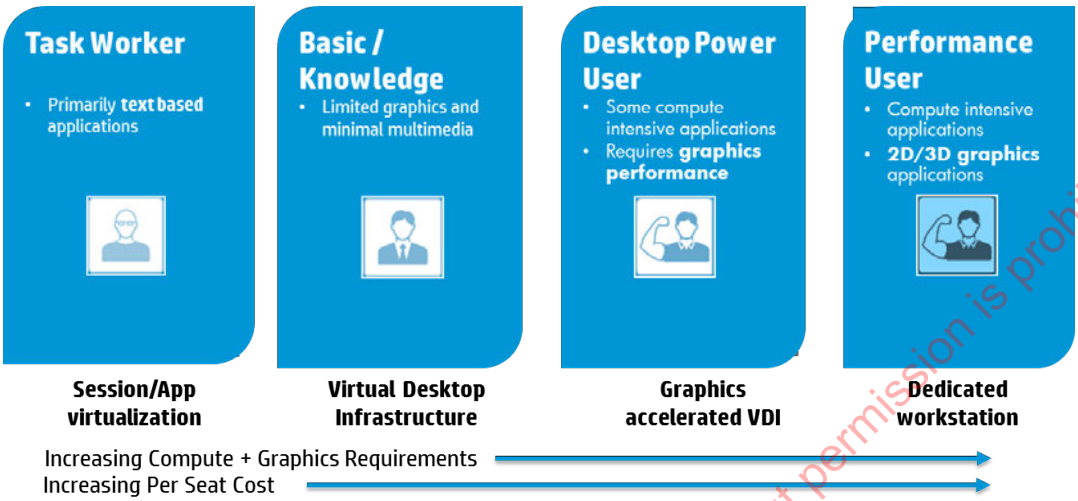
3. Fill in the blank spaces in the table according to the HP Helion CloudSystem reference configurations.

	Small	Medium	Large
Servers			
System maximum storage capacity			

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HP client virtualization reference architectures



As the global workforce becomes increasingly remote, mobile, and technology-savvy, expectations for how IT is delivered to the workspace have heightened. Not only does IT struggle to maintain traditional desktops today, but also to enable more endpoint devices and applications than ever before. All market trends point to rapid and continued growth for greater mobility for work. Client virtualization can address the business demands in a resilient yet simpler way.

HP has developed different architectures within the client virtualization umbrella. Desktop users can be classified broadly into four different categories based on their application usage. With client virtualization reference architectures, HP is focusing on virtual desktop infrastructure (VDI), which is one of the fastest growing areas of client virtualization.

A wide variety of industry workers can benefit from VDI. HP has had success serving state and local government and education customers, as well as healthcare. Types of users can range from lightweight workload task workers to productivity/knowledge workers, and graphic-intensive users such as CAD/CAM operators. The solution configuration depends on the types of users supported.

Basic /knowledge /productivity workers have a consistent set of applications with more than one application open at any point of time. Such users have limited graphics and multimedia requirements. VDI delivers a whole desktop experience to remote users across the network.

Instead of a user having a local PC running a local copy of the operating system, the operating system runs in the data center. Users connect to and control their own instance of their Windows desktop remotely in a one-to-one manner from their own client. This way, users can use any client device to access “their desktop.”

If you replace a user’s desktop with a thin client that automatically connects to a remote machine in the data center when the client is powered on, there is a good chance that the user would not even know they were using a remote desktop. HP partners with leading VDI vendors to offer an end-to-end VDI solution.

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HP client virtualization reference architecture methodology

Much more than a simple plan of action, the HP client virtualization methodology mitigates the risk and cost of transforming a client environment. By following a proven, prescriptive, step-by-step process, HP can establish the necessary people, processes, and programs for untangling the inherent complexities of client virtualization to help customers succeed.

With the HP client virtualization methodology, customers receive:

- Capacity-appropriate solution design, derived from actual data rather than generic information or assumptions.
- Reduced risk by working with a dedicated project manager, who oversees the end-to-end desktop transformation from start to finish.
- Training cost avoidance by using a familiar infrastructure, including BladeSystem, Virtual Connect, and HP 3PAR StoreServ platforms.

The HP client virtualization portfolio includes reference architectures for enterprises and small-to-medium businesses (SMBs):

- **Gen8 Enterprise**—Addresses the needs of larger environments with rack capacities of up to 3,250 VMs
  - Up to 7,280 productivity users in two racks
  - BladeSystem c7000 enclosure with HP 3PAR storage
  - Citrix/vSphere
- **Gen8 small to medium business (SMB)**—Addresses acquisition cost and perceived complexity
  - 50 to 600 VM increments
  - Simplified for smaller enterprises or branches
  - ProLiant DL380 servers
  - Citrix VDI-in-a-Box, Microsoft Windows Server 2012, VMware View

These reference architectures provide fully integrated solutions to support secure mobility, including simplified networking with HP Virtual Connect, superior performance with ProLiant Gen8 servers, and tiered storage options that can be fine-tuned for different kinds of user workloads. Covering architectural design, sizing, performance, and a sample bill of materials for easy ordering and configuring, these blueprints enable solutions that are:

- Easy to deploy
- Scalable
- Cost effective
- Provide an optimal remote desktop experience

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HP Client Virtualization SMB Reference Architecture for Citrix VDI-in-a-Box

75 productivity users
• One ProLiant DL380p Gen8 server
• One Intel Xeon E5-2680 @ 2.70GHz processor
• 96 GB RAM - 8GB DDR3 DIMMs, 1333 MHz
• Eight 300GB 6G SAS 10k RPM 2.5in drives, RAID 0+1

165 productivity users
• One ProLiant DL380p Gen8 server
• Two Intel Xeon E5-2680 @ 2.70GHz processors
• 192 GB RAM - 8GB DDR3 DIMMs, 1333 MHz
• Eight 300GB 6G SAS 15kRPM 2.5in drives, RAID 0+1

If the customer is an SMB or a branch office, the Citrix VDI-in-a-Box reference architecture from HP provides an easy, affordable all-in-one appliance-like configuration that is quick to deploy with predictable, repeatable costs.

With innovations in performance, feature flexibility, and management capabilities, the ProLiant DL380p Gen8 server can handle demanding compute requirements, while safeguarding for future growth.

This reference architecture delivers unique features:

- **All-in-one design**—Leveraging the all-in-one design of Citrix VDI-in-a-Box, each server has all the functionality needed to provision and manage virtual desktops without requiring any external management servers, databases or shared storage.

  Citrix XenServer Hypervisor, Microsoft Hyper-V, and VMware vSphere hypervisors are also supported. VDI-in-a-Box includes a single web-based, centralized management console for managing all servers and users in the grid.

- **Predictable repeatable costs**—The HP Reference Architecture for Citrix VDI-in-a-Box provides tested and validated configurations for desktop capacity per server. Whether you use the server stand-alone or in a grid of many, the performance capacity per server remains unchanged, yielding predictable costs and performance.

- **Built-in high availability**—Key features such as high-availability are built-in without requiring shared storage—simply have more than one server in the grid and the system automatically load balances and delivers high-availability.

- **Rich user experience**—Deliver a rich high-definition user experience anytime, anywhere, on any device. More than 1.5 billion devices including tablets, mobile phones, HP thin-clients, and PCs can be used to access the virtual desktops.

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HP Client Virtualization SMB Reference Architecture for VMware View

200 productivity users
• One ProLiant DL380p Gen8 server
• Two Intel Xeon E5-2680 @ 2.70GHz processors
• 256GB RAM - 16GB DDR3 DIMMs, 1333 MHz
• Four 300GB 6G SAS 10kRPM 2.5in drives, RAID 0+1
• One 365GB IO accelerator card
• One HP VSA

600 productivity users
• Three ProLiant DL380p Gen8 servers, each with:
• Two Intel Xeon E5-2680 @ 2.70GHz processors
• 192 GB RAM - 16GB DDR3 DIMMs, 1333 MHz
• Four 300 GB 6G SAS 10kRPM 2.5in drives, RAID 0+1
• One HP 365 GB IO accelerator cards
• One HP VSA

The VMware View reference architecture from HP provides an affordable, low initial cost configuration that is quick to deploy and scales on-demand with predictable repeatable costs and performance.

By providing a complete solution that has been fully tested, presized, and optimized, the HP Client Virtualization SMB Reference Architecture for VMware View simplifies deployment of a new client solution and speeds time to production. Rather than spend time validating sizing and performance metrics, you can rapidly deploy one ProLiant DL380p Gen8 server with the integrated storage, management, and VMware View software to support a prescribed number of productivity workers.

With VMware View Planner for workload simulation, the theoretical maximum number of users achieved was 200; host CPU load was approximately 90%. To avoid shortages in hardware and overages in budget, as well as to account for the differences in rigid lab environments versus highly diverse customer environments, HP recommends that customers use a planning number that is approximately 60% of the maximum.

The reference architecture includes:

- VMware View 5 information
- ProLiant DL380p Reference Architecture whitepaper
- HP P4000 LeftHand Virtual SAN Appliance Software (HP VSA)
- HP IO Accelerators

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HP Client Virtualization SMB Reference Architecture for Microsoft Windows Server 2012

The Client Virtualization SMB Reference Architecture for Windows Server 2012 is configured with everything you need, there is no additional infrastructure to deploy and no additional virtualization or management software required. It helps any size businesses to deploy a high-performance virtual desktop solution without a high price tag. Benefits of the HP CV SMB RA for Windows Server 2012 include:

- **Provides leading performance**—Benchmark testing confirms that the HP Client Virtualization SMB Reference Architecture for Windows Server 2012 can support at least 175 virtual desktops per host server with excellent response time. In addition, customers can benefit from performance advancements with ProLiant Gen8 servers, ensuring that the solution can comfortably meet the needs of their organizations.
- **Makes deployment easy**—It is easy to set up the Client Virtualization SMB Reference Architecture for Windows Server 2012 solution on the ProLiant server and configure the desktop images, so virtual desktops can be quickly delivered to users. Because all of the software is from Microsoft, there is no need to work with a third-party vendor, and licensing costs are kept to a minimum. Customers can start with the sample bill of materials included in the reference architecture, and then tailor the solution to meet their unique needs.
- **Includes everything you need**—With this reference architecture, there is no additional infrastructure to deploy—no need for additional management servers, databases, storage area networks (SANs), or additional virtualization or management software. Everything needed is included in the solution.

The design of the Client Virtualization SMB Reference Architecture for Windows Server 2012 is based on extensive scalability testing conducted by a Microsoft team in Redmond, Washington. The final design was tested using the industry-standard Login VSI performance and scalability testing tool to ensure that the reference architecture meets all HP and Microsoft performance requirements.

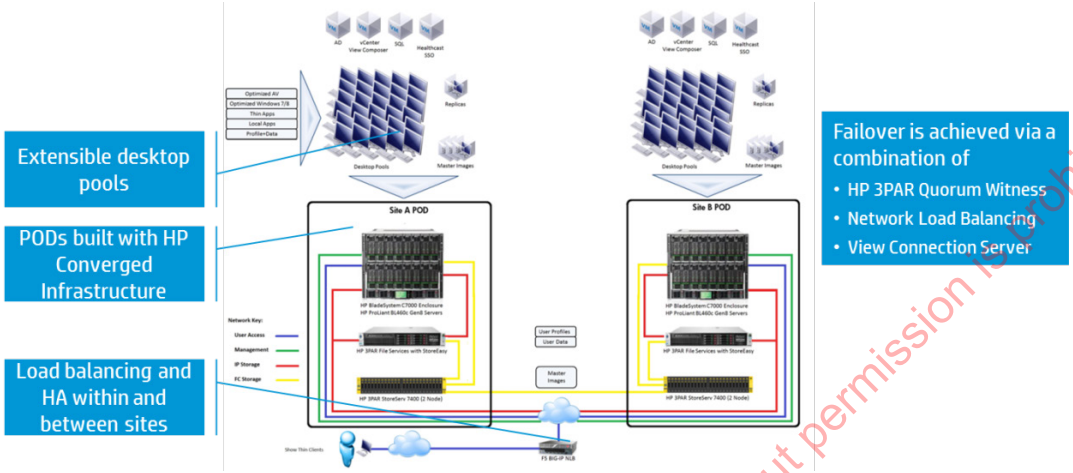
Critical components in any client infrastructure are the access devices. For accessing anything from financial services data to top-secret government information, thin client computing is a proven alternative to traditional PC computing. Depending on their needs, customers can choose from:

- **Smart Zero Clients**—Operate like zero clients, but are intelligent enough to reconfigure themselves to Microsoft protocols. Simply plug the Smart Zero Clients in, power them on, and they work.
- **Flexible Thin Clients**—Provide options to grow and expand securely, delivered with PC-like performance. Thin clients are secure by nature, but HP made top-level security a priority; the HP t610 PLUS Flexible Thin Client meets National Institute of Standards and Technology security recommendations.

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HP Mobile Care Reference Architecture based upon VMware Always-On Point of Care



Although every business can recognize the productivity gains made possible by supporting mobile work styles, they can also see the potential for increased complexity, rising support costs, and security breaches. With a proven process for successful desktop transformation, HP removes those worries by virtualizing the client environment to enable people to work anywhere, anytime, from any device.

By following a prescriptive five-stage program, HP can help customers deploy an advanced client virtualization solution that securely and cost-effectively supports the mobile workforce and BYOD—delivered as a simple, complete reference architecture based on HP servers, storage, networking, and services.

Mobile workforce reference architecture

Motivations for an always-on reference architecture for healthcare include:

- Enable anywhere, anytime information access to improve patient outcomes
- Increase clinicians' efficiency so they can spend more time with patients
- Ensure compliance and security, mitigate risks

This reference architecture uses the following components:

- HP 3PAR StoreServ Storage
- VMware Always-On Point of Care with Horizon View
- HP BladeSystem and Virtual Connect with I/O Accelerators
- HP Networking
- HP Thin Clients
- Load balancing
- Multi-site failover
- Connection persistence

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Elements of the solution include:

- High availability
  - Server blades—Density, redundancy, monitoring, power, cooling
  - Virtual machine infrastructure—(AD, SQL, View) and desktops
  - Storage—Synchronous replication and automated site failover
  - Virtual network—Global redirection of desktop sessions across sites
- Smart load balancing
  - Based upon geo-location, source IP, and latency
  - Connection persistence is critical
- Mobility
  - Support BYOD and a wide variety of wired and wireless clients
- Security
  - User, protocol encryption, certificates, data, virus detection
- Single Sign On (SSO)
  - Eliminates multiple logins and passwords for sessions and applications
- Tap & Go
  - Card readers, biometric/fingerprint scan

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Learning check

Your facilitator will lead a class discussion to capture key insights and challenges from this section of the module. To prepare for the discussion, answer the following questions about HP Converged Infrastructure, cloud fundamentals, and reference architectures. Record your answers here and be prepared to share them with the group.

1. What type of industries and workers can benefit from the virtual desktop infrastructure?

2. Name the features of HP Client Virtualization SMB Reference Architecture for Citrix VDI-in-a-Box.

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Hadoop reference architectures

Many enterprises today have data streaming in from all directions and are challenged to take this unstructured data, synthesize it, qualify it, and transform its business value from a historical analysis to predictive analysis. Hortonworks lists these use cases as demonstration of how Apache Hadoop and the Hortonworks Data Platform can help achieve this data transformation:

- **Social media data**—Mine Twitter, Facebook, and other social media conversations for data about you and your competition, and use it to make targeted, real-time decisions that increase market share.
- **Web clickstream data**—Analyze, visualize, and ultimately change how visitors behave on your website.
- **Server log data**—Expand server log analysis by speeding and improving security forensics and providing a low-cost platform to show compliance.
- **Machine and sensor data**—Store and refine this data and identify meaningful patterns; get the insight to make proactive business decisions.
- **Geolocation data**—Reduce data storage costs and provide value-driven intelligence from asset tracking to behavior prediction to enable optimization.

INTERNET For further information on business applications of Hadoop, scan this QR code or right-click it and open the hyperlink:

HP and Apache Hadoop allow you to derive new business insights from Big Data by providing a platform to store, manage, and process data at scale. However, Apache Hadoop is complex to deploy, configure, manage and monitor. HP reference architectures for Hadoop provide several performance-optimized configurations on HP infrastructure that provide a significant reduction in complexity and increase in value and performance.

HP offers a choice of reference architectures for Apache Hadoop that support varying Big Data workloads. These reference architectures are available on ProLiant DL380 and SL4500 platforms, with the three leading distributions—Cloudera, Hortonworks, and MapR—offering additional choice as customers build their own Hadoop ecosystems.

Hadoop solutions based on ProLiant SL4540 servers offer breakthrough economics, density, and simplicity. The SL4540 server supports a maximum of 27 servers with 1.62 PB total raw capacity in a single expansion 42U rack. The ProLiant DL360p Gen8 server features two sockets with six-core Intel Xeon E5-2667 processors and the Intel C600 Series chipset, providing the performance required for fastest time to completion for CPU-bound Hadoop workloads.

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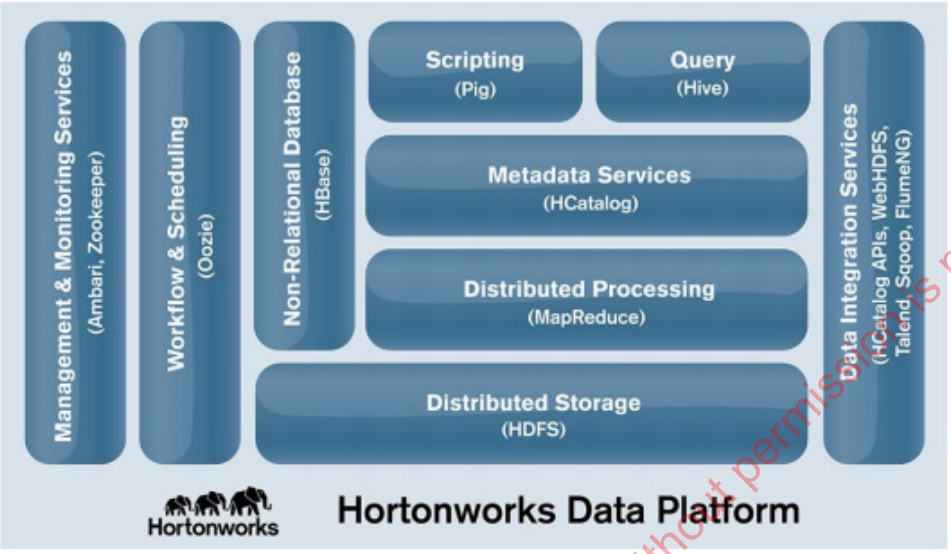
Benefits of a solution based on the HP Hadoop Reference Architecture include:

- Ease of acquisition
- Rapid deployment
- Simplified management
- Risk-free scalability
- Seamless analytics

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Hortonworks Data Platform overview



Hortonworks is a major contributor to Apache Hadoop, the world's most popular big data platform. Hortonworks focuses on further accelerating the development and adoption of Apache Hadoop by making the software more robust and easier to consume for enterprises and more open and extensible for solution providers.

The Hortonworks Data Platform, powered by Apache Hadoop, is a massively scalable and 100% open source platform for storing, processing, and analyzing large volumes of data. It is designed to deal with data from many sources and formats in a quick, easy, and cost-effective manner. The Hortonworks Data Platform consists of the essential set of Apache Hadoop projects including:

- YARN
- Hadoop Distributed File System (HDFS)
- HCatalog
- Pig
- Hive
- HBase
- ZooKeeper
- Ambari

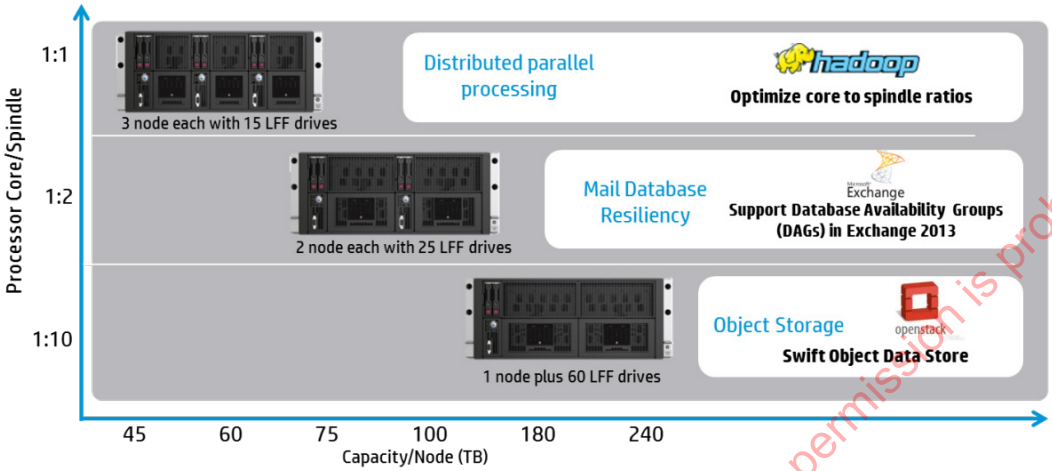
Hortonworks is a major contributor of code and patches to many of these projects, which have been integrated and tested as part of the Hortonworks Data Platform release process. Installation and configuration tools have also been included.

Unlike other providers of platforms built using Apache Hadoop, Hortonworks contributes 100% of their code back to the Apache Software Foundation. The Hortonworks Data Platform is licensed by Apache and completely free and open source. Hortonworks sells only expert technical support, training, and partner-enablement services.

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SL4540 single-rack Hadoop reference architecture



SL4540 3x15 configuration for Hadoop worker nodes

The HP SL4540 Gen8 (3x15) three-node configuration of the ProLiant SL4540 Gen8 with two sockets, eight-core processors, and the Intel C600 Series chipset consists of three compute nodes and a total of 45 large form factor (LFF) 3.5-inch hard drives in the chassis. The 3x15 configuration of ProLiant SL4540 Gen8 servers provides customers with 67% more storage capacity and 33% more compute density at a 42U rack level when compared to 2U rack-mount servers.

The ProLiant SL4540 is a dual-socket Gen8 server, with a choice of five different Xeon processors, up to 192 GB of memory, and one PCIe slot for expansion per node. Every compute node also has its own dedicated networking ports. ProLiant SL4540 servers pack maximum performance, productivity, and cost-effectiveness in ultra-dense configurations. Testing in April 2013 shows that the ProLiant SL4540 holds the world's fastest 10TB Hadoop TeraSort result.

The HP Smart Array P420i controller provides increased I/O throughput performance resulting in a significant performance increase for I/O bound Hadoop workloads (a common use case) and the flexibility for the customer to choose the desired amount of resilience in a Hadoop cluster with either JBOD or various RAID configurations.

The HP FlexibleLOM network technologies provide customers the flexibility to move easily between 1GbE and 10GbE network interconnects on the server.

Two intelligent resilient framework (IRF) bonded HP 5900AF-48XG-4QSFP+ ToR switches are specified for performance and redundancy. If IRF bonding is used, it requires two 40GbE ports per switch, which would leave two 40GbE ports on each switch for uplinks.

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It is important to isolate the HDP cluster on the network so that external network traffic does not affect the performance of the cluster. In addition, this also allows for the Hadoop cluster to be managed independently from that of its users, which ensures that the cluster administrator is the only one capable of making changes to the cluster configurations. To achieve this, HP recommends isolating the JobTracker, NameNode, and Worker nodes on their own private Hadoop cluster subnet.

After a Hortonworks HDP cluster is isolated, the users of the cluster will still need a way to access the cluster and submit jobs to it. To achieve this, HP recommends multi-homing the management node so that it participates in both the cluster subnet and a subnet belonging to the users of the cluster. Hortonworks Management Center is a web application that runs on the management node and enables users to manage and configure the Hadoop cluster (including seeing the status of jobs) without being on the same subnet, provided the management node is multi-homed. Furthermore, users can shell into the management node and run the Apache Pig or Apache Hive command line interfaces (CLIs) and submit jobs to the cluster that way.

In addition, after the Hortonworks HDP cluster is on its own private network, you need to think about how to be able to reach the HDFS in order to move data onto it. The HDFS client needs to potentially be able to reach every Hadoop DataNode in the cluster in order to stream blocks onto it to move data onto the HDFS. The reference architecture provides several ways to do this.

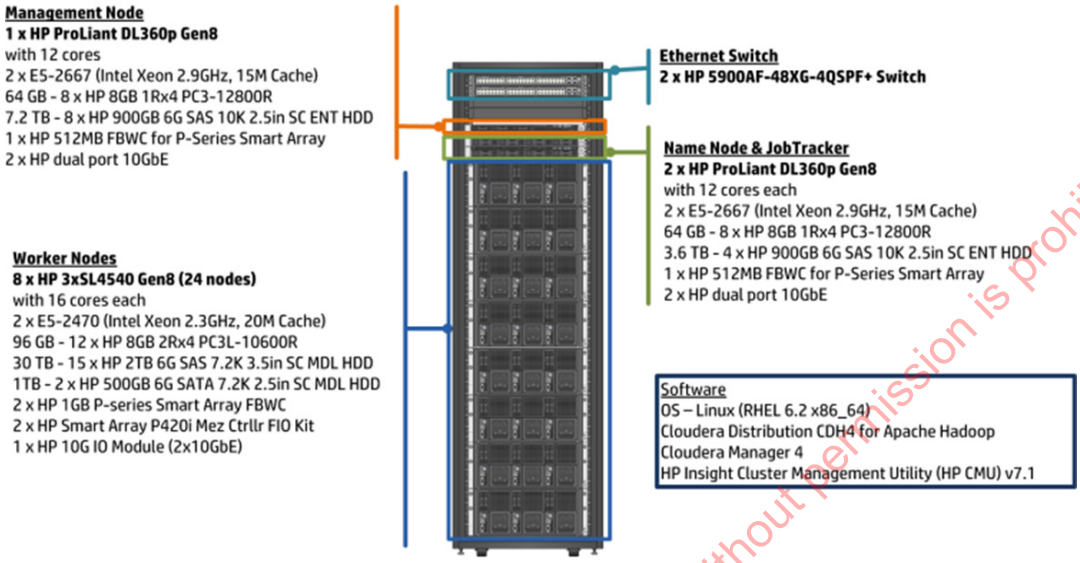
The first option is to use the already multi-homed management node. This server has been configured with twice the amount of disk capacity (an additional 3.6 TB) compared to the other management servers in order to provide an immediate solution to move data into the Hadoop Cluster from another subnet.

Another option is to leverage WebHDFS, which provides an HTTP proxy to securely read and write data to and from the HDFS.

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SL4540 single-rack Cloudera/Hortonworks reference architecture



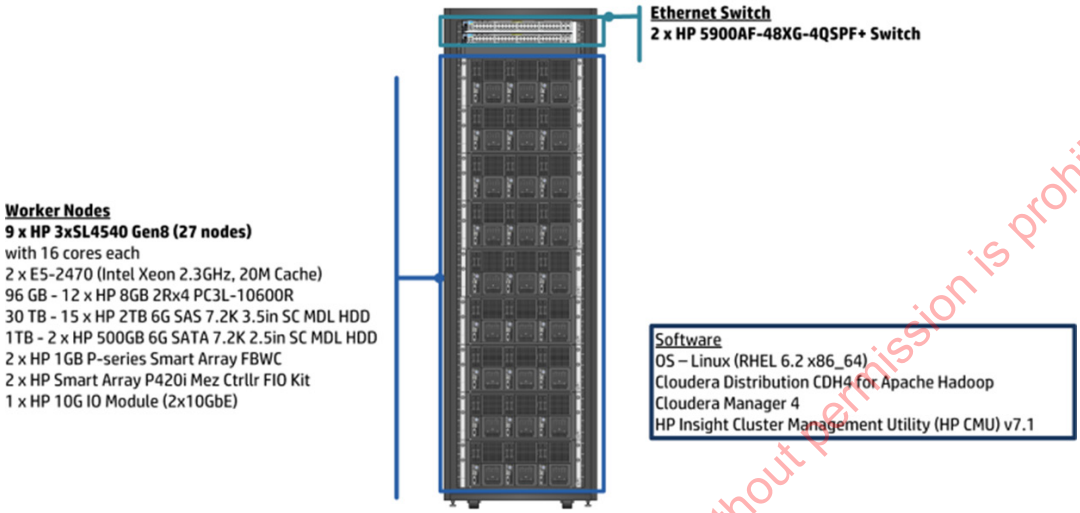
The single-rack HDP configuration provides a starting point for an HDP cluster configuration. The configuration includes the following components:

- **Rack enclosure**—The rack contains eight ProLiant SL4540 chassis with 24 server nodes, three ProLiant DL360p servers, and two HP 5900AF-48XG-4QSFP+ switches within a 42U rack.
- **Network**—Two HP 5900AF-48XG-4QSFP+ switches are specified for performance and redundancy. The HP 5900AF-48XG-4QSFP+ includes up to four 40GbE uplinks which can be used to connect the switches in the rack into the desired network. If IRF bonding is used, it requires two 40GbE ports per switch, which would leave two 40GbE ports on each switch for uplinks.
- **Management nodes**—ProLiant DL360p Gen8 management nodes are specified:
  - The management node
  - The JobTracker node
  - The NameNode
- **Worker nodes**—After the redundant switches and management servers are installed in the rack, there is space for eight ProLiant SL4540 Gen8 chassis with 24 worker nodes within the rack.

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SL4540 expansion rack Cloudera/Hortonworks reference architecture



This graphic describes the SL4540 expansion rack Hortonworks/Cloudera reference architecture.

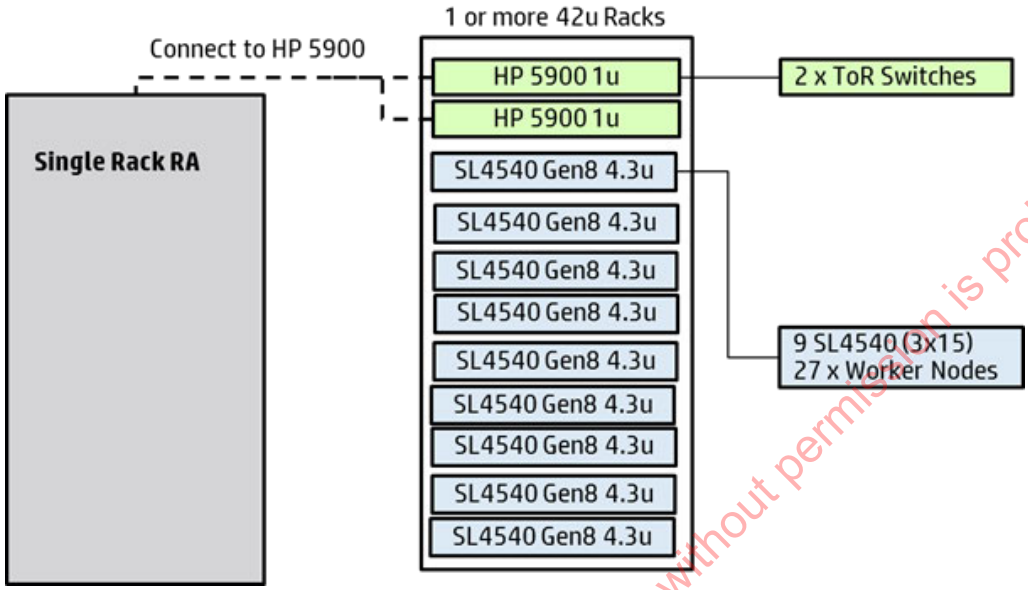
The 27 server nodes in the ProLiant SL4540 Gen8 (3 x 15) chassis are configured as worker nodes in the cluster because all required management processes are already configured in the single-rack reference architecture. In addition to the operating system, the following worker processes are typically present:

- DataNode
- TaskTracker (or HBaseRegionServer if using HBase)

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SL4540 Cloudera/Hortonworks multi-rack cluster configuration



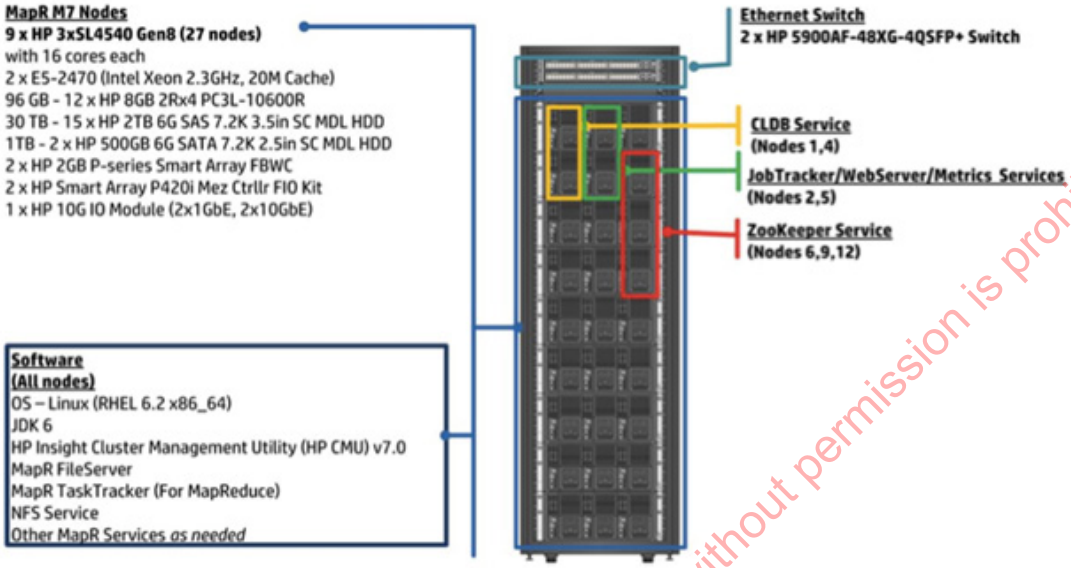
The multi-rack cluster design assumes that the single-rack configuration is already in place and extends its scalability. The single-rack configuration ensures the required amount of management services are in place for large scale out. For multi-rack clusters, you only need to add more racks of the following configuration to the single-rack configuration:

- **Rack enclosure**—The rack contains nine ProLiant SL4540 Gen8 chassis with 27 server nodes and two HP 5900AF-48XG-4QSFP+ switches within a 42U rack.
- **Network**—Two HP 5900AF-48XG-4QSFP+ switches are specified for performance and redundancy. The HP 5900AF-48XG-4QSFP+ includes up to four 40GbE uplinks, which can be used to connect the switches in the rack into the appropriate network. If IRF bonding is used, it requires two 40GbE ports per switch, which would leave two 40GbE ports on each switch for uplinks.

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SL4540 MapR reference architecture



The single-rack MapR M7 configuration provides a starting point for a MapR M7 cluster configuration. The configuration reflects the following components.

- **Rack enclosure**—The rack contains nine ProLiant SL4540 Gen8 chassis with 27 server nodes and two HP 5900AF-48XG-4QSFP+ switches within a 42U rack. This leaves 1U open for optional keyboard, video, and mouse (KVM) switch.
- **Power and cooling**—In planning for large clusters, it is important to properly manage power redundancy and distribution. To ensure the servers and racks have adequate power redundancy we recommend that each server has a backup power supply, and each rack has at least two Power Distribution Units (PDUs). There is an additional cost associated with procuring redundant power supplies. This is less important for larger clusters because the inherent failover redundancy within the MapR M7 ensures there is less impact.
- **Network**—Two HP 5900AF-48XG-4QSFP+ switches are specified for performance and redundancy. The HP 5900AF-48XG-4QSFP+ includes up to four 40GbE uplinks which can be used to connect the switches in the rack into the desired network. Keep in mind that if IRF bonding is used, it requires two 40GbE ports per switch, which would leave two 40GbE ports on each switch for uplinks.

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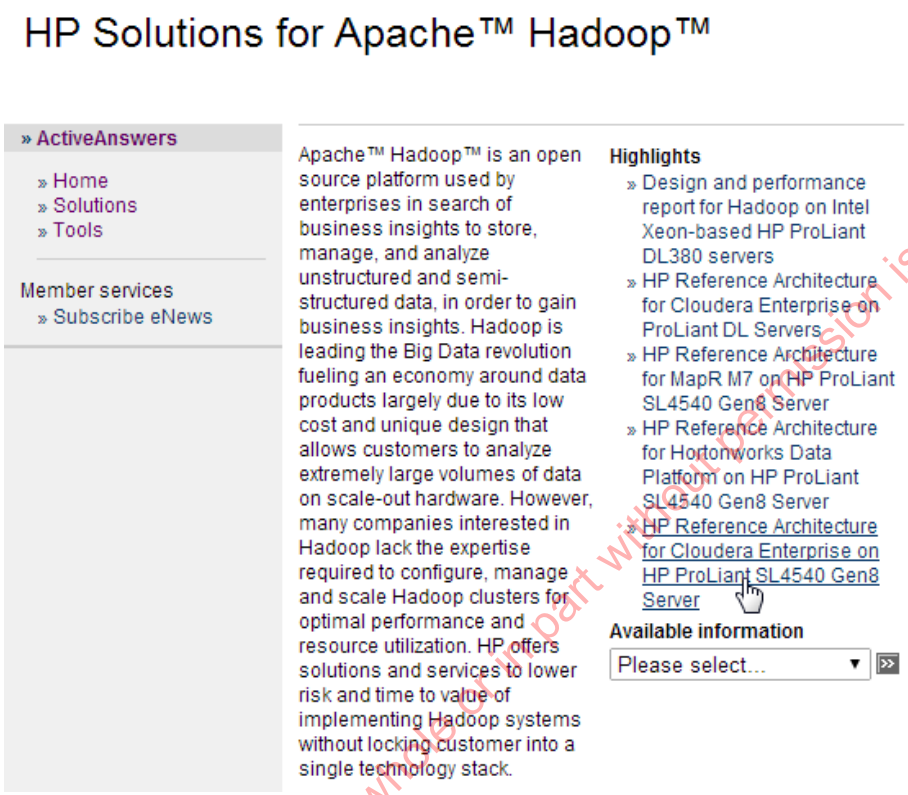
- **ProLiant SL4540 Gen8 servers**—The ProLiant SL4540 servers in the rack act as nodes in the MapR cluster. The architecture of MapR software allows virtually any service to run on any node, or nodes, to provide a high-availability, high-performance cluster. The basic requirements of a node are not different for control service or for worker service nodes resulting in a homogeneous server configuration. At the same time, the service assignment to the nodes can affect the performance of the cluster. For good cluster performance, some of the control services such as Container Location Database (CLDB) and ZooKeeper services need to be run on separate nodes. To provide high availability, it is recommended to configure multiple control services in the rack. One should have at least three ZooKeeper, two to three CLDB, two to three JobTracker, and two WebServer services to provide high availability functionality in the cluster to eliminate single points of failure.

The diagram on the previous page shows the recommended configuration for a single-rack MapR M7 cluster that includes high-availability functionality. There are three ZooKeeper services, two CLDBs, and two JobTracker services configured to provide high availability. Two WebServer services, along with the Metrics services, are placed on the JobTracker nodes. NFS services can be placed on most of the nodes as needed. The redundant control services—CLDB, ZooKeeper, and JobTracker services—have been distributed across separate chassis to provide high availability in case of a single chassis failure.

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Reference architectures in ActiveAnswers



The HP ActiveAnswers website serves as a repository for reference architectures, such as HP reference architectures for Apache Hadoop and Microsoft SQL Server 2012 Fast Track Data Warehouse. This collection of reference architectures provides a prescriptive approach for balancing server, storage, network, and software configurations for architecting SQL Server 2012 data warehouse solutions.

The reference architectures provide server and storage guidance for various data warehouse workloads and describe a repeatable architectural approach for relevant processes. For example, the reference architecture for Microsoft SQL Server 2012 Fast Track Data Warehouse provides information on processes such as implementing a scalable model for a symmetric multiprocessor (SMP)-based SQL Server 2012 data warehouse. The result of the process represents a recommended minimal SQL Server 2012 configuration, inclusive of all the software and hardware required to achieve and maintain a baseline level of out-of-box scalable performance when deploying SQL Server data warehousing (SSDW) sequential data access workload scenarios versus traditional random I/O methods.

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The reference architecture provides specific details about the configuration and bill of materials for a variety of Fast Track configurations, based on a ProLiant DL380p Gen8 server and HP MSA 2040 SAN storage running on Microsoft Windows Server 2012.

Note
For more information about the HP 85 TB reference architectures for Microsoft SQL Server 2012 Fast Track Data Warehouse, scan this QR code or right-click it and open the hyperlink:

Other reference architectures available as PDF documents at the ActiveAnswers website include:

- HP Reference Architecture for Cloudera Enterprise 5 on ProLiant DL Servers
- HP Reference Architecture for MapR M7 on HP ProLiant SL4540 Gen8 Servers
- HP Reference Architecture for Hortonworks Data Platform on HP ProLiant SL4540 Gen8 Servers
- HP Reference Architecture for Cloudera Enterprise on HP ProLiant SL4540 Gen8 Servers

HP Reference Architectures portal

To access the HP Reference Architectures portal, scan this QR code or right-click it and open the hyperlink:

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Learning check

Your facilitator will lead a class discussion to capture key insights and challenges from this section of the module. To prepare for the discussion, answer the following questions about reference architectures. Record your answers here and be prepared to share them with the group.

1. Name the three distributions of Apache Hadoop for which HP offers reference architectures.

2. What are the benefits of a Hadoop reference architecture? (List at least four points.)

3. On which platforms are HP reference architectures for Apache Hadoop designed?

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Summary

In this module, you learned that reference architectures from HP help customers design and build the type of converged infrastructure, Helion CloudSystem, or client virtualization platform that meets their requirements. HP also makes available Hadoop reference architectures for ProLiant SL4540 servers.

After you analyze a customer's business and IT requirements, you can recommend a reference architecture as a possible solution. You can also use the reference architecture configuration as a vehicle to discuss in more detail the technologies and services available from HP.

Just as you can buy a house pre-built, customers can buy a packaged system from HP, such as Helion CloudSystem built on ConvergedSystem 700x or ConvergedSystem for client virtualization. HP gives customers the choices they need on their journey to the cloud.

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HP Helion CloudSystem 8 Architecture

Module 4

What's in this module for you?

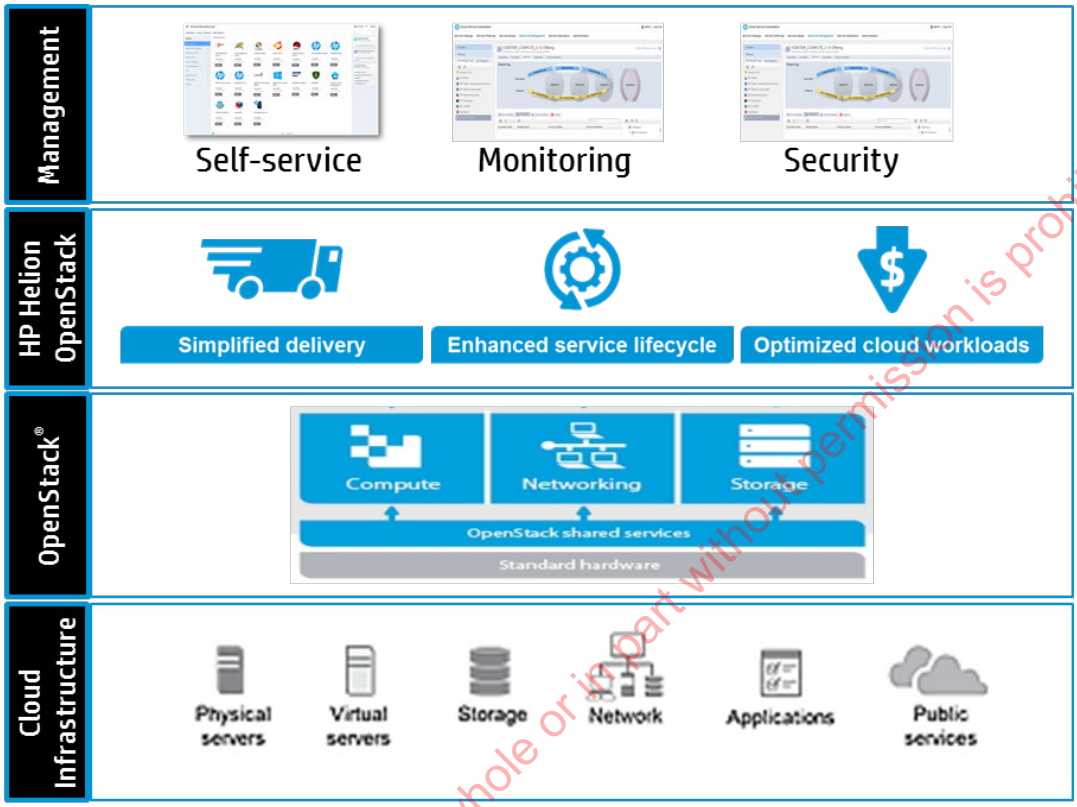
After you have completed this module, you should be able to:

- Articulate the business value of the common HP Helion architecture
- Highlight the main HP Helion CloudSystem 8 Foundation features
- Draw and explain the HP Helion CloudSystem 8 architecture

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Common HP Helion architecture



HP made a strategic decision to use OpenStack as an important foundational component of the HP Helion CloudSystem architecture. OpenStack provides the cloud run-time environment to support portability of services and a common extension or plug-in model for HP and any vendor to add value to OpenStack.

The HP Helion CloudSystem architecture is designed to be open at every layer of a cloud solution regardless of the delivery model chosen or whether a hybrid delivery model is required.

HP Helion CloudSystem Enterprise and HP Helion CloudSystem Foundation are separate virtual appliances. However, all appliance management tasks are performed through the CSA Cloud Service Management Console and the OpenStack functionality included in Foundation is available to Enterprise.

To account for the operation of the Foundation software underlying Enterprise, consider the maximum supported configuration for Foundation appliance when planning an Enterprise cloud.

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Architecture components

The main components are:

- **Portal**—A common cloud consumption experience across delivery models or cloud platforms.
- **HP Cloud Management, Security, and Developer tools**—Integrated and modern application life cycle management tools for cloud-based application development.
- **HP Helion OpenStack**—A single, common, standards-based architecture with a natural extension model that can support all delivery models and offerings.
- **OpenStack**—HP believes that OpenStack is the most mature and most open choice for delivering on customer-driven cloud use cases.
- **Cloud Infrastructure**—Cloud-ready compute, storage, and network resources.

Atlas is the foundation for the Converged Infrastructure appliances, the substrate on which programs such as HP Insight Control server provisioning (ICsp), HP OneView, and HP Helion CloudSystem are built. It encapsulates all that should be common or consistent between the Converged Infrastructure appliances, including the appliance platform itself, guidelines for consistent behavior, and a set of common services.

Atlas provides a customized operating system instance, with installation and support mechanisms, on which Converged Infrastructure software stacks can run. This operating system instance is closed and hardened in order to present a “black box” appliance view to users.

	Business value	Solution examples
Management	▪ Leverage of existing IT process and technology ▪ Self-service ▪ Converged management and security	▪ HP Cloud Service Automation ▪ HP Performance Anywhere ▪ HP ArcSight Logger
HP Helion OpenStack	▪ Simplified cloud management ▪ Workload portability ▪ Hybrid delivery	▪ OpenStack Installation and Configuration Management ▪ Standards–based modeling ▪ Multi-cloud provider support
OpenStack	▪ No vendor lock-in ▪ Portability of workload ▪ Leverage of community	▪ Havana (Nova bare-metal) plug-in ▪ Neutron/networking (SDN) ▪ Leading TripleO installation initiative
Cloud infrastructure	▪ Differentiated Infrastructure ▪ Workload specific resources ▪ Leverage existing investment	▪ HP 3PAR ▪ HP Moonshot (bare-metal) ▪ HP Helion CloudSystem

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Infrastructure-as-a-Service controller

The Infrastructure as a Service (IaaS) controller was designed by HP to make HP Insight Software easier to use by handling virtualization, orchestration, and other advanced features. It was designed to work with the Converged Infrastructure Controller, which handles Virtual Connect and physical resource management. The two controllers share a software infrastructure, such as logging, task management, authentication, and other similar areas, which resulted in foundational services for Converged Infrastructure appliances.

The IaaS controller provides a bridge between cloud delivery models so that it is easier to transition from the management of physical and virtualized services to true cloud delivery models.

Six or more products are based on these complementary controllers:

- **HP Cloud Maps**—Development of new cloud service offerings for HP Helion CloudSystem in less than an hour with Cloud Maps
- **HP Server Automation**—Enterprise server lifecycle automation of tasks such as provisioning, patching, configuration and compliance
- **HP Database and Middleware Automation (DMA)**—Automation of time-consuming manual administrative tasks lowers costs, improves efficiency and enables scaling
- **HP Asset Manager**—IT asset management across the lifecycle with policy enforcement, multi-source support and analytics
- **HP SiteScope**—Remote monitoring of IT infrastructure and applications without installing any software on target systems

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Learning check

1. All OpenStack functionality included in Foundation is available to Enterprise.
   - ☐ True
   - ☐ False
2. List the benefits of HP Helion OpenStack that provide business value.

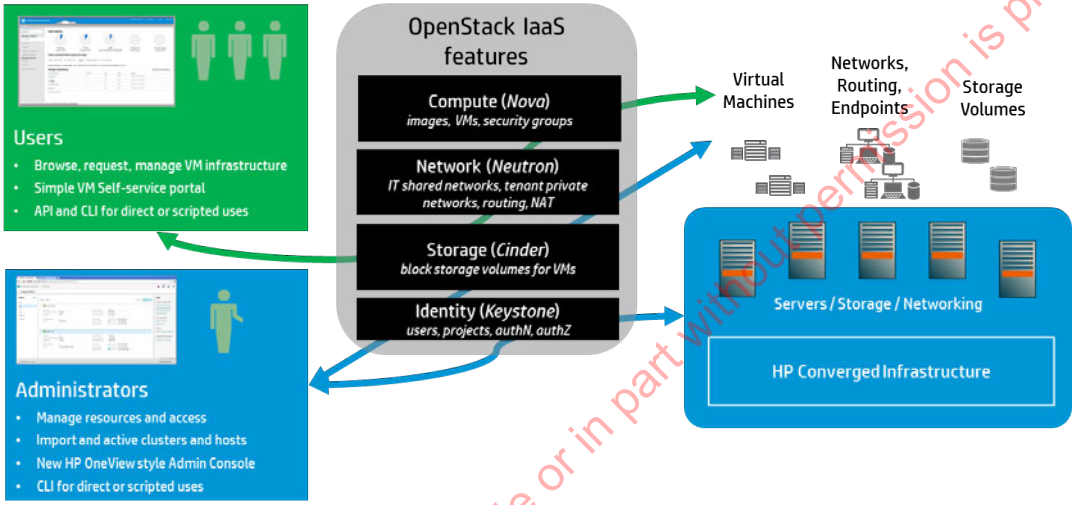
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HP Helion CloudSystem 8 Foundation-specific features

This section covers features that are specific to HP Helion CloudSystem 8 Foundation. Features specific to HP Helion CloudSystem 8 Enterprise are covered in the HP Helion CloudSystem 8 Enterprise module.

HP Helion CloudSystem 8 Foundation



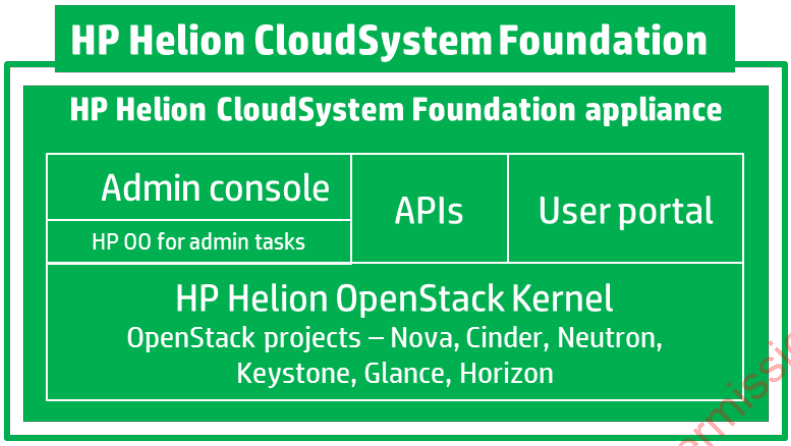
Helion CloudSystem Foundation is based on the HP Helion OpenStack distribution of OpenStack cloud software. It integrates hardware and software to deliver core IaaS provisioning and lifecycle management of compute, network, and storage resources.

Customers can manage Helion CloudSystem Foundation from an administrative console, self-service portal, command-line interfaces (CLIs), and OpenStack APIs. It provides an appliance-based deployment console to simplify installation and maintenance, and an embedded version of HP Operations Orchestration (OO) for automating administrative processes.

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HP Helion CloudSystem 8 Foundation components



Helion CloudSystem Foundation is the platform that you use to manage Foundation and Enterprise appliances. Foundation includes the following components, which run on virtual machine (VM) appliances on the management cluster or hypervisor:

- **Admin console (CloudSystem Console)**—Web-based user interface for administrative tasks, including managing and monitoring the cloud and releasing resources back to the cloud. From the console, you can activate compute nodes, configure networks and storage, and perform maintenance tasks on the Foundation and Enterprise appliances.
- **User/consumer portal (CloudSystem Portal)**—Web-based interface for creating, launching, and managing VM instances. The portal can be accessed by appending /portal to the Foundation appliance URL (for example, `https://192.0.2.2/portal`).
- **HP Operations Orchestration**—Operations Orchestration Central automates operational tasks and processes using a set of predefined workflows. OO Central is packaged with the Foundation appliance and is launched from the Integrated Tools screen in the CloudSystem Console. Enterprise integrates with OO Central to support pre- and post-server group provisioning.

  Operations Orchestration Studio is an optional tool for customizing workflows, which is installed separately. The OO Studio installation files are included with the Helion CloudSystem installation tar files.
- **Command-line interface (CLI)**
  - **csadmin**—Provides command line access for storage system administrative tasks, private network VLAN management tasks, appliance management tasks, and console user management tasks.
  - **csstart**—Deploys and configures the Foundation base appliance on the management cluster or hypervisor. For a friendlier user experience, launch the csstart GUI; or you can run csstart from the command line.

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HP Helion CloudSystem 8 Foundation tasks

Helion CloudSystem Foundation tasks include the virtualized resources that you can configure and manage in Helion CloudSystem Foundation:

- **Add a Provider Network**—A Provider Network is part of the Cloud Data Trunk, which is the physical network hosting the VLANs that OpenStack networking makes available to users. The Cloud Data Trunk provides communication for compute nodes and virtual machine instances.
- **Add one or more images**—An image is a template for a virtual machine file system. It contains information about the operating system to provision to a virtual machine instance.
- **Add a block storage driver**—A block storage driver defines the characteristics of the volume type that is created for storage systems. Drivers deliver technology or vendor-specific implementations for the OpenStack Block Storage (Cinder) functionality. Helion CloudSystem supports the HP 3PAR Fibre Channel, direct-attach, and iSCSI drivers. These drivers require connectivity to the management console of a supported HP 3PAR storage system.
- **Add volume types**—A volume type describes the characteristics of a class of volumes that can be selectable by a cloud user. For the HP 3PAR drivers, each volume type is associated to a block storage driver and a common provisioning group (CPG). When you create volume types, the type of driver along with other specified storage parameters help define the provisioning characteristics of the storage volumes. This provides a template that cloud users can use to create volumes. The hypervisor type (Linux KVM or VMware ESX) is also defined in the volume type.
- **Verify or add flavors**—Flavors define the size of compute resources (number of virtual CPUs, memory and ephemeral storage capacity) that can be assigned automatically to virtual machines.
- **Create compute nodes**—You create and manage ESX compute hosts in VMware vCenter Server. All compute hosts are configured as clusters, which can then be imported into Helion CloudSystem.

  You create KVM compute nodes on KVM hosts. After a KVM compute node is created, it appears on the Compute Node screen in the CloudSystem Console with an Unknown status, meaning it is not yet activated.
- **Import ESX clusters**—Helion CloudSystem retrieves information about an ESX cluster when you import it. The cluster is added to the Compute Nodes overview screen in an Unknown state, meaning it is not yet activated.
- **Activate a compute node**—The ESX cluster or KVM compute nodes must already be visible in the CloudSystem Console. Activating a KVM compute node installs OpenStack agents on the compute node. (Activating an ESX cluster does not install any software.) After activation, the ESX clusters or KVM compute nodes are ready to serve as targets for resource provisioning.

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HP Helion CloudSystem 8 Foundation—Compute features

A compute node provides the ephemeral storage, networking, memory, and processing resources that can be consumed by virtual machine instances. Compute nodes manage the resources required to run instances in the cloud.

Helion CloudSystem supports two types of compute nodes:

- **ESX clusters**—Clusters are created in VMware vCenter Server. When the vCenter Server is registered and configured in the CloudSystem Console, clusters can be imported from vCenter Server and activated in the cloud.

  You create and manage ESX compute hosts in vCenter Server. All compute hosts are configured as clusters and must be imported into Helion CloudSystem. After import, you can activate clusters and create instances that consume the resources.

- **KVM compute nodes**—KVM compute nodes are created manually. After the nose is created, the Cloud Management Network enables the CloudSystem Console to see the KVM compute nodes. When the CloudSystem Console detects a compute node, it is automatically added to the Compute Nodes screen in an Unknown status.

  You create KVM compute nodes on KVM hosts. After a compute node is created, the Data Center Management Network allows Helion CloudSystem to see the compute node. The compute node displays on the Compute Nodes overview screen in an Unknown status, meaning it is not yet activated. After activating the compute node, you can create instances that consume the resources.

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ESX clusters with OpenStack vCenter driver and HP value-added manageability

- Consumption
  - Create and delete VM instances
  - Start, stop, reboot VM instances
  - Customize VM instances on first boot
  - Attach and detach volumes to VM instances
  - Attach and detach networks to VM instances
  - Assign security groups to VM instances
  - Manage images
- Management
  - Register vCenter, register vCNS
  - Import, activate, and deactivate clusters
  - Auto-deploy proxy VM appliances to run OpenStack agents
  - Monitor inventory, health, and performance of hosts
  - Manage images and flavors (VM types)

KVM hosts with OpenStack KVM driver and HP value-added manageability

- Consumption
  - Create and delete VM instances
  - Start, stop, reboot VM instances
  - Customize VM instances on first boot
  - Attach and detach volumes to VM instances
  - Attach and detach networks to VM instances
  - Assign security groups to VM instances
  - Manage images
- Management
  - Auto-discover, activate, deactivate hosts
  - Auto-configure hosts to run OpenStack agents
  - Monitor inventory, health, and performance of hosts
  - Manage images and flavors (VM types)

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HP Helion CloudSystem 8 Foundation—Networking and storage features

A block storage driver and a volume type must be defined before creating a volume in the CloudSystem Portal. The CloudSystem Console enables you to view the status of the volumes and to delete volumes that are detached from VM instances.

Block storage for VM built from HP 3PAR OpenStack driver for Fibre Channel and iSCSI

- Consumption
  - Create/manage block storage volumes
  - Snapshot VM to block storage volume
  - Attach block volumes to VMs as data disks
  - Attach block volumes to VMs as boot disks
  - Maintain block volumes for future use with VMs
- Management
  - Configure Cinder 3PAR driver
  - Create/manage Cinder volume types

VLAN-based shared and tenant private networking built from HP SDN technology

- Consumption
  - Create VMs and connect to networks (subnets)
  - Connect with private or routed (network address translation [NAT]) connectivity
  - Modify VM network connections
  - Create/manage security groups (port filtering)
  - Assign security groups to VMs
- Management
  - Create/manage L2 networks
  - Assign VLAN's to networks
  - Create/manage L3 subnets
  - Create/manage L3 routers (NAT gateways)
  - Create/manage IP addresses

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Networks in Helion CloudSystem Foundation

The underlying network infrastructure in Helion CloudSystem Foundation is managed by a Software Defined Networking (SDN) appliance. Multiple network node appliances manage network services, such as DHCP and routing. A vCenter proxy appliance runs the OpenStack agents for use. All of these virtual appliances to support networking are automatically created when Helion CloudSystem Foundation is configured. You can use the CLI to access and manage these appliances.

Helion CloudSystem Foundation uses three types of networks:

- Private networks are restricted and can be accessed only by virtual machine instances assigned to the network.
- Provider networks are shared networks in the data center on which users can provision any number of virtual machine instances.
- The external network allows you to route virtual machine instances on private networks out from the Helion CloudSystem private cloud to the data center, the corporate intranet, or the Internet.

HP Helion Public Cloud Networking

HP Helion Public Cloud Networking, based on OpenStack Networking, provides a broad spectrum of functionality to define and configure virtual networks. OpenStack Networking enables you to manage networks and IP addresses. It ensures that the network will not be the bottleneck or limiting factor in a cloud deployment and gives users real self-service, even over their network configurations.

Helion Public Cloud Networking is a virtual network service that provides a powerful API to define the network connectivity and addressing used by devices from other services, such as Helion Public Cloud Compute. The Helion Public Cloud Networking API supports virtual network, subnet, router, and port abstractions to describe network resources.

A default Helion Public Cloud Networking configuration ships with Helion Public Cloud Compute Service activation. The network is ready to deploy Helion Public Cloud Compute virtual machines (instances) without further configuration required. The default configuration includes:

- A network
- A subnet
- A router connecting the subnet to the Internet
- A security group with basic server options

Users can configure rich network topologies by creating and configuring networks, subnets, ports, and routers. Other services such as Compute may be used to attach virtual devices to ports on these networks. In particular, Networking supports each tenant having multiple private networks, and allows tenants to choose their own IP addressing scheme, even if those IP addresses overlap with those used by other tenants. This enables advanced cloud networking use cases, such as building multi-tiered web applications and allowing applications to be migrated to the cloud without changing IP addresses.

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Network tasks and user roles

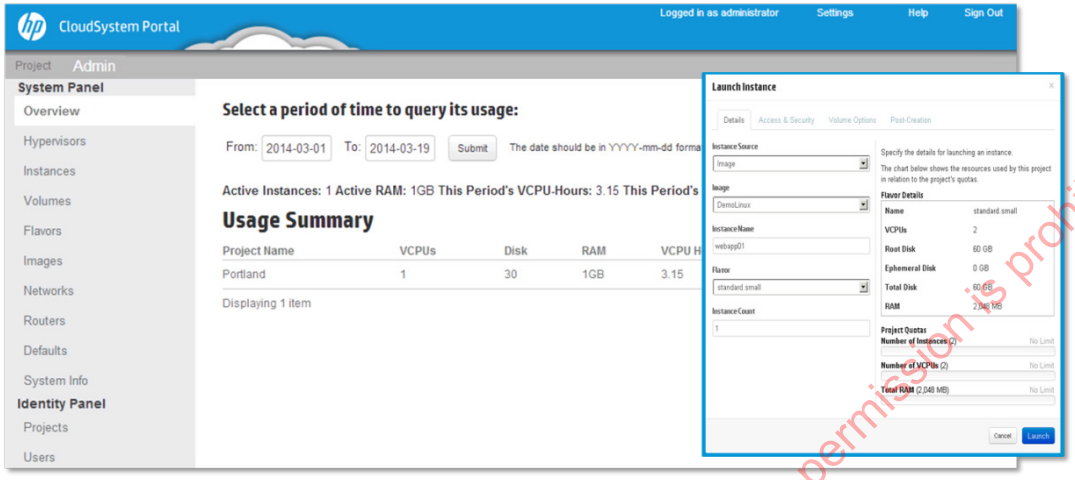
The following table lists Helion CloudSystem network tasks according to user roles and the interfaces used to perform them.

Task	User role	Interface
Create pools of VLAN IDs and VLAN ranges that can be assigned to private networks	Infrastructure administrator	CloudSystem Console
Create provider networks	Infrastructure administrator	CloudSystem Console
Complete the external network configuration	Infrastructure administrator	CloudSystem Portal
Customize network offerings using supported APIs	Infrastructure administrator	Foundation base appliance command line
Attach private networks to instances	Cloud user	CloudSystem Portal
Create routers to connect networks	Cloud user	CloudSystem Portal
Manage IP addresses using either dedicated, static IPs or DHCP	Cloud administrator	CloudSystem Portal
Access instances that are on private networks from outside of the cloud using floating IP addresses	Cloud user	CloudSystem Portal

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CloudSystem Portal



In many software applications, the interface for user operations is separate and distinct from the administrator console. That is not the case in OpenStack. Both user and administrator operations are available using the same interface. Separation is provided by login credentials--unprivileged users cannot view administrator settings and cannot perform administrator operations.

By default, the administrator belongs to the administrator project and can perform operations like any other user in a project. However, the administrator also has access to administrative operations in the Admin tab. For the Admin tab to be displayed, the current project must be the administrator project.

An administrator can belong to more than one project. When the administrator selects the administrator project in the Project tab, the Admin tab appears. When administrators select any other project they might belong to, the Admin tab is not shown.

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Cloud-ready images

An image is a VM that has some particulars removed so it can be injected and customized at instance creation. Cloud-ready image features include:

- Disk partitions can be resized
- No hard-coded MAC addresses
- SSH installed—access through public key
- Root account logins disabled
- Firewall disabled (OpenStack provides security)
- Processes user data and other metadata, including scripts
- Writes boot log to console
- Hardware definitions compatible with underlying hypervisor
- Supported guest of underlying hypervisor
- Cloud-init tools installed

Image formats supported in Helion CloudSystem are:

- Image format support
  - ESX—Flat and Sparse Virtual Machine Disk format (VMDK) image files with SCSI adapters are supported for VM guest provisioning on VMware ESX hypervisors. Other formats including compressed VMDK images, and IDE adapters, are not supported. If an image uses the Sparse VMDK format, you must set the required properties on the image using the OpenStack Glance CLI.

    Note
    See the OpenStack Configuration Reference at OpenStack Cloud Software for information about configuring VMware-based images for launching as VMs.

  - KVM—Quick EMUlator (QEMU) copy-on-write format (QCOW2) formatted image files are supported for VM provisioning on KVM hypervisors. Other formats are not supported.
- Image naming and single datastore support in VMware vCenter Server
  - Folders cannot be used to separate an additional set of Helion CloudSystem images that are uploaded to the vCenter Server.
  - Each set of Helion CloudSystem images must be in the same datastore in the vCenter Server. For example, if the Enterprise appliance image is added after the Foundation image, the Enterprise image must be uploaded to the same datastore as the running Foundation appliance, and it must have a unique name from other Enterprise appliances running in the same vCenter Server.

OpenStack Compute (Nova) uses a special metadata service to allow instances to retrieve specific instance data. Helion CloudSystem supports the OpenStack metadata API. The Amazon Elastic Compute Cloud (EC2)–compatible API is not supported.

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Learning check

1. HP Helion CloudSystem Foundation is a platform that manages Foundation and Enterprise appliances.

   ☐ True

   ☐ False

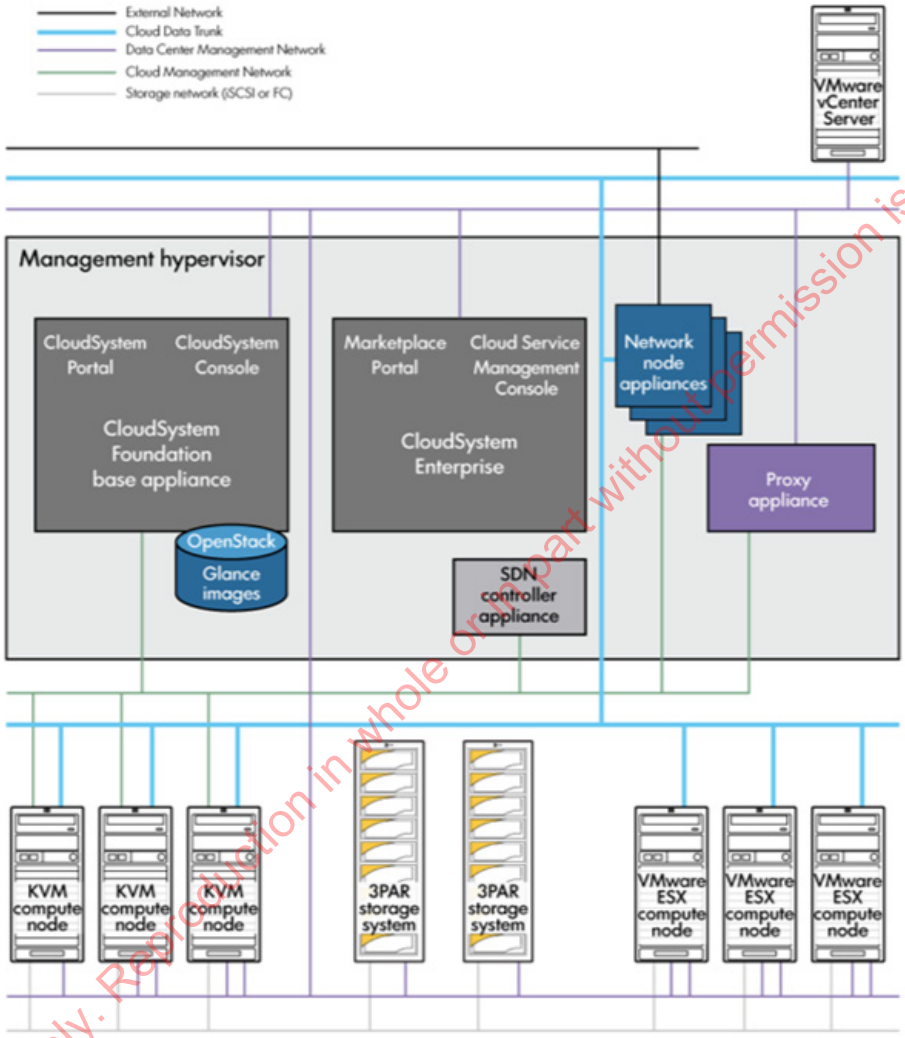
2. List the five Helion CloudSystem Foundation tasks that can be configured and managed in Helion CloudSystem Foundation.

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HP Helion CloudSystem 8 architecture

High-level Helion CloudSystem 8 architecture



The Helion CloudSystem Foundation base appliance includes a management console GUI and a web-based user portal that is built on OpenStack Horizon functionality. The base appliance includes the data store for Glance images that can be used to build the compute virtual machines. The installation of Helion CloudSystem Foundation also includes the SDN appliance, the network node appliances, and a vCenter Server proxy appliance.

From within the CloudSystem Console, you can install the Enterprise piece of Helion CloudSystem. Enterprise provides significant manageability and design tool extensions and cloud resource consumption from multiple providers through the HP Cloud Service Automation (CSA) Cloud Service Management Console. Access to these services is provided to users through the Marketplace Portal. After you install the Enterprise software, you can move between Foundation and Enterprise user interfaces to manage, provision, and deploy cloud services.

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Associated appliances

The following appliances are automatically created after the cloud networking settings are saved.

- **SDN appliance**—Manages the network infrastructure for the Helion CloudSystem.
- **Network node appliances**—Manage network services, such as DHCP and L3 (routing) services, for provisioned virtual machines and provisioned virtual networks. Three network node appliances are created when the cloud networking settings are saved.
- **Proxy appliance**—Acts as a communication mechanism between OpenStack technology and VMware vCenter Server, and runs the OpenStack agents for up to twelve clusters for each vCenter Server. Additional appliances are automatically created when the number of new clusters added to the cloud are reached. New proxy appliances are created with the first, 13th, and 25th cluster additions.

Note
The proxy appliance is created automatically after an ESX cluster is imported. (No proxy appliances are started in a KVM-only environment.)

Storage

Helion CloudSystem works with HP 3PAR StoreServ Storage, a cluster-based storage architecture that incorporates data management and fault tolerance technologies that can meet the storage needs of smaller sites and can be scaled for global organizations. 3PAR storage is required to create block storage for VM guests.

Storage for manually provisioned hypervisor hosts is more flexible, and can include local disks.

Virtual server storage

Virtual server storage connects the 3PAR storage system to VM instances. Options include:

- Fibre Channel storage area network (SAN), which provides block-level storage that can be accessed by the applications running on any networked servers
- Direct-Attach Fibre Channel Storage, a single-layer Fibre Channel storage network that eliminates SAN switches and host bus adapters (HBAs)
- iSCSI, which is block-level storage that uses traditional Ethernet network components for connectivity

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Physical servers

Servers running an ESX cluster or a KVM hypervisor can be used as a management cluster, a management hypervisor, or as compute clusters or nodes.

- Management cluster or hypervisor—Clustered or stand-alone hypervisors that host the virtual machine appliances that comprise the Helion CloudSystem solution. There are three possible configurations:
  - An ESX management cluster that hosts the virtual machines running Helion CloudSystem and its integrated tools.
  - A standalone ESX management hypervisor that hosts the virtual machines running Helion CloudSystem and its integrated tools.
  - A KVM management hypervisor that hosts the virtual machines running Helion CloudSystem software.
- Compute nodes—ESX clusters and KVM hosts that provide the pool of hypervisor resources used to provision virtual machine instances.

User authentication

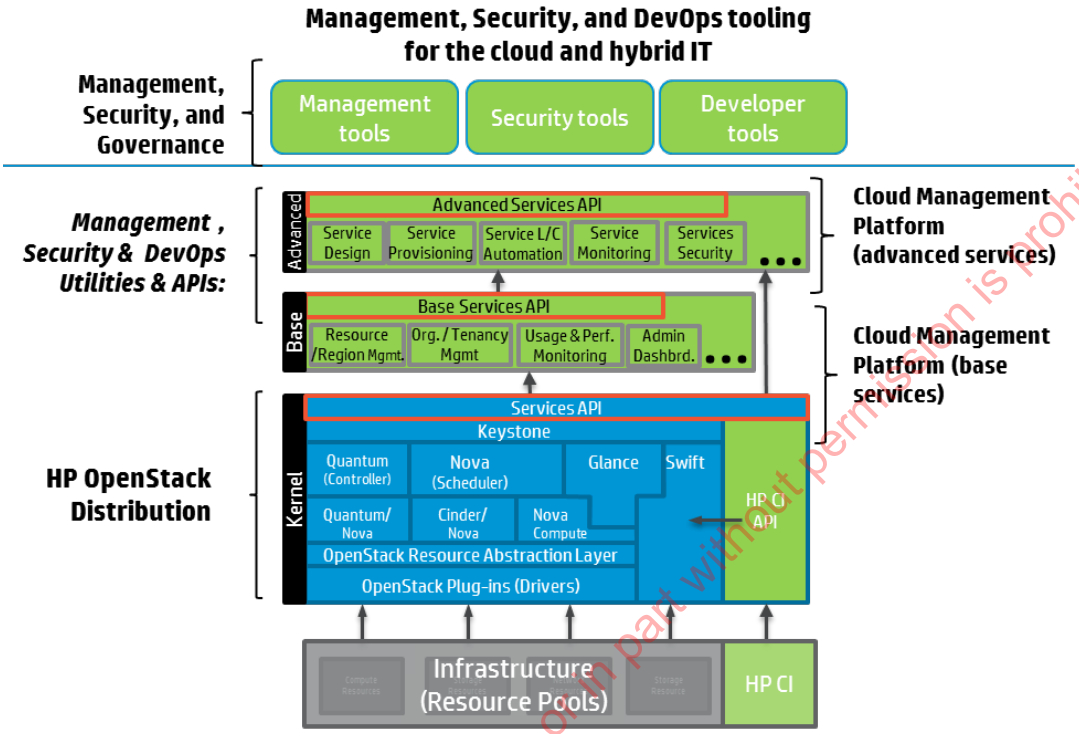
You can choose one of two methods of user authentication. If you use local logins, Helion CloudSystem provides local authentication for users authorized to access Helion CloudSystem. The infrastructure administrator enters user data, which is saved in the appliance database. When anyone tries to access the CloudSystem Console or Portal, the login information entered is checked against the user attributes stored in the database.

Alternatively, you can use an external authentication directory service (also called an *enterprise directory*) to provide a single sign-on (SSO) for groups of users instead of maintaining individual local login accounts. Examples of an authentication directory service include Microsoft Windows Active Directory or Open-Lightweight Directory Access Protocol LDAP (OpenLDAP).

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Detailed Helion CloudSystem 8 architecture



Based on OpenStack, Helion CloudSystem 8 provides the foundation for the common architecture across private, public, and hybrid cloud delivery. It is the world's first OpenStack based cloud technology platform for hybrid delivery.

The HP Helion OpenStack technology platform provides:

- **Simplified service delivery** with automated-live content distribution and easier installation and configuration processes. Manually intensive operational processes can be reduced from hundreds of steps over multiple packages to a simple, automated process.
- **Enhanced service life cycle management** with model-based infrastructure topology. Extensible administration and monitoring dashboards further allow you to streamline IT operations and lower operational risk and costs to allow automated deployment of applications on heterogeneous, hybrid cloud environments.
- **Optimized cloud workload** across cloud providers with "model once and provision anywhere" capability, combined with repeatable, consistent workload placement across diverse cloud deployment models, allows customers to optimally align workloads with resources and improve resource utilization.
- **Flexible and open architecture,** powered by OpenStack, provides an industry-leading, vendor-neutral, open source cloud architecture.

Note
In the graphic, OpenStack components are in green, and managed components are in blue. You might need to mark your copy.

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OpenStack services in HP Helion CloudSystem 8

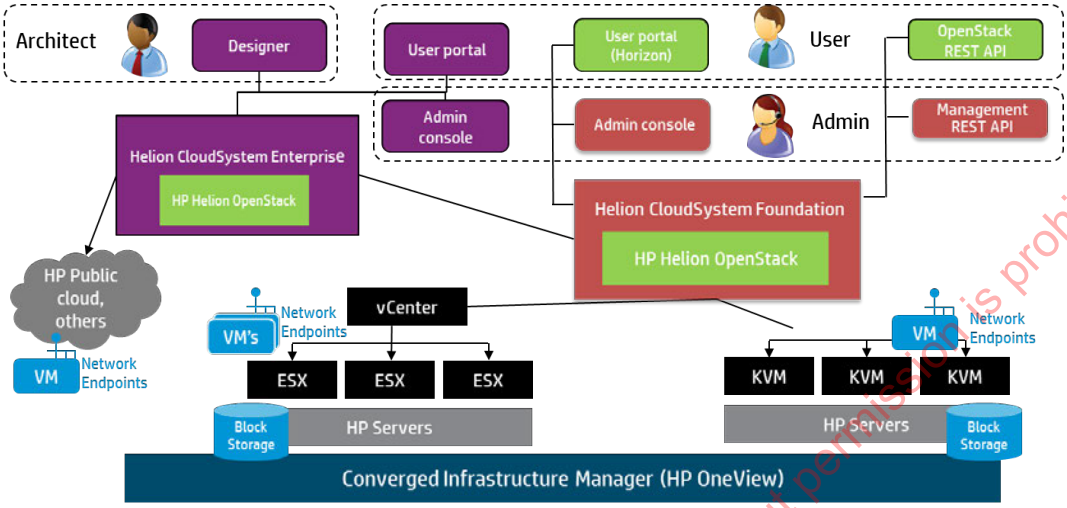
- CloudSystem 7.2—KVM private cloud
  - Keystone—Identity
  - Nova—Compute
  - Glance—Image
- Helion CloudSystem 8.0—HP Helion OpenStack and OpenStack Havana
  - Keystone
  - Nova
  - Glance
  - Horizon—Dashboard
  - Neutron (L2-L3)—Networking
  - Cinder—Block storage volumes
  - Eve—Infrastructure Topology Provisioning Service
  - Focus—Topology Design Registry and Repository Service
  - Graffiti—Resource Pool Registry and Capability Tagging Service

Note
- Helion CloudSystem 8.0 leverages OpenStack from HP Cloud OS
- Helion CloudSystem 8.0 and Cloud OS teams patch OpenStack into HP Cloud OS
- Cloud OS team feeds patches upstream to OpenStack

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User roles and component mapping



User roles enable you to assign permissions and privileges to users based on their job responsibilities. You can assign full privileges to a user, or you can assign a subset of permissions to view, create, edit, or remove resources managed by the Helion CloudSystem appliance.

An infrastructure administrator (Full role) created in the CloudSystem Console can view and manage all resources in the CloudSystem Console. Using the same username and password, the infrastructure administrator can log in to the CloudSystem Portal in the Admin role, with full access to the Administrator project.

A read-only user created in the CloudSystem Console can view all resources in the CloudSystem Console but cannot create, edit, or delete resources. A read-only user can log in to the CloudSystem Portal if the user is a member or admin of a non-Administrator project. A read-only user is not restricted to read-only privileges in the CloudSystem Portal. This user has either full member or full administrator privileges, depending on the user configuration in the CloudSystem Portal.

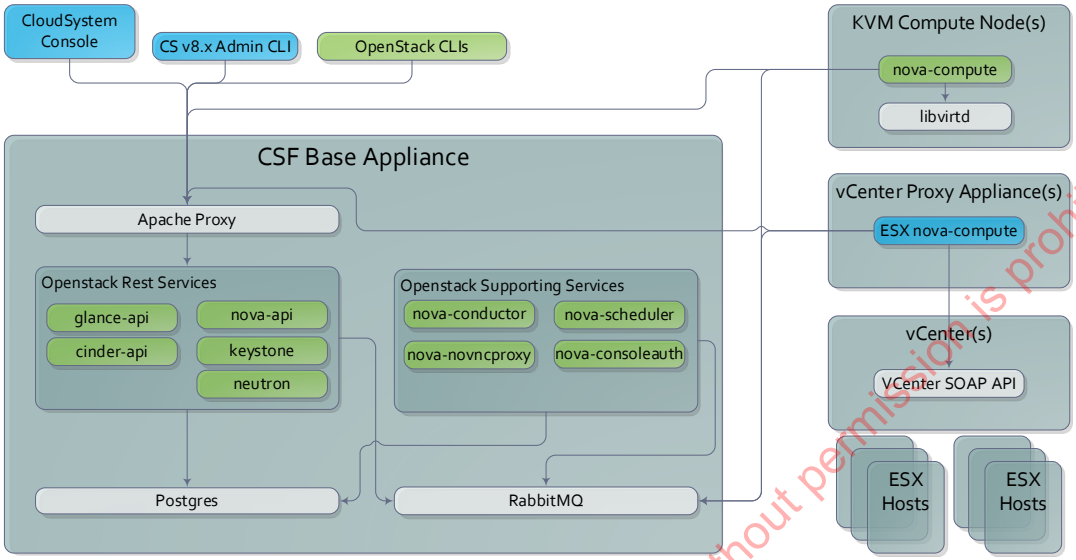
A cloud administrator is an administrative user who can view usage and manage instances, volumes, flavors, images, projects, users, services, and quotas. A cloud administrator created in the CloudSystem Portal can view and manage all resources in the CloudSystem Portal. A cloud administrator can log in to the CloudSystem Console only if that administrator has a user account in the CloudSystem Console.

Users can view and manage resources in the project to which they are assigned. A member created in the CloudSystem Portal can view all services available to them in the CloudSystem Portal and can create, edit, and delete resources provided by those services. The actions a member can perform on their cloud are a subset of the actions an administrator can perform. A member user can log in to the CloudSystem Console only if the user also has a user account in the CloudSystem Console.

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Compute management



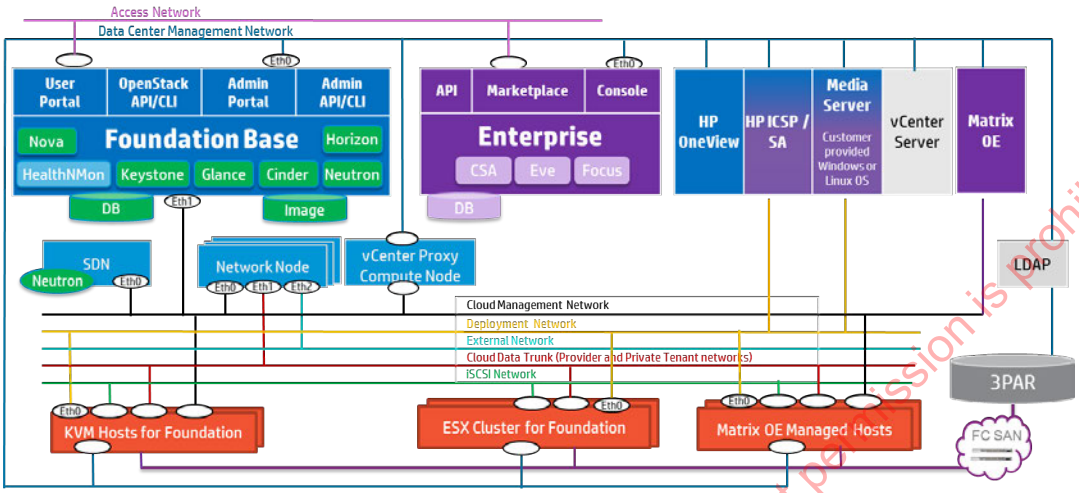
The base appliance includes the data store for Glance images that can be used to build the compute VMs. The installation of Helion CloudSystem Foundation also includes the SDN appliance, the network node appliances, and a vCenter Server proxy appliance.

The proxy appliance acts as a communication mechanism between OpenStack technology and VMware vCenter Server, and runs the OpenStack agents for up to 12 clusters for each vCenter Server. Additional appliances are automatically created when the number of new clusters added to the cloud are reached. New proxy appliances are created with the first, 13th, and 25th cluster additions.

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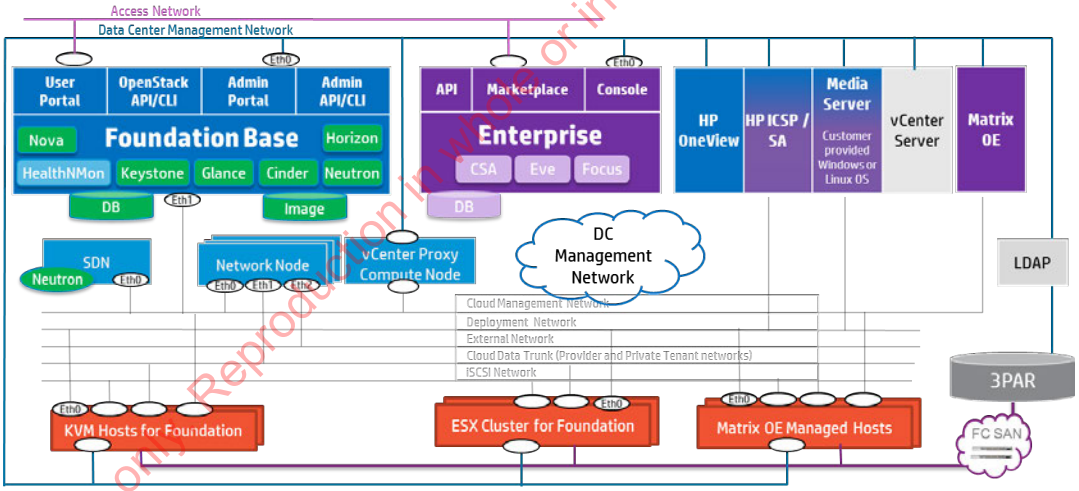
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Deployment networking architecture



The graphic illustrates the set of required and other common networks and systems in a Helion CloudSystem installation.

Data center network



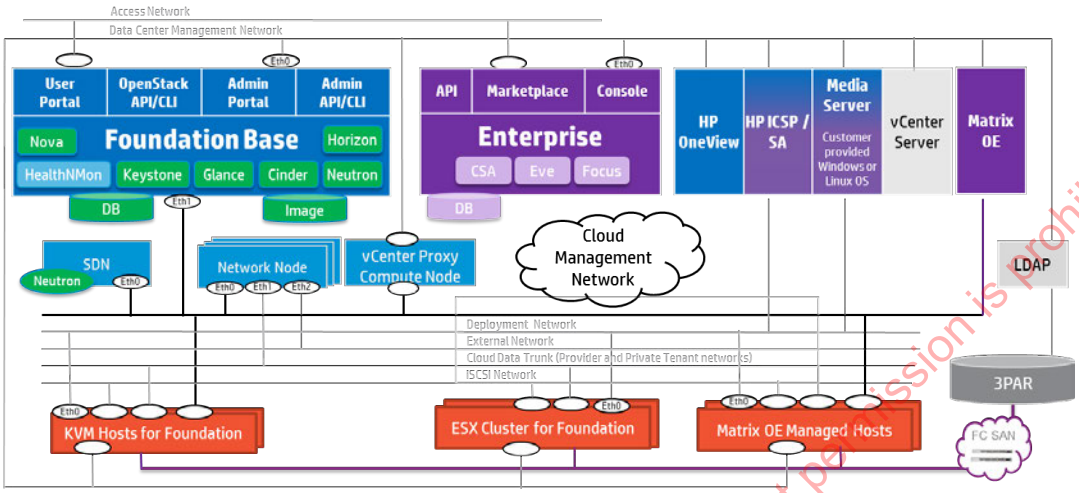
The data center network is for accessing and managing the infrastructure components that make up the cloud. This includes HP Onboard Administrators, OneView Server, ICsp, Matrix Operating Environment (OE), vCenter, 3PAR storage controllers, and compute host consoles.

The optional access network provides external access to the CloudSystem Portal and the Cloud Service Automation (CSA) Marketplace Portal.

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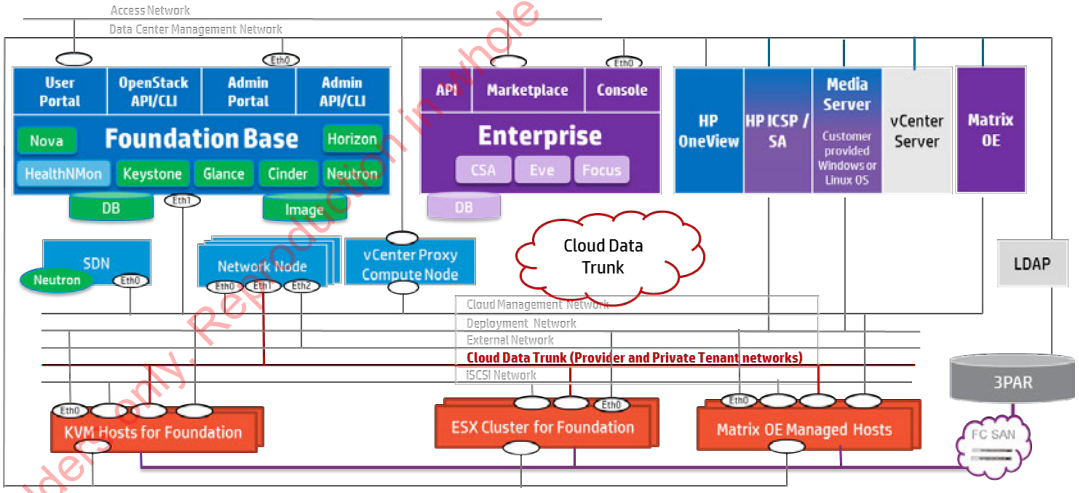
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Cloud management network



The cloud management network is used exclusively by Foundation to manage VMs and the appliance that supports VM creation and management. Helion CloudSystem provides DHCP services to appliances and compute nodes on this network.

Cloud data trunk



The cloud data trunk is for the provider and tenant networks.

A provider network is defined and provided by the cloud administrator. VMs can attach to such networks and are not guaranteed exclusive access to these networks. Provider networks are shared networks in the data center on which users can provision any number of VM instances.

Private networks are part of the cloud data trunk. A private network is defined only by a tenant. Such a network can be used by VMs, but is not routed. Any connection to outside the private network is provided by a tenant-defined router and a floating IP translated by NAT on an external network. Private networks are restricted and can be accessed only by VM instances assigned to the network.

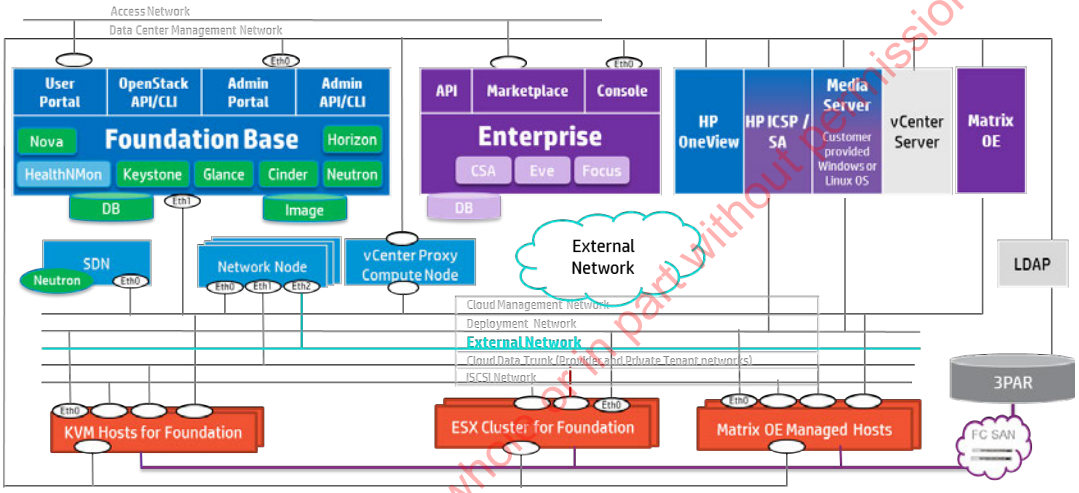
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Private networks are created from a pool of VLANs, which you configure using the CloudSystem Console. The OpenStack Networking service assigns VLANs from this pool to private networks when they are created by users using the CloudSystem Portal.

Users create private networks to associate with their provisioned virtual machine instances. Users can assign private networks to virtual machine instances during virtual machine provisioning. Users create individual private networks using VLANs that you identify for that purpose. Therefore, each private network is shared exclusively among members of a given project.

External network



The external network allows you to route virtual machine instances on private networks out from the Helion CloudSystem private cloud to the data center, the corporate intranet, and the internet.

One external network is automatically created during Helion CloudSystem Foundation installation. Virtual machines are not directly attached to the External Network. Internal provider and private networks connect directly to virtual machine instances. The external network connects to network nodes.

After installation, you can use the features in the CloudSystem Portal to enable use of the external network for accessing VM instances on cloud networks. You create a subnet for the external network. Cloud users can then create routers to connect the external network to private networks for their projects. Traffic from the external network is routed to selected virtual machines inside the cloud using floating IP addresses.

Because a single subnet is allowed for the external network, you should configure one that is large enough to accommodate future expansion.

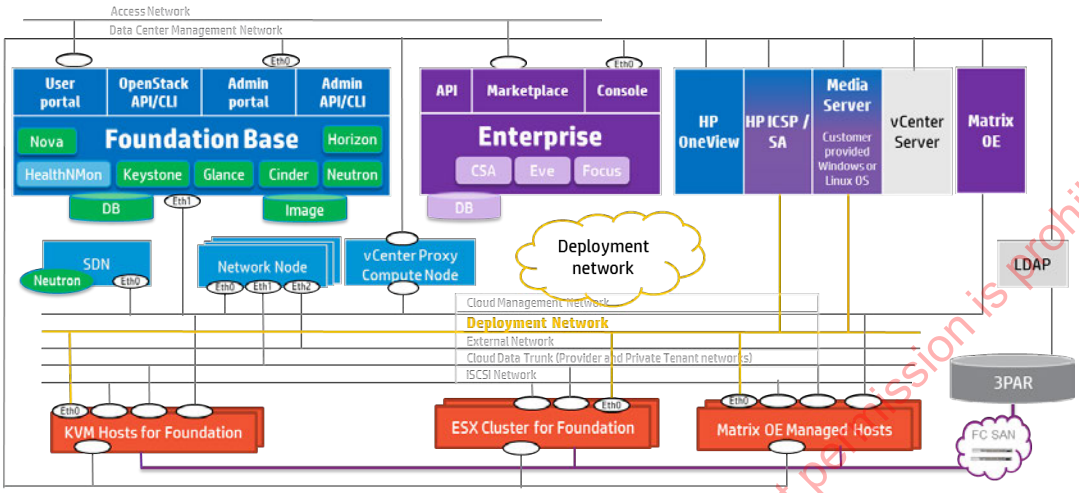
In Helion CloudSystem, you can identify a data center network as the external network. This external network has a special significance in Helion CloudSystem; it allows you to route virtual machine instances on Private networks out from the Helion CloudSystem private cloud to the data center, the corporate intranet, or the Internet.

At most, one external network can be configured in Helion CloudSystem.

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Deployment network

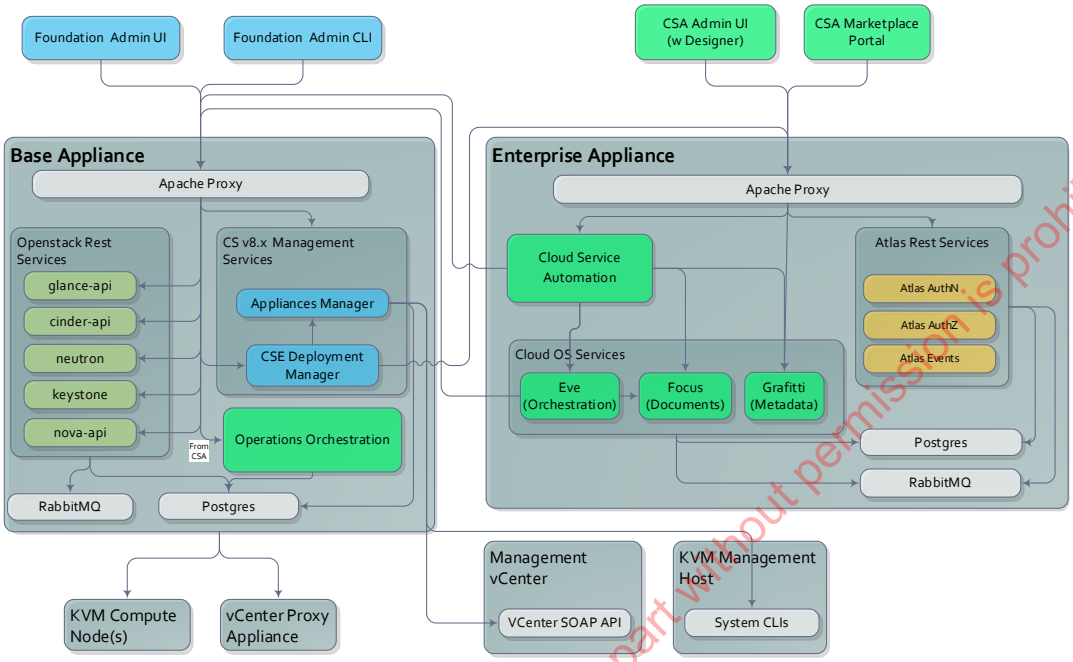


A deployment network can be configured in the environment for Insight Control server provisioning of compute nodes. This network is not used by Helion CloudSystem.

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Helion CloudSystem 8 Enterprise architecture



Eve is the HP Infrastructure Topology Provisioning Service. It is designed to:

- Provision infrastructure topology templates based on OASIS Topology and Orchestration Specification for Cloud Applications (TOSCA) (composite, hybrid, and distributed).
- Separate template creation and resource pool binding, for simpler, reusable templates.
- Integrate via a plug-in model with Cloud APIs (such as OpenStack Nova) for orchestrating provisioning.
- Create and configure network services such as virtual load balancers.

Focus is the HP Topology Template Registry and Repository Service. It provides for persistent storage and management of TOSCA-based templates. It is designed to:

- Search for documents based on criteria
- Store new documents
- Retrieve a version of an existing document
- Update the contents and metadata of a document
- Delete a document or a specific document version

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HP Graffiti is the Resource Pool Registry and Capability Tagging Service. It is designed to provide:

- A dictionary of the capabilities of all the resources in a cloud environment
- A searchable directory to find cloud resources based on their capabilities
- The mechanism for dynamic binding, allowing you to describe requirements rather than concrete bindings
- The base concepts of requirements and capabilities within TOSCA

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Learning check

1. Who/what defines a private network?
   a. Database
   b. Repository
   c. Tenant
   d. Network
2. Which user role is allowed to attach private networks to instances, and which interface would be used to do this?
   a. Infrastructure administrator, CloudSystem Console
   b. Cloud user, CloudSystem Console Instance
   c. Cloud user, CloudSystem Portal
   d. Cloud administrator, Foundation base appliance command line

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Summary

As a foundational component of the HP Helion CloudSystem architecture, OpenStack supports the portability of services and the common extension or plug-in model that allows any vendor to add value to OpenStack. This means that the HP Helion CloudSystem architecture is open at every layer, even if a hybrid delivery model is required.

HP Helion CloudSystem Foundation, which is based on the HP Helion OpenStack distribution of OpenStack Cloud Software, delivers core IaaS provisioning and lifecycle management of compute, network, and storage resources, and it can be managed from a number of interfaces, including an administrative console, self-service portal, CLIs, and OpenStack APIs.

The Helion CloudSystem Foundation base appliance's end-user portal is built on OpenStack Horizon functionality and it includes the data store for Glance images that can be used to build the compute virtual machines. The installation of Helion CloudSystem Foundation also includes the OpenStack SDN appliance, the network node appliances, and a vCenter Server proxy appliance.

The CloudSystem Console allows customers to install the Enterprise component of Helion CloudSystem, which provides significant manageability and design tool extensions and hybrid cloud. Access to these services is provided to users through the Marketplace Portal. After installing the Enterprise software, customers can move between Foundation and Enterprise user interfaces to manage, provision, and deploy cloud services.

Based on OpenStack, HP Helion CloudSystem 8 provides the foundation for the Converged Cloud common architecture across private, public, and hybrid cloud delivery. It is the world's first OpenStack based cloud technology platform for hybrid delivery.

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Additional resources

The latest versions of HP Helion CloudSystem manuals and white papers can be downloaded from the Enterprise Information Library, including the following documents:

- HP Helion CloudSystem 8.0 Release Notes
- HP Helion CloudSystem 8.0 Installation and Configuration Guide
- HP Helion CloudSystem 8.0 Administrator Guide
- HP Helion CloudSystem Help
- HP CSA Concepts Guide
- HP CSA Release Notes
- HP CSA API Quick Start Guide
- HP CSA Troubleshooting
- HP CSA API Reference
- HP CSA Documentation List
- HP Operations Orchestration Concepts
- HP Operations Orchestration Central User Guide
- HP Operations Orchestration Application Program Interface (API) Guide
- HP Helion CloudSystem Foundation and Enterprise Software 8.0: Recommended Backup and Restore Procedures

Online help for the admin console is available by clicking the help control button in the console GUI.

INTERNET To access the Helion CloudSystem Information Library, scan this QR code or right-click it and open the hyperlink:

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Implementing the Plan
Module 5

What's in this module for you?

After completing this module, you should be able to:

- Match HP solutions to customer requirements for moving forward to cloud solutions
- Explain how to use HP OneView to manage a HP Converged Infrastructure and Cloud environment
- Name the appropriate HP consulting and support services for HP Converged Infrastructure and cloud solutions

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First steps for moving forward

The first step for many customers on a journey to cloud is to focus on a self-service infrastructure and private cloud infrastructure as a service (IaaS). In many cases, these customers focus first on non-production workloads, with the majority focused on development and test environments. This initial focus on the IT organization has multiple benefits, including drastically compressing the time it takes to provide access to development and test environments. The traditional approach would frequently take several months from the initial idea to the development environment being brought online, whereas in an IaaS environment, this can happen in minutes.

A self-service infrastructure provides a path into self-service applications, where the broader organization (beyond IT) can realize the benefits of software as a service (SaaS), including self-service, pay-as-you-go, and accelerated access to services within their internal (or private) environment.

Finally, customers reach a point where they would like to exploit cloud services, not only internally across the service and deployment model spectrums, but also sourcing external services from the public domain. They would like to become service brokers in this hybrid environment, creating a seamless experience across private and public domains.

Legacy workloads and applications must be moved to the cloud. This might simply be a re-hosting exercise but it might require application modernization, which would mean replacing applications. This step must be undertaken cautiously, because it introduces challenges in moving the data.

All these steps along the journey to cloud move the customer forward toward IT transformation. HP offers solutions that meet customer needs today while laying the groundwork for what is next.

In addition, customers have different needs regarding how cloud services are consumed and funded. Some customers favor using capital expenditures (CapEx) to build their own solutions, and others prefer to use operational expenditures (OpEx) to fund the consumption of services provided by someone else. For the former group of customers, HP provides Helion CloudSystem and Cloud Service Automation (software only) solutions; for the latter, HP provides managed services and public cloud options.

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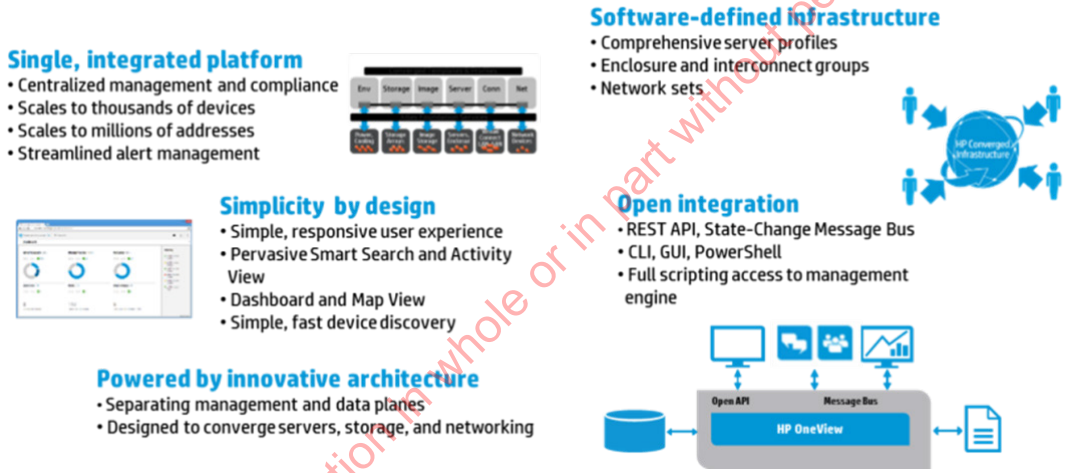
Moving toward infrastructure convergence and cloud

The cloud offers the promise of a new style of IT. But the cloud can only deliver on that promise if it is part of a well-coordinated effort that leverages both existing IT infrastructure and new technologies. Customers can move toward infrastructure convergence with HP solutions and technologies, and leverage an HP Converged Infrastructure to move toward the cloud at their own pace.

HP provides two solutions to manage a Converged Infrastructure:

- HP OneView management software
- HP Insight Control server provisioning (ICsp)

HP OneView—The Converged Infrastructure management platform



HP OneView is an innovative technology that is the industry's first converged infrastructure management platform. With HP OneView, basic tasks take seconds and stay simple at any scale, radically accelerating all data center processes.

OneView provides one view of the server, network, and storage environment. It features elements that map to the steps along the journey to cloud. HP OneView offers:

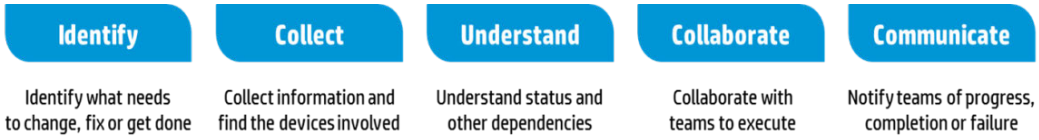
- A single integrated platform
- A simple, integrated user experience
- Software-defined infrastructure
- Open integration

OneView is available as a virtual and physical appliance. From the HP OneView management platform, you can use profiles and templates to automate configuration of key server, storage, and network resources. Its user interface streamlines the number of steps required to accomplish key tasks. It also offers a RESTful application programming interface (API).

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Data center processes are built on five common tasks



OneView consolidates five common data center tasks. In addition, OneView:

- Creates a modern and integrated workspace for lifecycle management of an HP Converged Infrastructure
- Helps organizations close the IT management gap
- Shifts focus from “how devices run” to “how people work”

OneView elements map to the same common data center tasks



The elements that comprise OneView include these common data center tasks:

- Dashboard capacity and health at your fingertips
- Smart Search to find what you want instantly
- Map View for visualizing relationships between devices
- Templates to design once, deploy on demand
- Activity feed to receive alerts and messages instantly

The tools that traditionally have been used map the task of identifying and tracking an issue overwhelm the user with information. To simplify this, HP has looked at the best mobile applications and how they summarized massive amounts of information in a single view. From that, the HP OneView Dashboard was created.

Through Dashboard, the customer can assess what is happening across the entire data center in seconds. Whether you have 20 devices or 20,000, the view is equally simple and you are just one click away from more detail.

To help find key information in milliseconds versus hunting through offline records, HP created Smart Search. Smart Search is built into almost every task so you have immediate access to the event device, or task information you need.

In a converged environment, understanding relationships between devices and connections is critical, especially for change management or troubleshooting. HP Map View combines device status with relationships so you can understand how things are connected from the data center down to the device helping you quickly find, triage, and fix problems in seconds or minutes.

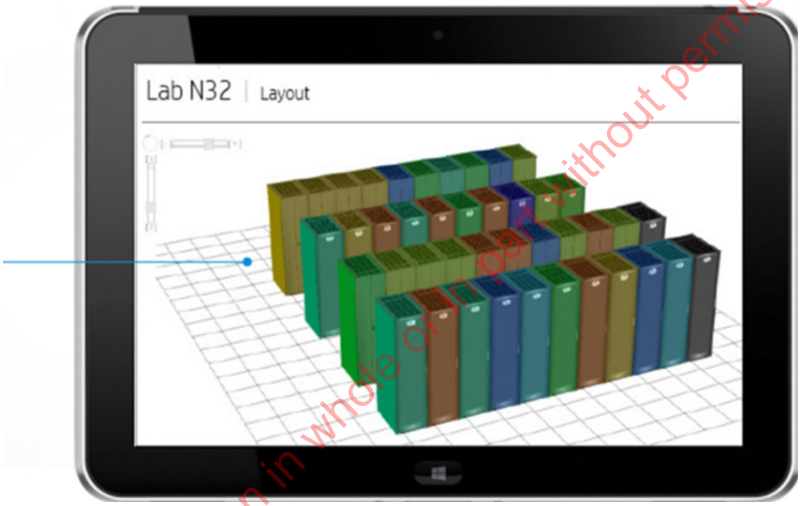
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Collaboration is a common task, and for 20 years, IT tools have been built for silos and did nothing to foster collaboration, which is a critical requirement for convergence. With templates, IT teams can work together to create profiles of configurations and procedures. Any configuration or process can now be designed by the experts and captured in software for later use by everyone.

Most communications between teams happen outside of the tool versus inside. Just like Facebook or Twitter helps you keep track of daily events, friends, and family, Activity Feed is a single place for IT administrators to communicate, work together and stay on the same page with alerts, jobs and projects in the data center. With Activity Feed, communication becomes more connected in and happens in real-time.

OneView detail

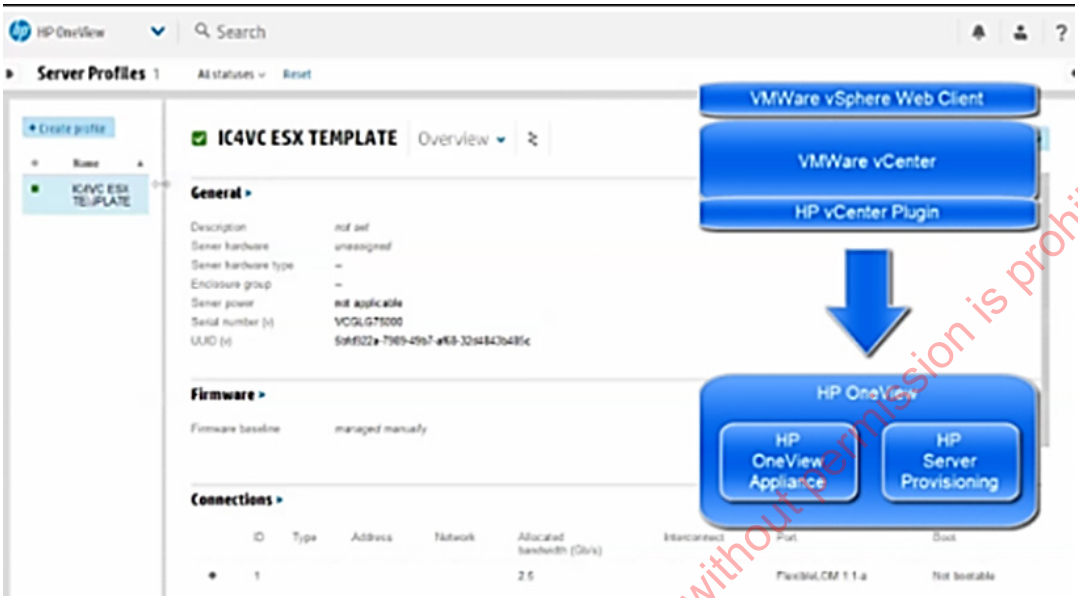


As an example of the type of detail that HP OneView can provide, the HP OneView Thermal Map provides a 3-D view of power and thermal mapping, which can be driven by automated power and location discovery. The Thermal Map instantly tracks power and cooling usage. Color-coded mapping shows where the most consumption is occurring.

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HP OneView for VMware vCenter integration



HP OneView for VMware vCenter seamlessly integrates the manageability features of HP OneView, HP ProLiant servers, HP BladeSystem, HP Networking, and HP Storage into the VMware vCenter console. The integration of OneView with VMware vCenter enables virtualization administrators to automate control of HP compute, storage, and networking resources without detailed knowledge of each device. OneView for VMware vCenter is the only platform that can provision, monitor, update, and scale resources without having to leave the vCenter console.

Easy to download, deploy, and use, the solution is packaged as a plug-in for VMware vCenter and serves as an intelligent bridge between vCenter, HP Converged Infrastructure, and HP OneView. The solution includes three modules.

- Server module—Comprehensive system health and alerting in VMware vCenter Server
  - Deep levels of HP server, blade, firmware, and infrastructure inventory and management
  - End-to-end view of the Virtual Connect networking environment
  - One-click host- and cluster-level networking configuration
  - Remote control and deployment of servers and operating system
  - Ability to create or grow VMware clusters from OneView profiles

Note
The server module is licensed as part of HP Insight Control or HP OneView.

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- Storage module
  - Monitor health, configuration, and capacity of HP Storage in VMware vCenter Server
  - Visualize the relationship between the VMware virtual machines, ESX servers, and HP Storage arrays
  - Create, expand, or delete data stores on HP arrays
  - Build a virtual machine from a template on HP arrays
  - Include vSphere Storage APIs for Storage Awareness for HP arrays

Note
The Storage module is free to use with HP supported storage solutions.

- 3PAR Recovery Manager for VMware (RMV) integration module
  - Application-consistent virtual machine snapshots for rapid online recovery
  - Support for provisioning, volume, and drive type, and remote copies

Note
The RMV integration module is an individually licensed product.

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HP Insight Control server provisioning

HP Insight Control server provisioning (ICsp) is the provisioning solution that works with the OneView management platform. ICsp is a virtual appliance used to install and configure ProLiant servers. It uses resources such as OS Build Plans and scripts to run deployment jobs.

ICsp helps to streamline server provisioning. It serves as the common multi-server provisioning capability for Insight Control software and Helion CloudSystem solutions—ICsp is included with both products. It significantly simplifies the process of taking bare-metal ProLiant servers through deployment to production.

Features of ICsp include the ability to perform physical operating system provisioning as well as the installation of firmware, BIOS, HP integrated Lights-Out (iLO), and HP Smart Array configurations.

> **!** **Important**
> ICsp does not support virtual machine (VM) provisioning; it only supports physical ProLiant servers. ICsp is included with HP Insight Control 7.2 and later.

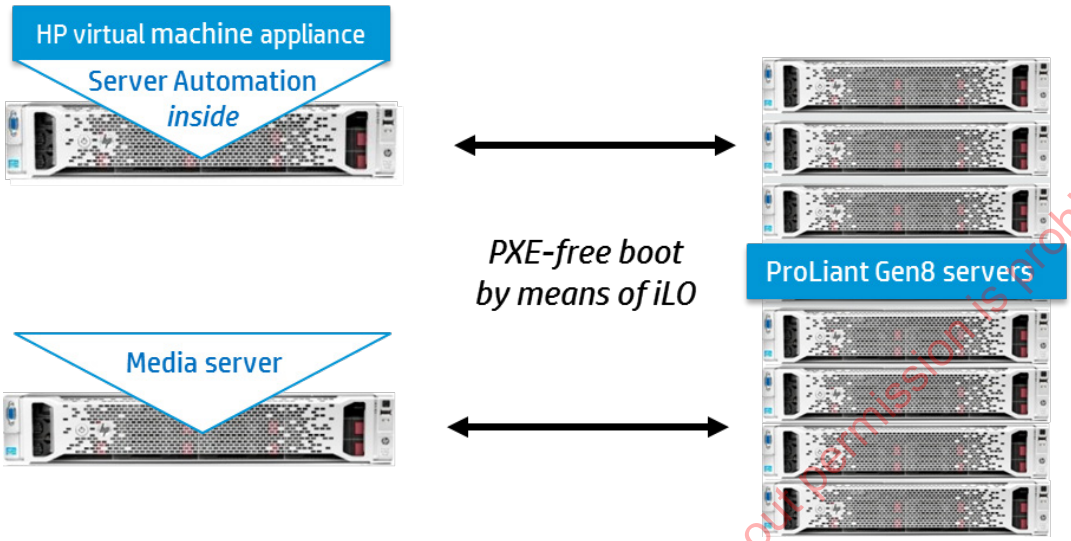
ICsp enables you to:

- Provision ProLiant bare-metal servers with Windows, Linux, or VMware ESXi and to set the Hyper-V role in Microsoft Windows Server
- Capture and install a supported Windows or Linux server operating system image
- Update drivers, utilities, and firmware on ProLiant servers using HP Service Packs for ProLiant (SPPs)
- Perform hardware provisioning, which includes configuring the BIOS, iLO, and HP Smart Array configuration and updating the firmware
- Deploy to target servers without using the Preboot Execution Environment (PXE) (when installing on ProLiant Gen8 or later servers)
- Run OS Build Plans on multiple servers simultaneously
- Customize ProLiant provisioning using a browser-based interface

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Insight Control server provisioning ecosystem



The ICsp environment includes:

- An HP virtual machine appliance that is hosted on the VMware ESXi hypervisor
- An external media server to contain the operating system distribution kits, images, and SPPs
- ProLiant servers that need to be provisioned

The Insight Control VM appliance is installed in the VMware environment. For those customers already using HP Remote Deployment Pack (RDP), there is a direct migration path from Insight Control server deployment to ICsp.

With ProLiant Gen8 servers, Intelligent Provisioning can be performed using a PXE-free boot via HP intelligent Lights-Out (iLO).

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Learning check

Your facilitator will lead a class discussion about matching HP solutions to customer requirements for moving forward to cloud solutions. Answer the following questions by writing your answers in the space provided. Be prepared to share your answers with the group.

1. HP OneView is available as a virtual and physical appliance.
   - ☐ True
   - ☐ False
2. Which common data center tasks are the elements that comprise OneView?

   _____

   _____

   _____

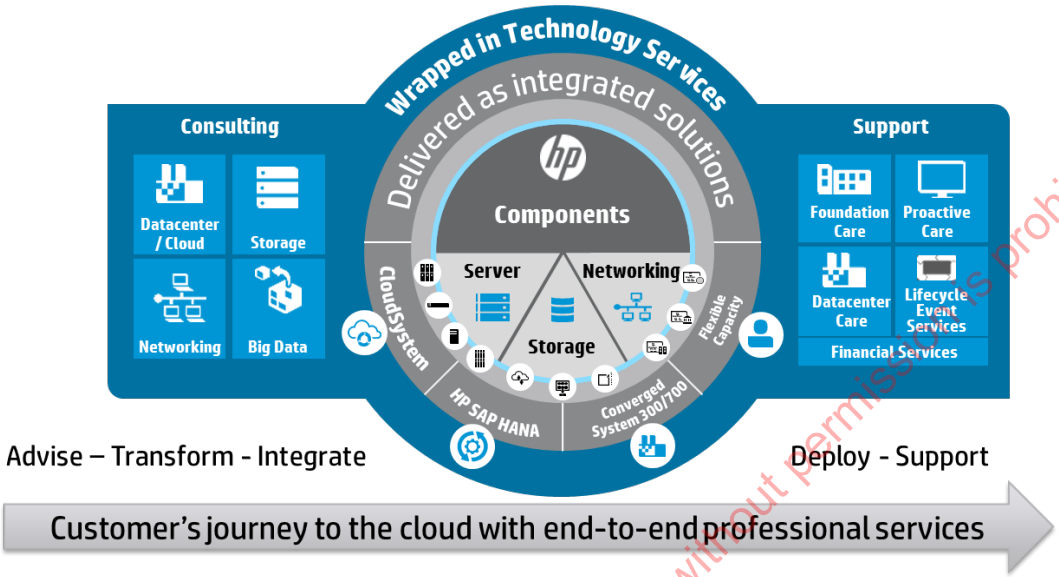
   _____

   _____
3. Which resources does HP Insight Control server provisioning use to run deployment jobs? (Select two.)
   a. Activity feed
   b. Map View
   c. OS Build Plans
   d. Scripts
   e. Templates

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HP Services enable the New Style of IT



HP provides a comprehensive portfolio of professional services to advise, transform, and manage clients' cloud journey and investments with an end-to-end lifecycle approach, addressing their needs in the areas of people, processes, and technology. HP Services enable a customer to:

- Understand opportunities and risks of cloud to accelerate business outcomes
- Accelerate cloud initiatives with advice and practical experience from HP experts
- Have confidence in an implementation driven by standard practices, tooling, processes, and frameworks
- Lower risk of deployments and optimize cost and quality
- Drive efficient cloud operations with proactive monitoring, preventative maintenance, tuning, management, support, and optimization of hybrid cloud environments

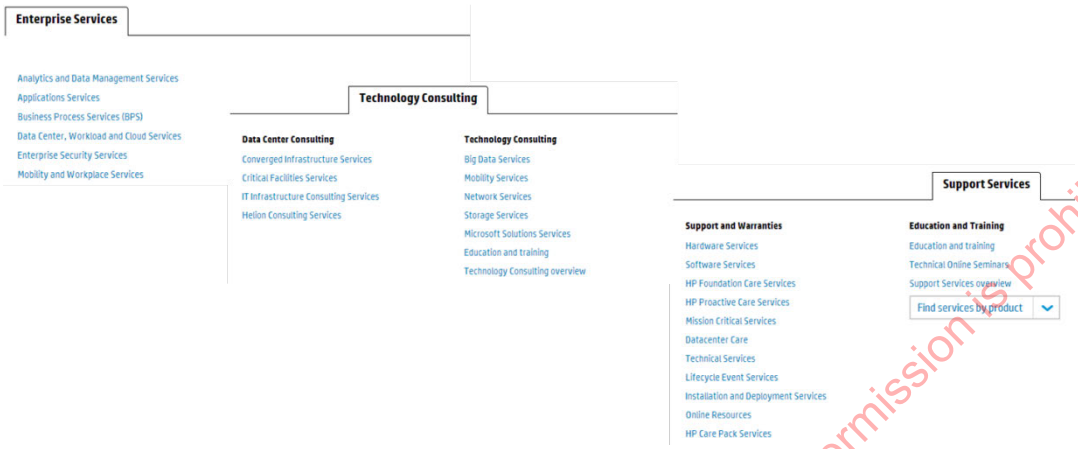
HP delivers:

- End-to-end innovative solutions that integrate business processes, applications, infrastructure, and operations
- A single point of accountability for all professional services
- Cloud experts with industry-leading knowledge, experience, and best practices developed across geography, public sector, and private sector engagements
- Consistent global delivery of world class cloud professional services
- Hybrid delivery models across private, managed, and public clouds

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HP Services



HP Services fall into three major categories:

- **Enterprise Services**—Is the global business and technology services division of the HP Enterprise Business unit. It catalogs its services into three service portfolios—Infrastructure Technology Outsourcing (ITO), Application Services, and Industry Services (which includes Business Process Outsourcing [BPO]). Enterprise Services offerings include:
  - Analytics and Data Management Services
  - Application Services
  - Business Process Services (BPS)
  - Data Center, Workload, and Cloud Services
  - Enterprise Security Services
  - Mobility and Workplace Services
- **Technology Consulting**—Is part of HP Technology Services, a business unit within the HP Enterprise Business unit. It provides IT design, planning, implementation, integration, and maintenance services and support for organizations and government agencies. It leverages a portfolio of services that is tightly aligned and optimized for the HP enterprise product portfolio. HP consulting services portfolio includes primarily data center consulting and technology consulting services, as shown in the preceding graphic.

INTERNET For more information about HP Technology Consulting Services, scan this QR code or right-click it and open the hyperlink:

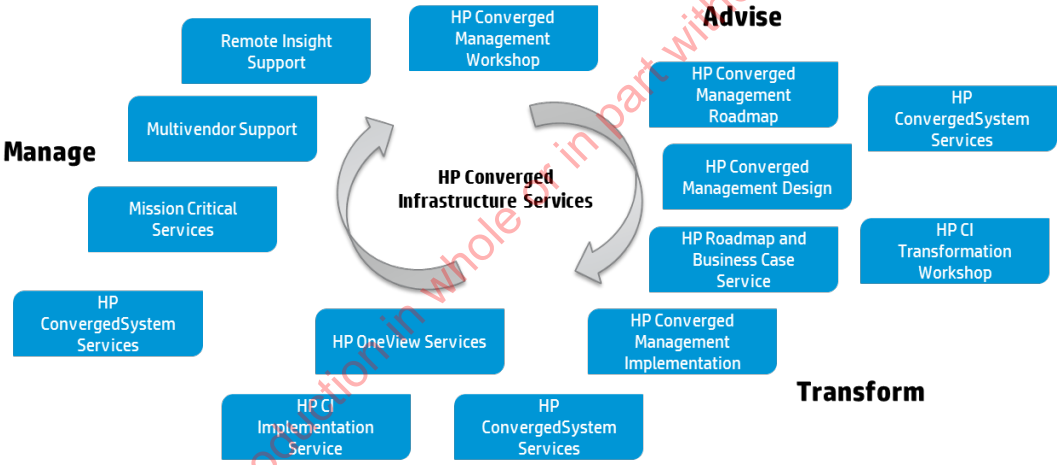
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- **Support Services**—Is a simplified and standardized portfolio of support services across all technologies, offered uniformly in all geographies. It is provided by HP Technology Services. It includes HP Care Pack Services, HP Datacenter Care, Foundation Care Services, Hardware Support Services, Lifecycle Event Services, Installation and Deployment Services, Proactive Care Services, Software Services, and Mission Critical Services.

INTERNET For more information about HP Support Services, scan this QR code or right-click it and open the hyperlink:

HP Converged Infrastructure Services



Customers who realize that it is time to build a better enterprise for the new style of IT start with data center convergence: facilities, servers, storage, and networking, all managed securely and intuitively.

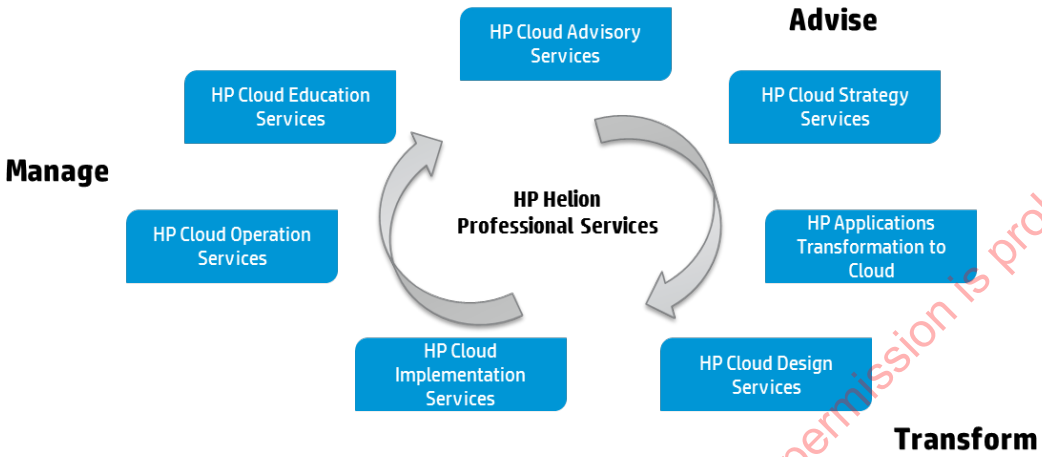
Regardless of where these customers are on their journey to data center infrastructure convergence, HP has a portfolio of services for the Advise, Transform, and Manage phases, as shown in the preceding graphic.

Note
Only a subset of the entire services portfolio is shown in the graphic.

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HP Helion Professional Services



HP offers a comprehensive portfolio of cloud professional services to advise, transform, and manage customers' cloud journey.

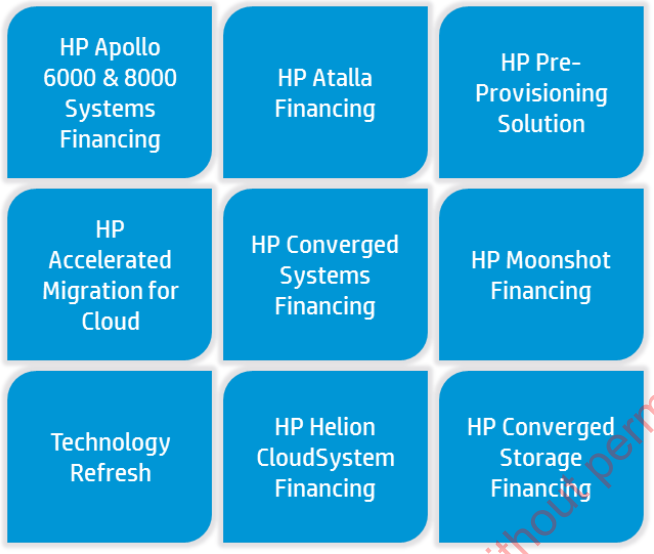
HP Helion Professional Services offers an end-to-end, lifecycle-oriented portfolio that helps organizations quickly capitalize on the promise and full potential of the cloud. Featuring seven modular, integrated, and highly flexible sets of services, HP Helion Professional Services can help customers understand all aspects of the cloud, create a desired future state, and then plan, design, build, and enable operational efficiency of hybrid delivery cloud solutions.

Customers can begin the cloud journey at any point in the lifecycle, based on their organization's cloud maturity.

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HP Financial Services



As cloud becomes reality, businesses continue to embrace it. This transition, however, does not happen overnight. Customers developing their cloud investment strategy should ask:

- Should I pay for ownership or usage?
- How do I prevent locking myself to a technology that might become quickly outdated?
- How can I maximize the value of my current IT equipment?

HP Financial Services can provide a customized investment strategy to efficiently fund customers' journey to cloud, by:

- Moving away from a costly ownership model, freeing up capital for innovation (controlling funding requirements, such as shifting from CapEx to OpEx)
- Implementing a refresh cycle that allows for scaling up or down, based on business needs
- Retiring legacy systems while ensuring data security and maximizing end-of-life value

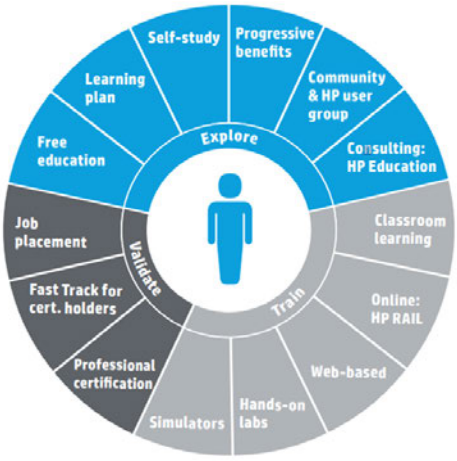
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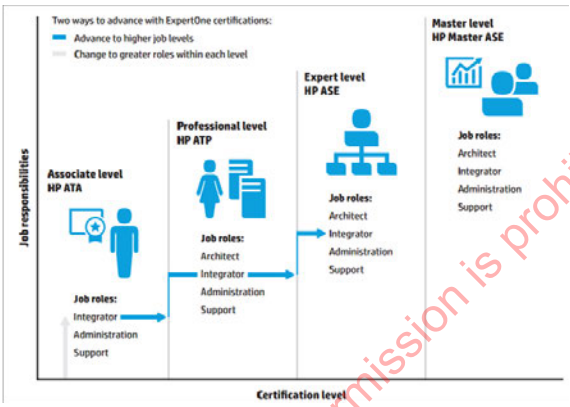
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HP ExpertOne and HP Education Services





HP ExpertOne provides training and certification for the most sought-after IT disciplines, including convergence, cloud computing, software-defined networking, and security.

The HP ExpertOne program provides learning opportunities through a direct channel with HP Education Services and HP Institute, and through the indirect channel of Learning Solution Partners. Training is offered in many ways—self-paced, instructor-led virtual, instructor-led on-premise, remote lab, and video instructor led.

HP ExpertOne gives you:

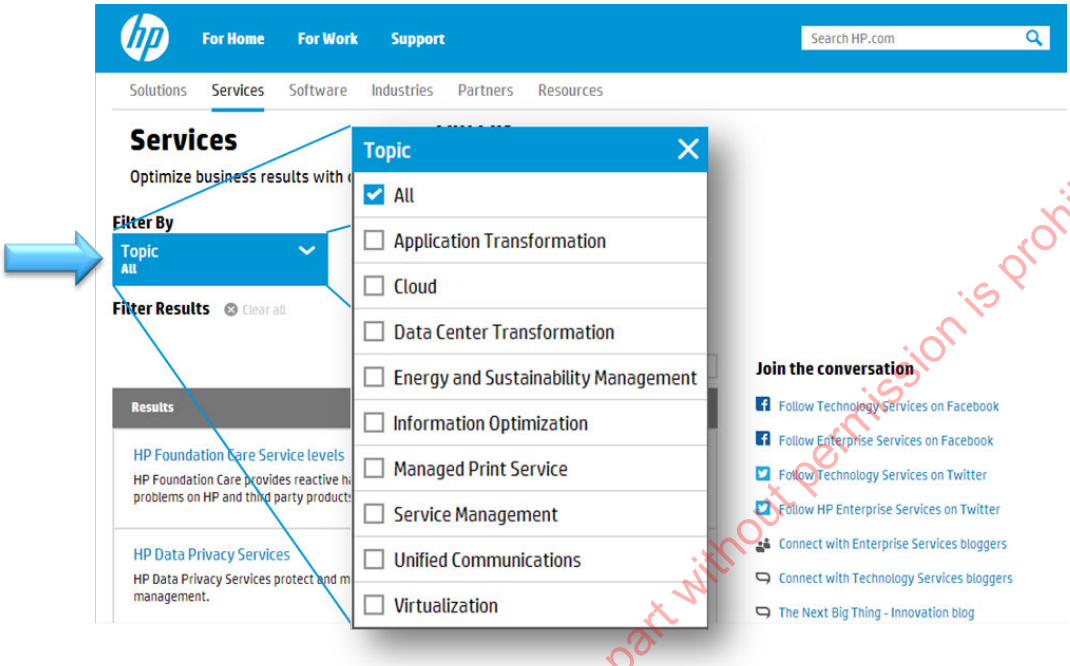
- A full range of skill levels, from foundational to master
- Personalized learning plans and resources through My ExpertOne
- Certifications that command some of the highest pay premiums in the industry
- A focus on end-to-end integration, open standards, and emerging technologies
- Maximum credit for certifications you already hold
- A supportive global community of IT professionals
- A wide-ranging curriculum from HP

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Finding the right service



Finding and matching the right service with the customer needs can be a daunting task. At the HP Services homepage, you can search for services by topic, such as Applications Transformation, Cloud, and Data Center Transformation.

HP Services homepage

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You can also connect with HP Enterprise Services and HP Technology Services bloggers:

- Enterprise Services Blog



- Technical Support Services Blog



Learner activity

To learn more about the HP Services offerings:

1. Using the tables on the next few pages, use the Internet to search for a named HP service or follow the provided URL. Choose a service offering that interests you or that you would like to learn more about. The services are presented in no particular order.

> **Note**
> Your facilitator might assign certain services for you to explore.
> Also, not all HP Professional Services are listed on these pages.

2. Using the tables, learn about and summarize the key attributes of each service in the **Key attributes** column.
3. Using the last table in this activity, associate each service with the appropriate phase of the journey to the cloud—the Advise, Transform, Integrate, Deploy, or Support phases. For example, the <x> service is appropriate to recommend to the customer during the <y> phase. Write the names of the services in the appropriate column.
4. Be prepared to be called on by your facilitator to share what you have learned or what stood out for you about the service offering.

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HP Service offering	URL	Key attributes (your own notes)	Positioning (Check the correct phases on the journey to cloud)
Converged Infrastructure Implementation Service			☐ Advise ☐ Transform ☐ Integrate ☐ Deploy ☐ Support
HP Cloud Workload Analysis Service			☐ Advise ☐ Transform ☐ Integrate ☐ Deploy ☐ Support
HP Helion Public Cloud services			☐ Advise ☐ Transform ☐ Integrate ☐ Deploy ☐ Support
HP Helion CloudSystem Enterprise Software Installation and Startup Service			☐ Advise ☐ Transform ☐ Integrate ☐ Deploy ☐ Support
HP Converged Infrastructure Transformation Workshop			☐ Advise ☐ Transform ☐ Integrate ☐ Deploy ☐ Support
HP Cloud Design Service			☐ Advise ☐ Transform ☐ Integrate ☐ Deploy ☐ Support
HP Cloud Future Definition Service			☐ Advise ☐ Transform ☐ Integrate ☐ Deploy ☐ Support
HP Applications Transformation to Cloud Service			☐ Advise ☐ Transform ☐ Integrate ☐ Deploy ☐ Support

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HP Datacenter care		☐ Advise ☐ Transform ☐ Integrate ☐ Deploy ☐ Support
HP CloudStart Solution Services		☐ Advise ☐ Transform ☐ Integrate ☐ Deploy ☐ Support
HP Helion CloudSystem Foundation Software Installation and Startup Service		☐ Advise ☐ Transform ☐ Integrate ☐ Deploy ☐ Support
HP Converged Infrastructure Design Service		☐ Advise ☐ Transform ☐ Integrate ☐ Deploy ☐ Support
HP Cloud Workshop		☐ Advise ☐ Transform ☐ Integrate ☐ Deploy ☐ Support
HP Proactive Care Services		☐ Advise ☐ Transform ☐ Integrate ☐ Deploy ☐ Support
HP OneView Startup Installation and Configuration Service		☐ Advise ☐ Transform ☐ Integrate ☐ Deploy ☐ Support
HP Lifecycle Event Services		☐ Advise ☐ Transform ☐ Integrate ☐ Deploy ☐ Support

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HP Cloud Gap Analysis Service		☐ Advise ☐ Transform ☐ Integrate ☐ Deploy ☐ Support
HP Hybrid Delivery Strategy Service		☐ Advise ☐ Transform ☐ Integrate ☐ Deploy ☐ Support
HP Foundation Care Services		☐ Advise ☐ Transform ☐ Integrate ☐ Deploy ☐ Support

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Organize the HP Services along the phases of the journey to cloud by writing the names of the services you researched in the appropriate column.

Advise	Transform	Integrate	Deploy	Support

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Service level agreements for HP Helion Public Cloud products

HP offers an industry-leading service level agreement (SLA) to host enterprise-grade workloads. With 99.95% monthly availability for all infrastructure products in General Availability, HP protects customers at a level that surpasses most other services.

Many cloud providers consider 99.9% uptime acceptable, which means you could incur twice as much downtime without any protection. More importantly, some providers average their SLA calculation over the entire year, which means some months could see even greater downtime. Helion Public Cloud consistently offers protection with an SLA of 99.95% monthly availability. HP offers higher levels of credit for most products (up to 30%) than many leading cloud providers.

The HP SLA covers failures of even a single instance in a single Availability Zone. Customers are not required to maintain instances in multiple AZs to be eligible for an SLA as long as they are willing to use another AZ if/as needed. This is different from other clouds where the SLA credit is valid only if customers are operating 24/7 in multiple AZs.

HP can provide a strong SLA and assurance because of the hardware used, organizational discipline, and operational excellence in providing an enterprise-class service.

Note
For more information about HP Helion Public Cloud SLAs, scan this QR code or right-click it and open the hyperlink:

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Learning check

Your facilitator will lead a class discussion to capture key insights and challenges from this section of the module. To prepare for the discussion, answer each of the following questions. Write your answers here and be prepared to share them with the group.

1. Which HP service is based on HP reference architectures for cloud and best practices, and addresses key architectural and transitional issues?
   a. Converged Infrastructure Design Service
   b. Converged Infrastructure Implementation Service
   c. Cloud Planning Services
   d. Cloud Advisory Services
2. Which service is most appropriate for a customer who wants to formulate a cloud information security strategy that is information centric, built-in, adaptive and proactive?
   a. Cloud Protection Program and Consulting Services
   b. Cloud Operation Services
   c. Cloud Implementation Services
   d. Cloud Planning Services
3. The HP SLA covers failures of a single instance in a single Availability Zone.
   ☐ True
   ☐ False

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Case study: KION Managed Private Cloud Solution



KION GROUP

- Challenges
  - Develop and find joint funding for a cross business unit business development initiative and HP solution across all business units
  - Develop a competitive, compelling offer for managed private cloud business scenarios for customers and HP
  - Develop a price competitive HP only architecture end to end
  - Leverage HP organizations and forge one solution for the customer
- Solutions
  - Technical Consulting (TSC) provided advisory , transform, implementation services helped to drive the overall solution
  - TSC enabled HP as the lead solution SA/SI and enabler for cross business unit project work within HP
  - TSC led requirements gathering and HP design effort from business requirements to implementation
- Results/Teaming
  - Collaborative team effort across HP simplified, and expedited the solution to provide a “customer for life”
  - Final architecture use by customer was re-purposed for EMEA ES solution blueprint ECS Private Cloud
  - HP was able to “Bring the Vision to Life”—Customer migrated 1,500 servers into a managed cloud environment including production SAP environment

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Case study: The European Commission





Critical application infrastructure

- Challenges
  - Border management, visa information system for the European Union (EU)
  - Complex, critical, highly secure systems needed robust and stable architecture
  - Multiple IT vendors in place, needed one vendor to own the architecture, collaborate with Accenture and others who worked on applications
- Solutions
  - HP Technical Services (TS) Consulting led development of architecture, design, implementation planning, migrations
  - Converged Infrastructure: Integrity server blades and x86 servers, HP 3PAR, storage and libraries, networking switches
  - Data Center Care, mission critical services, and support for multiple vendors' systems and software
  - ES SLMS for the distribution and management of Oracle licenses
- Results/teaming
  - Collaboration across product and services business units (BUs), solution from One HP
  - Positioning of key alliance partnership with the customer early on, value of TS portfolio

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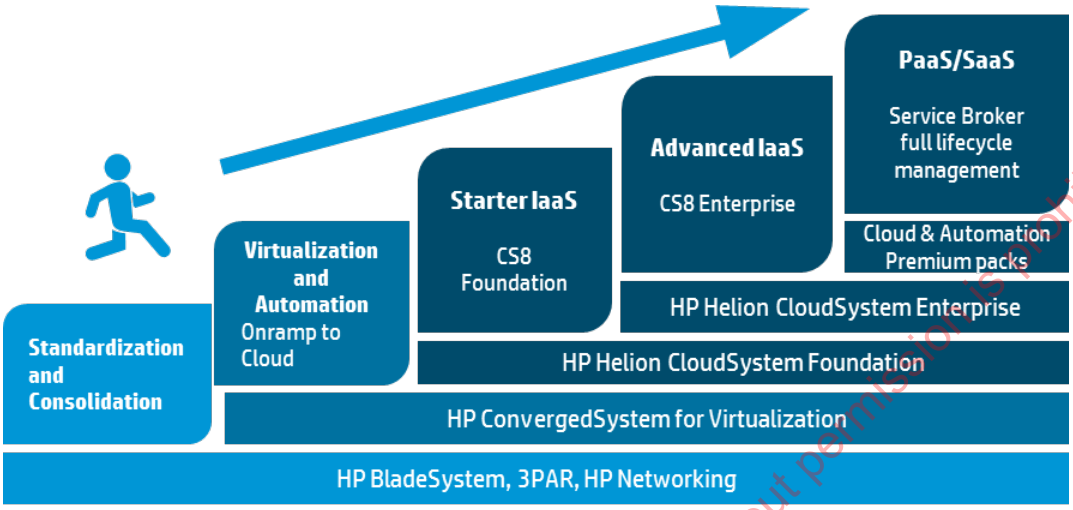
- What was won:
  - Architected and designed by TS consulting
  - Converged Infrastructure: Integrity server blades and x86 servers, HP 3PAR StoreServ 7000, P6350 storage and libraries, A10500 core networking switches
  - TS Datacenter Care, mission critical services for sites in France and Austria and TS Infrastructure consulting services
  - ES SLMS for the distribution and management of Oracle licenses
- Why it was won:
  - HP has worked with the European Commission since 2005, deploying the mission-critical HP Converged Infrastructure solution and the associated technology services for the EU-VIS as well as the archiving and back-up solution for the EU-BMS
  - Positioning of key alliance partnership with the customer early on, value of TS portfolio strength and international capabilities
  - Innovative converged infrastructure solutions to optimize data center operations and cope with unpredictable workloads

Case study notes:

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Summary



Regardless of where a business is on its journey, HP offers solutions that meet business needs today while laying the groundwork for future expansion.

Helion CloudSystem is for customers who are ready for self-service IT and other benefits of the cloud. Helion CloudSystem supports all cloud service models and deployment models, so customers can use it to get started with self-service infrastructure provisioning and grow to add applications and service brokering across hybrid environments.

All Helion CloudSystem offerings and HP Helion solutions are built on a foundation of Converged Infrastructure and the HP Software automation, management, and security portfolio. They are supported by a full range of consulting services from discovery workshops and strategy development to solution design and implementation.

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Activity

Your instructor will lead you in an activity using the following websites:

- HP Helion CloudSystem website: http://www.hp.com/go/cloudsystem
- HP Helion website: http://www8.hp.com/us/en/cloud/helion-overview.html

First, navigate to the HP Helion CloudSystem website and read one or two of the case studies provided on the right.



Review the customer business and technical requirements as well as the challenges they are facing. Consider the technologies and solutions you have learned in this course. Then propose a possible journey that a customer might take toward a converged infrastructure or cloud, using the solutions you have researched at the HP Helion website. If the case study you select shows the solution that the customer ultimately implemented, think of an alternative solution that also could have addressed the customer's requirements.

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Use the following spaces to ensure that you include all the high-level elements of the solution, including the type of solution (Converged Infrastructure, ConvergedSystem, Helion CloudSystem), software, and services.

Converged Infrastructure Solutions	ConvergedSystem Solution	Helion CloudSystem Solution

Management Software	Application Software	HP Professional Services

Be prepared to discuss your case and solution with the group. Be able to explain why you made the choices you made, and your decision-making process.

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Customer Engagement Tools

Module 6

What's in this module for you?

After completing this module, you should be able to:

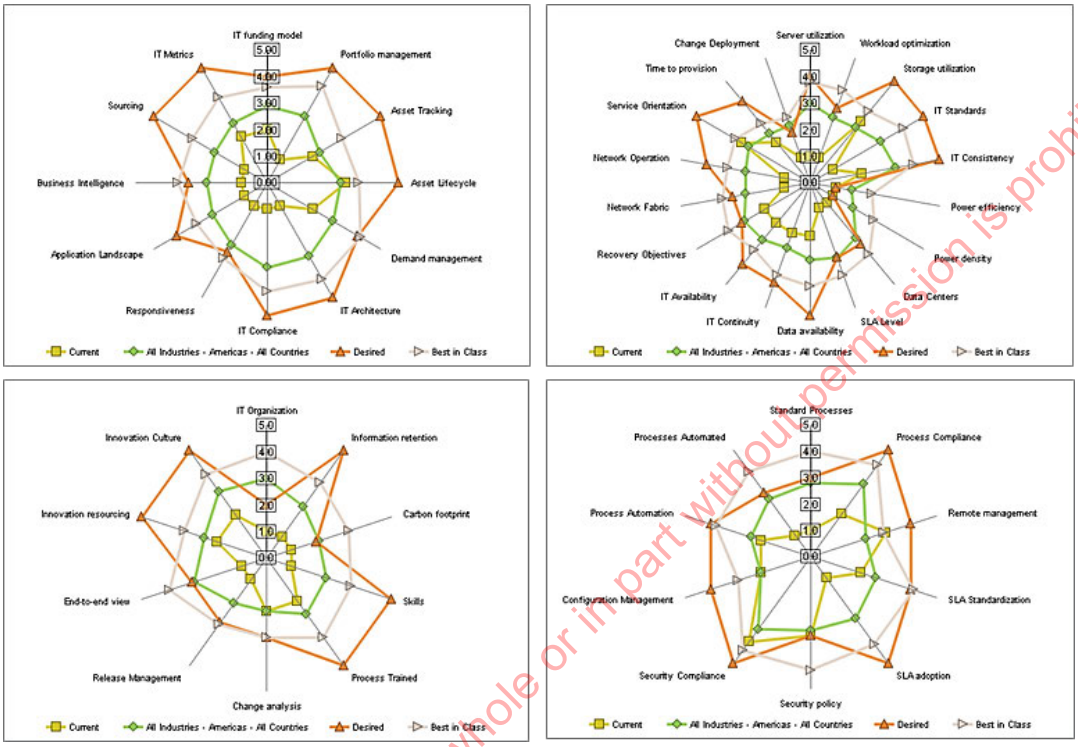
- Explain the value of HP assessment and configuration tools to your customer
- Use these tools and their output effectively to help your customer plan and design HP Converged Infrastructure and cloud solutions

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Using HP assessment tools

HP Converged Infrastructure Capability Model



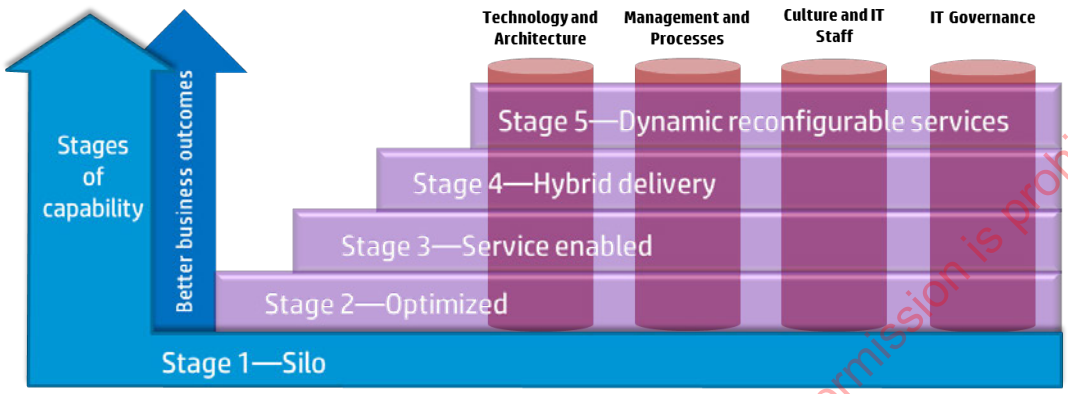
Many leading analysts agree that the next-generation data center is created by improving IT across three characteristics: operational efficiency, quality of service, and speed of implementing IT projects. A successful strategy for developing a next-generation data center requires both a tactical and a strategic dimension. Tactically, companies need to break down the IT silos by standardizing, modularizing, and virtualizing their IT environment, while automating error-prone manual processes, and simplifying and tightening management control. Strategically, they need to change how IT interacts with the business—bringing together people, process, and technology.

In the HP Converged Infrastructure Capability Model (CI-CM), HP has created a tool that represents a business' tactical and strategic dimensions, in addition to its very specific needs and objectives. HP CI-CM uses a pragmatic and structured approach, based on business and IT objectives and quantitative metrics. It provides a high-level, customized roadmap of suggested next-steps and recommended projects to meet your overall business and IT priorities. This roadmap helps you drive toward your next-generation data center.

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Assessing the journey toward converged infrastructure and beyond



Specific IT domain areas that drive capability

HP CI-CM is used first to establish the current state of the IT infrastructure, and then to define where the required target state should be for each metric for a given IT organization.

HP CI-CM measures a company's maturity in four domains:

- **Technology and Architecture**—This domain focuses on your hardware as well as data center facilities, on how your infrastructure is utilized, and on how well your IT services can withstand failures. The goal here is for hardware, software, and network resources to be shared, virtualized, and progressively automated. This means moving from dedicated, high-cost IT islands to low-cost, highly available pooled IT assets.
- **Management Tools and Processes**—This domain focuses on deploying resources to plan, manage, and deliver IT services in a better way. The aim is to move toward more standardized, integrated processes, and tools that align IT more closely with your business goals.
- **Culture and IT Staff**—Moving to a more business-centric IT environment calls for the IT organization structure, roles, and functions to be redefined. This area, though challenging, is crucial to achieve and sustain a more adaptive IT environment.
- **Demand, Supply, and IT Governance**—This involves outlining the organizational structures and processes that enable better alignment between your enterprise IT environment and your overall business strategies and objectives. Here, the roles in the business strategy development process are defined and the mechanisms for executing the strategy with adherence to the IT strategy are established. In essence, this aligns IT supply with business demands.

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HP CI-CM stages

The infrastructure's current state and desired state are rated against five stages of capability in each of the domains:

- **Stage 1**—This domain is primarily a dedicated, project-based technology. A business unit specifies an application, they specify the infrastructure, the application and infrastructure are moved into the data center, and IT managers operate it and answer calls on it and so forth. In this stage of evolution, the technology is built around the project itself. This in turn limits the sharing assets and the consistency of infrastructure, operating systems, and operating processes.

  The results of this type of project-based architecture is a one-application-to-one-server environment—in essence a compartmentalized approach. It also tends to lead to old legacy systems that are not upgraded, because systems 'belong' to the business unit, and after the systems are depreciated, they are perceived to be 'free'. As a result, data centers can become 'museums of old equipment and applications' that are very maintenance-intensive, often with a very inefficient cooling architecture.

- **Stage 2**—This stage consists of ruthless standardization of all elements of the IT architecture. It also requires standardization of management tools and processes. From an operational governance perspective, there is a significant shift in power in standardized IT environment (for example, in Stage 1, a business unit would decide what a new system would do and how it would do it. In Stage 2 and business unit stills decides what a new system will do, but IT decides how it will be done—application, infrastructure, and so on). This approach enables IT to have:

  - Consistency of technology and operating system images
  - Standardized applications and data bases
  - Standardized operational practices often independent of technology type
  - Reduced maintenance labor
  - Higher reliability

- **Stage 3**—In this stage, IT moves to a consolidated, virtualized, and shared infrastructure where all of the aspects of IT are rationalized including architectures, processes, and tools. In this stage, all technology aspects are managed by IT and are not under business unit control. This enables IT to share the assets across applications without business unit intervention. The infrastructure tends to be pooled and sharable, there tends to be pervasive use of virtualization, a standards-based, shared infrastructure, and disaster tolerance and consolidated environmentally efficient data centers. The objectives include increased asset utilization, greater ability to handle periods of peak business demand, faster deployment of new applications, improved service levels, maximized reliability, and operational efficiency.

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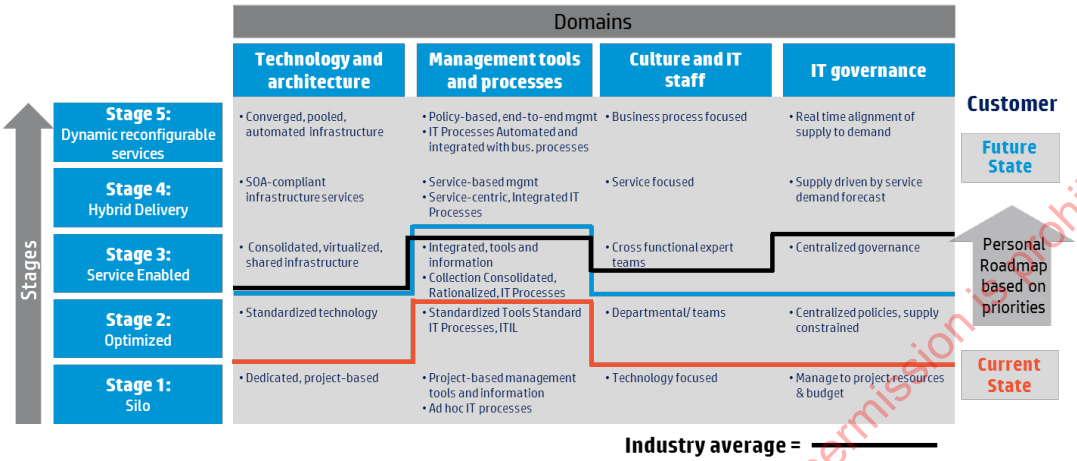
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- **Stage 4**—Infrastructure and other enterprise architecture artifacts are offered as a service on-demand with tiered service levels. These offerings are supported by service-centric integrated IT processes. The service levels are not measured on the technology but on the service as whole. The notion in this case is that each layer of the IT environment is offered as a service—starting with the infrastructure services that provide server and storage. Tangible benefits include faster time to market for practically any IT service.
- **Stage 5**—IT provides all services from a pooled, shared, automated source of supply, which can be inside or outside the enterprise IT environment (for instance, cloud-based). It enables automated management and reallocation of infrastructure based on business process needs, and it eliminates manual labor from most provisioning, and changes improving resource utilization. The IT infrastructure is virtualized, resilient, orchestrated, optimized, modular, and 'fully converged'.

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HP CI-CM: Current and future states



After a company's IT capability has been assessed, the next step is to identify the priorities in terms of which metrics are most important to make progress on in a given timeframe. This information will then provide a specific roadmap towards a Converged Infrastructure for a given IT organization, and for which specific metrics exist to measure progress towards that goal.

It is important to underline that there is no 'right' answer with respect to a desired state of capability. It is not a mere technological discussion either. The model provides a framework for a guided discussion out of which a consistent approach emerges, and a plan to accomplish that approach can be developed.

This is not a rigid 'one size fits all' type of approach. Each stage of capability and the resulting IT organization should be aligned with the overall business strategy that the company intends to enact. These business objectives ultimately guide the final decision regarding IT capability.

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HP CI-CM value proposition

The value delivered by CI-CM can be best summarized in terms of value to the customer, value to HP Direct Sales and Presales professionals, and value to HP Partner Sales and Presales professionals:

- **Value to customer**—For customers whose IT infrastructure serves 500 to 50,000 users who are seeking an objective analysis of their infrastructure's maturity, a benchmark compared with others with recommendations to improve. CI-CM is a consultative engagement framework and tool that provides a comprehensive and objective assessment and recommendations for improvement unlike other services that are biased toward product features and benefits. The CI-CM provides a holistic view of a company's IT infrastructure's readiness to perform in today's challenging business environment.
- **Value to HP Direct Sales and Presales professionals**—For HP account teams calling on small to midsize enterprise accounts who are interested in developing a consultative, long-term, trusted advisor relationship with their accounts while generating business across all of the HP portfolio. CI-CM is a consultative engagement framework and tool that provides a comprehensive assessment, and recommendations for improvement leveraging the HP product, service, and solutions portfolio, unlike other selling methods or services that are focused on product features and benefits. CI-CM provides a reference point for future sales engagements through development of a roadmap.
- **Value to HP Partner Sales and Presales professionals**—For highly skilled and certified HP partner account teams calling on small to midsize enterprise accounts who are interested in developing a consultative, long term, trusted advisor relationship with their accounts while generating business across all of the HP product and service and partner's service portfolio. CI-CM is a consultative engagement framework and tool that includes flexibility to integrate partner solutions as well. CI-CM provides a holistic view of the readiness of your customers' IT infrastructure to perform in today's challenging business environment and a reference point for future sales engagements through development of a roadmap while differentiating you from your competitors.

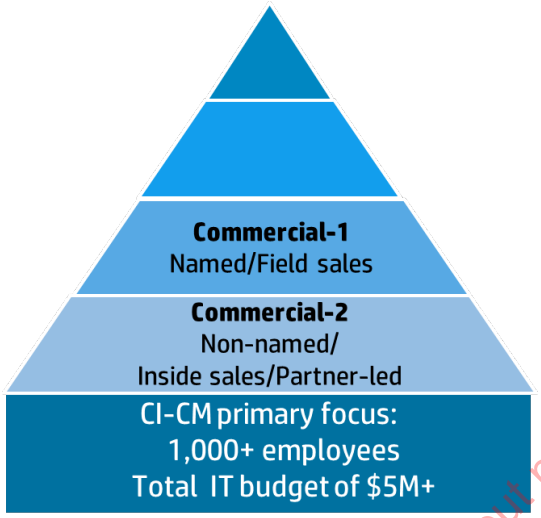
Important
CI-CM was not developed for small and medium businesses (SMBs), and is not broadly available to channel partners.

Note
Gartner has developed a similar tool, the ITScore, which evaluates IT organizations both in terms of how they provide IT services and how they serve the enterprise. For more information about the Gartner ITScore tool, scan this QR code or right-click it and open the hyperlink:

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HP CI-CM target markets



CI-CM targets enterprise-class accounts defined as companies with at least 1,000 employees (CI-CM has not been designed to target SMB companies with less than 1,000 employees, although regional differences do apply). HP recommends targeting companies with a healthy budget to ensure a reasonable ROI associated with the efforts required by a CI-CM workshop. Therefore, on average, it might be best to target companies that have a yearly IT budget of more than five million dollars.

Although it is offered free of charge, CI-CM does represent a commitment of time and resources. This means that strong IT executive sponsorship—CIO or CTO level—is a critical success factor to make sure the customer has a fair chance to capitalize on the results of the workshop. Practically speaking, the CIO's team will be most directly involved in the engagement. For example, IT operations, IT technology, or data center managers and directors should be involved at some level.

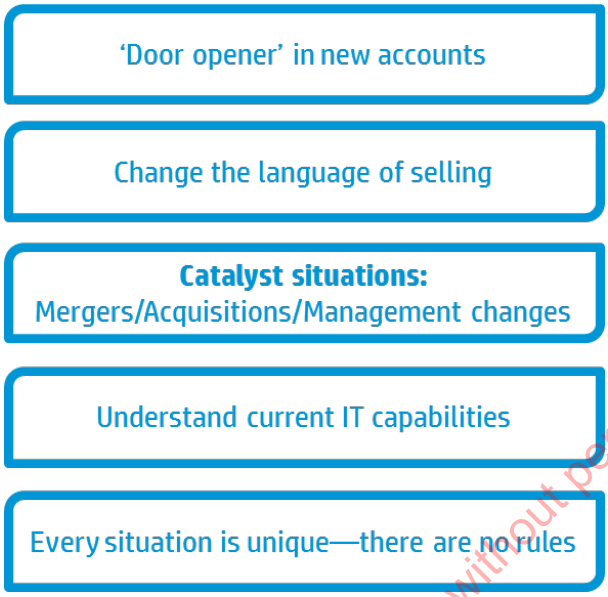
Line-of-business managers need to be involved to elevate the visibility of the results associated with the assessment. This could be leveraged when discussing alignment between IT and the business, or when presenting the final recommendations or findings. CI-CM can be used as a tool for the IT team to substantiate the need for change and potential future investments and requirements.

! **Important**
The CI-CM tool, methodology, and associated documents are HP confidential. A three-party NDA should be in place between HP, a qualified HP Partner, and the customer before initiating a workshop.

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HP CI-CM best-fit scenarios



In general, CI-CM should be offered when the customer is looking for a fairly broad engagement aimed at better understanding the capabilities of their IT department with specific reference to IT infrastructure.

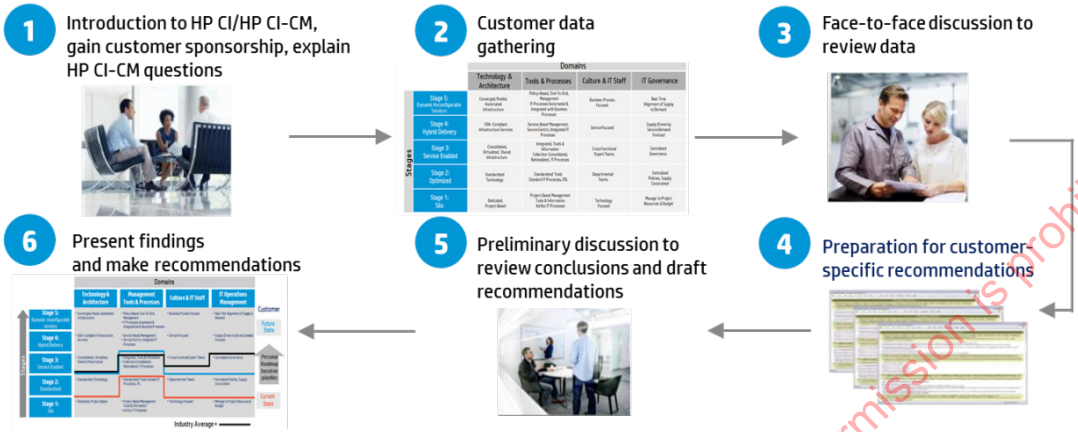
Examples of events that could prompt customers to reassess their IT infrastructure environment include a merger or acquisition or an IT management change. Alternatively, a customer might be looking at the possibility of consolidating or even outsourcing IT operations. The best time to use the tool is during the customer's "annual health check" for planning fiscal year purchases.

CI-CM is a fairly cost-effective IT infrastructure assessment and is supported by objective and vendor-agnostic industry comparisons. It can also be viewed as a general account planning tool to better understand and influence the IT infrastructure planning cycle. As a general recommendation, it would be best to offer CI-CM well before the end of the IT budget cycle to be best positioned for any future opportunities.

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HP CI-CM engagement process



The HP CI-CM is a tool, but it is also the process of using that tool. In reality, the CI-CM is part of an in-depth consultation. At the end of this engagement, the CI-CM provides a pragmatic, action-oriented approach aligned with the customer's priorities, based on quantitative metrics that delivers a high-level gap analysis and reference configurations to implement a more resilient infrastructure.

The CI-CM tool and process determines the customer's current data center state and how best to progress to their desired "end state" across technology, architecture, and management processes and tools.

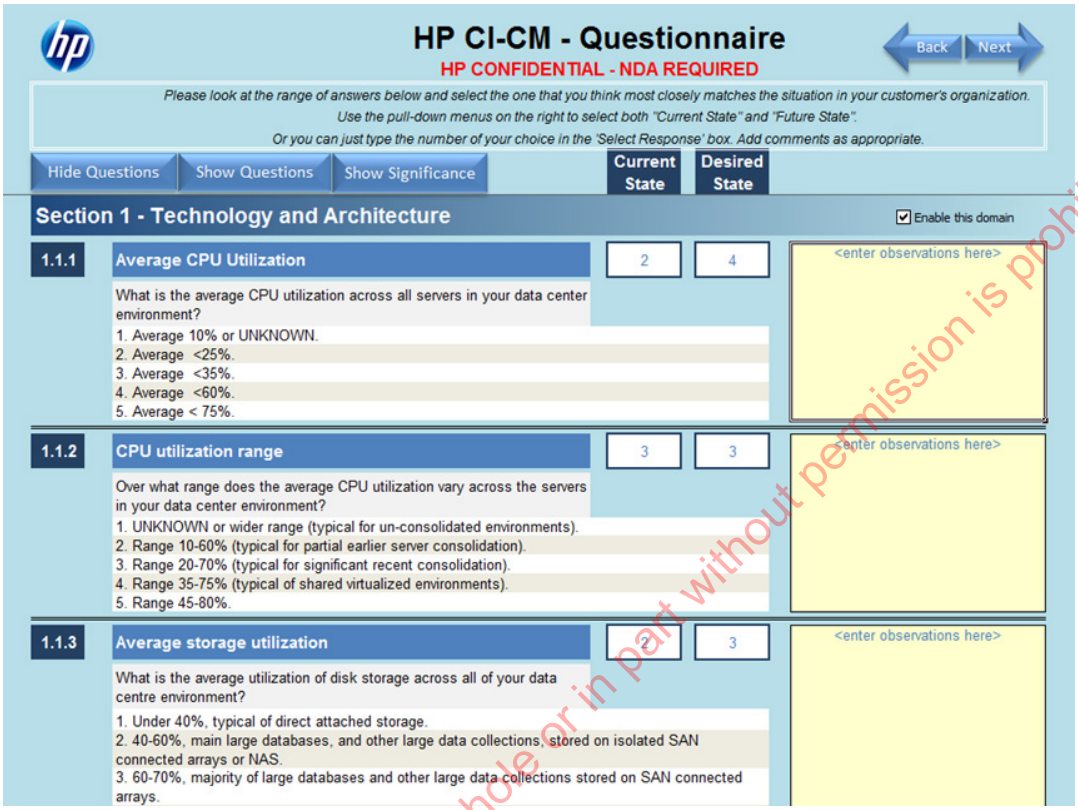
The value the customer and HP derive from CI-CM is based on the interaction and dialogue among our CI-CM practitioners, the HP account team and the customer. This is not a transactional, mechanical, or web-based approach.

Note
The CI-CM engagement process described here provides a general overview. The actual process will vary, to best address the customer's unique needs and priorities.

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HP CI-CM questionnaire



HP CI-CM - Questionnaire

HP CONFIDENTIAL - NDA REQUIRED

Back Next

Please look at the range of answers below and select the one that you think most closely matches the situation in your customer's organization.
Use the pull-down menus on the right to select both "Current State" and "Future State".
Or you can just type the number of your choice in the 'Select Response' box. Add comments as appropriate.

Hide Questions | Show Questions | Show Significance

Current State | Desired State

Section 1 - Technology and Architecture

Enable this domain

1.1.1 Average CPU Utilization — Current State: 2 — Desired State: 4 — <enter observations here>

What is the average CPU utilization across all servers in your data center environment?

1. Average 10% or UNKNOWN.
2. Average <25%.
3. Average <35%.
4. Average <60%.
5. Average < 75%.

1.1.2 CPU utilization range — Current State: 3 — Desired State: 3 — <enter observations here>

Over what range does the average CPU utilization vary across the servers in your data center environment?

1. UNKNOWN or wider range (typical for un-consolidated environments).
2. Range 10-60% (typical for partial earlier server consolidation).
3. Range 20-70% (typical for significant recent consolidation).
4. Range 35-75% (typical of shared virtualized environments).
5. Range 45-80%.

1.1.3 Average storage utilization — Current State: 2 — Desired State: 3 — <enter observations here>

What is the average utilization of disk storage across all of your data centre environment?

1. Under 40%, typical of direct attached storage.
2. 40-60%, main large databases, and other large data collections, stored on isolated SAN connected arrays or NAS.
3. 60-70%, majority of large databases and other large data collections stored on SAN connected arrays.

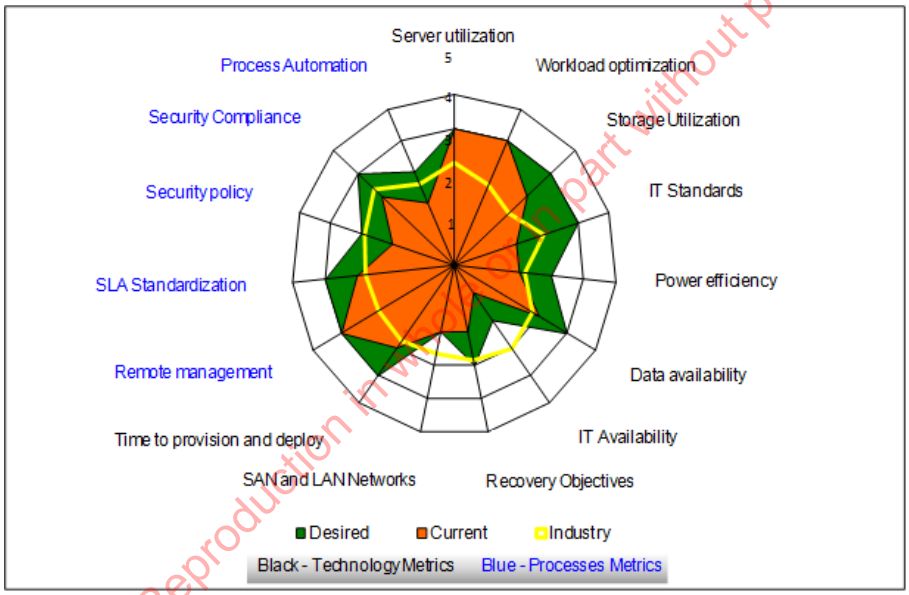
The CI-CM questionnaire provides the processes to work with a customer to analyze the current state of their IT environment and design the steps to improve IT effectiveness.

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HP CI-CM recommendations report





The recommendations report is very a detailed, customized report based on the customer's individual results that includes:

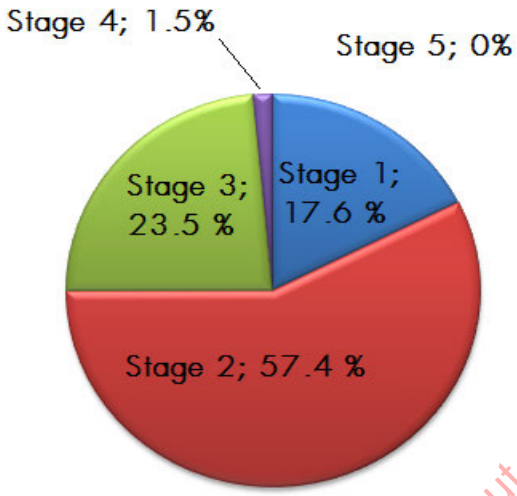
- Gap analysis and benchmarking across prioritized domains and levels of Capability
- Measure current state against industry averages
- Define a series of actionable and measurable steps towards a business-ready infrastructure
- Tailored to your environment and business priorities

CI-CM can recommend specific projects that can be implemented with the help of HP products and services. Each project constitutes the basis for an ROI analysis.

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HP CI-CM customer database



This pie chart provides a representation of the various domains along with the distribution of the benchmark or customer database along the five maturity stages. The CI-CM database contains close to 1,600 customer profiles across various industries and geographies.

On average, more than 50% of the population across all regions falls into Stage 2, which is 'standardized.' The number of organizations able to meet the classification at the higher levels of maturity decreases significantly.

Statistically speaking, there are very few organizations that can be truly considered at Stage 5 right now.

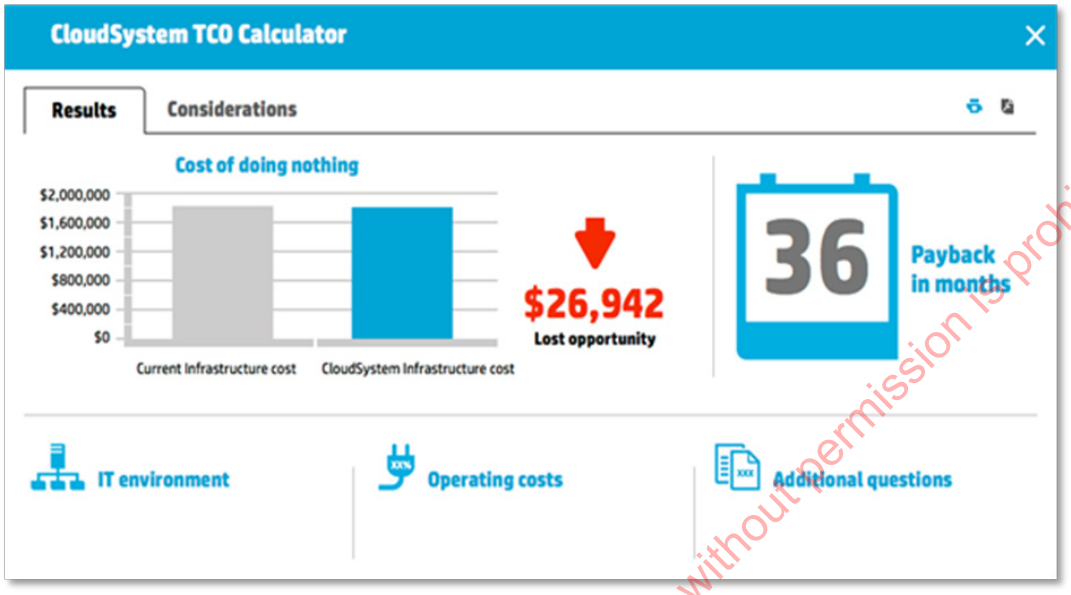
Interestingly, there are not many discrepancies between the stages of maturity across the two domains—which seems to corroborate the need for organizations to progress through the maturity curve in lockstep, considering all domains.

! **Important**
This is not an HP proprietary model. The data points are based on industry best practices and standards. All the data points have been gathered by third-party market research firms.

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HP TCO and ROI assessment tools



CloudSystem TCO Analysis

After you have determined the stage of the customer's IT, you can begin to articulate the financial benefit of an HP solution. HP has worked extensively with partners to develop total cost of ownership (TCO) and return on investment (ROI) calculators to help you provide useful information to C-level executives and other decision makers.

The primary HP TCO and ROI tools include:

- CloudSystem TCO Calculator
- Alinean ROI Analyst
- HP Converged Infrastructure ROI Calculator
- HP Hyperscale TCO Calculator

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Available HP server TCO/ROI assets

TCO/ROI tools for HP servers are listed in the following table.

Tool name	Brief description
ProLiant ROI Calculator	Showcases the business value of migrating from legacy servers to new HP Gen8 servers.
BladeSystem TCO Model	Compares the TCO of new HP racks to new HP blades with VC/FF.
BladeSystem ROI Model	Showcases the business value of migrating from HP rack to blades with VC/FF.
BladeSystem Competitive TCO Calculator	Helps users understand the competitive landscape (HP vs. Cisco) from a TCO perspective.
Hyperscale-Moonshot TCO Calculator	Showcases TCO benefits of Moonshot servers vs. traditional servers.
4P consolidation Calculator	Showcases benefits of HP a four-processor server compared to two-processor servers.
Client Virtualization ROI Calculator	Showcases the business value of migrating from a legacy environment to an HP client virtualization solution.
HP Server TCO Analysis (Two options)	Compares the current server operations to HP servers and an alternative solution option to help assess the ROI by migrating to one of the proposed platforms.
Newest Integrity Systems TCO-ROI Calculator	Showcases the TCO benefits of upgrading to new HP Integrity servers with the latest Intel Itanium processors against maintaining and extending the current HP environment.
HP 9000 and Alpha Upgrade TCO Challenge Calculator	Compares the TCO for maintaining and extending an HP 9000 or Alpha server environment versus the costs for upgrading to HP Integrity servers.
Oracle Sun to HP Migration TCO Calculator	Compares the TCO for maintaining and extending a legacy Sun SPARC environment versus the costs for migrating to HP servers.
IBM Power to HP Migration TCO Calculator	Compares the TCO for maintaining and extending an IBM Power environment versus the costs for migrating to HP servers.
HP Mainframe Migration TCO Calculator	Compares the TCO for maintaining and extending a mainframe environment versus the costs for migrating to HP open systems servers.
Oracle DB to Sybase ASE Migration TCO Calculator	Compares the TCO for maintaining and extending an Oracle DB environment for SAP applications versus the costs for migrating to Sybase ASE.
QTTROI Calculator	Showcases TCO and ROI for different migrations and also head-on comparison scenarios for current or competitive servers to Integrity and ProLiant servers.

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Learning check

Your facilitator will lead a class discussion to capture key insights and challenges from the module and accompanying lab activity. To prepare for the discussion, answer each of the following questions about the TCO/ROI and other assessment tools.

Write your answers here and be prepared to share them with the group.

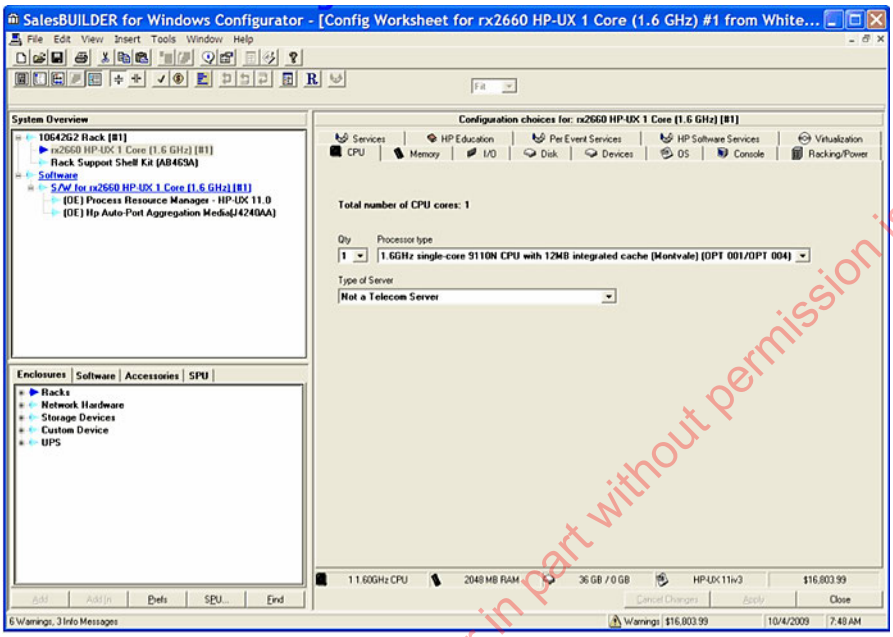
1. A company has rationalized all of the aspects of IT, including architectures, processes, and tools. Which stage of the CI-CM has this company achieved?
   a. Stage 1
   b. Stage 2
   c. Stage 3
   d. Stage 4
   e. Stage 5
2. When should the Converged Infrastructure Compatibility Model (CI-CM) be offered?

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Using HP configuration tools

SalesBuilder for Windows



SalesBuilder for Windows (SBW) is the premier HP configuration and quotation tool for the sales force and channel partners. SBW is a downloadable tool designed to support the complete HP product portfolio of servers and related service and support products.

The SBW Configurator displays the system diagram and modifications for HP clusters, servers, and storage running HP-UX, Windows, Linux, or mixed environments. You can use the Configurator to configure and customize technical solutions for new systems, upgrades, and add-ons. Components of the Configurator include:

- **Whiteboard**—The center of SBW; shows technical solutions and forms the unit of quoting and storing
- **Config Worksheet**—Main configuration tool; enables you to configure complete technical solutions
- **System Diagram**—A graphical view of your configuration; can be used for modifications

Other components of SBW include:

- **Quoter**—Prepares a budgetary quotation for the customer that shows part numbers, descriptions, and prices of all the products in the solution.
- **Price Book**—Data files containing the latest product descriptions and prices. The SBW price book (Pbv.exe) is updated every two weeks. Use only the current version.
- **Knowledge Base**—Data file containing the rules and product modeling used by SBW to check configurations.

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SBW exports schematic diagrams in Microsoft Office Visio format.

Important
HP could require a schematic diagram when ordering a specific system. HP requires that these schematic drawings be submitted in Visio format.

INTERNET If you would like to provide your customer with a detailed diagram as part of a design process, scan this QR code or right-click it and open the hyperlink for HP Visio stencils and templates:

SBW features

With the Consolidated Model Selection Form, you can configure a total solution for Integrity and ProLiant servers, including Industry Standard Servers (ISS), Business-Critical Solutions (BCS), and Network Storage Solutions (NSS) hardware and associated software and services. You can also quote a solution with current pricing and ensure that the hardware and software choices are compatible and options do not exceed restrictions.

Note
SBW does not consider projected partition size increases; you might need to modify the configuration to reflect preferred cell placement. You can disable the optimal placement feature to customize the layout.

- **Fast configuration**—Use the system diagram, configuration worksheet, or parts list to quickly configure, upgrade, or add on to systems.
- **Menu-driven interfaces**—Find detailed help and built-in configuration rules to leverage existing configurations to create and modify configurations for one or multiple systems.
- **System diagram and modifications**—View the system diagram and any changes you have made.
- **Accurate and timely order delivery**
  - Export files to configuration centers to create legal quotes and convert-to-order workflow processes, and export a bill of materials (BOM) in XML format.
  - Display the shipping method in the quote.

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SBW reduces the need for the printed HP Configuration and Ordering Guides, significantly reducing the time required to select all of the components necessary to build an HP system. The configuration engine checks the selections and alerts you to potential conflicts such as an operating system that does not support a targeted peripheral.

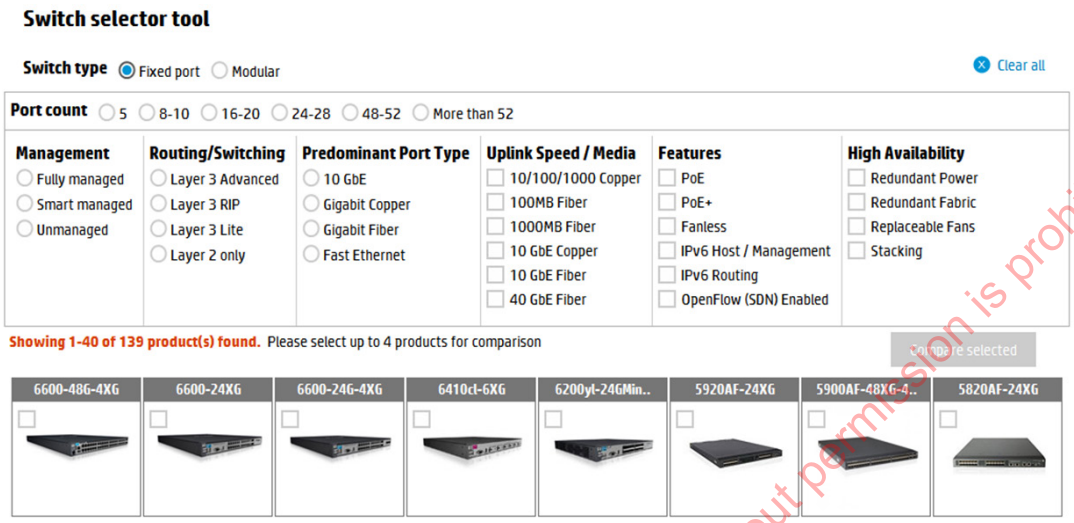
INTERNET For internal access to the SBW, scan this QR code or right-click it and open the hyperlink:

HP partners can visit: **https://www.tools.hp.com** (requires login)

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HP Networking Switch Selector



HP Networking Switch Selector is a web-based tool that helps you select the correct HP networking product based on specific requirements, such as:

- **Switch type**—Fixed-port or modular
- **Port count—**Number of ports
- **Management capabilities**—Fully managed, smart managed, or unmanaged
- **Routing and switching capabilities**—Layer 3 Advanced (support for features such as OSPF and BGP), Layer 3 RIP, Layer 3 Lite, or Layer 2 only
- **Predominant port type**—10GbE, Gigabit copper, Gigabit fiber, or Fast Ethernet
- **Uplink speed and media**—10/100/1000 copper, 100 MB fiber, 1000 MB fiber, 10 GbE copper, 10 GbE fiber, and 40 GbE fiber
- **Features**—PoE support, PoE+ support, fanless operation, basic support for IPv6 (such as an IPv6 management address), IPv6 routing capabilities, and OpenFlow support (permitting integration with a Software Defined Networking [SDN] solution)
- **High availability**—Redundant power, redundant fabric, replaceable fans, and stacking support (including support for Intelligent Resilient Framework [IRF])

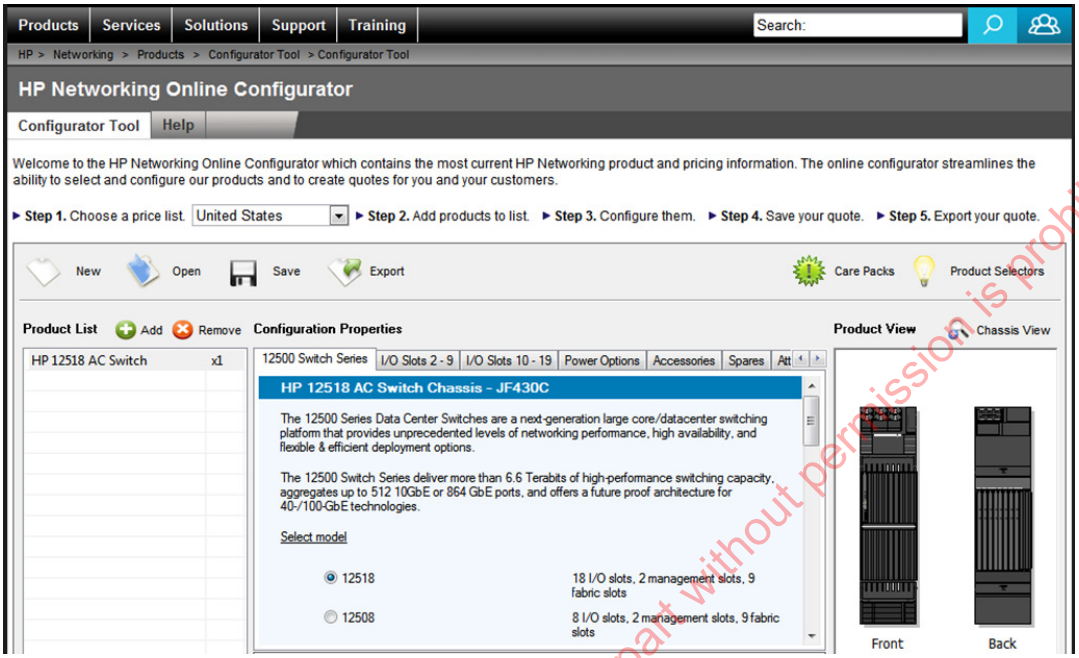
INTERNET

To access the HP Networking Switch Selector tool, scan this QR code or right-click it and open the hyperlink:

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HP Networking Online Configurator



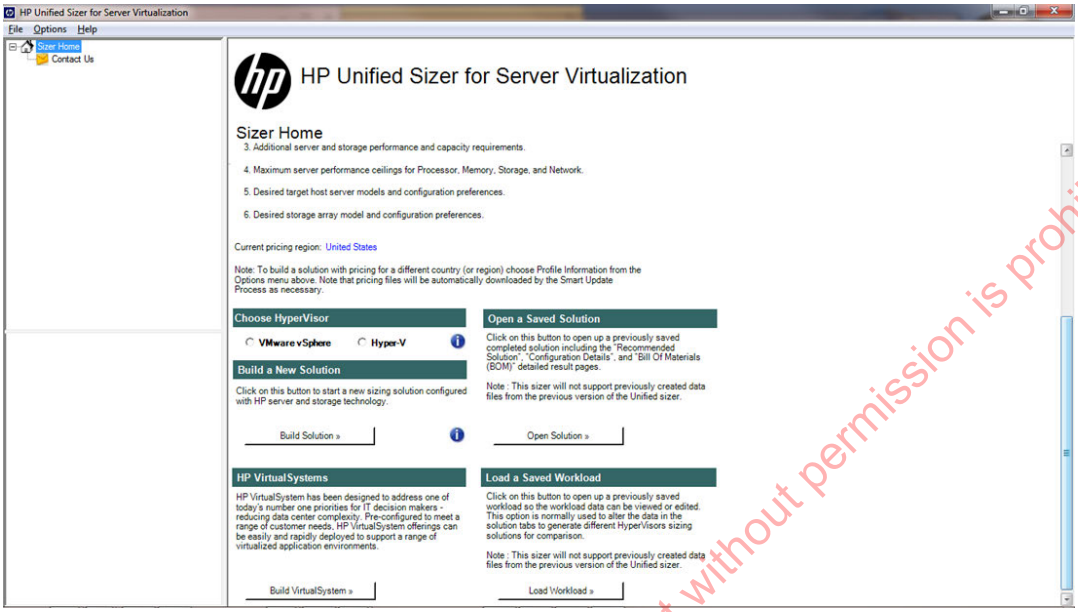
HP Networking Online Configurator enables you to create price quotations for HP networking products quickly and easily using your web browser. You can save quotation files to your hard drive or export them in several formats including Microsoft Excel.

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HP Unified Sizer for Server Virtualization



The HP Unified Sizer for Server Virtualization is an automated, downloadable tool that guides users toward the HP server and storage configurations that best fit the needs of specific virtualized environments.

The HP Unified Sizer for Server Virtualization allows users to enter information about an environment's current servers in a new solution, which they can save and open again later. The tool also lets users import information from performance data collecting tools, such as the Microsoft Assessment and Planning tool (MAP), so they can better represent the requirements for the servers. Based on this information, the tool produces richly detailed recommendations for virtual server configurations built on HP server and storage solutions. The tool allows rapid comparison of virtualized solutions using various HP server and storage choices, and it offers a choice of VMware vSphere or Microsoft Hyper-V virtualization technologies.

The tool produces a customizable server and storage solution complete with a detailed BOM that includes part numbers and prices.

INTERNET

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HP Power Advisor



The HP Power Advisor tool helps users estimate power consumption and select the proper power components at a system, rack, and multi-rack level. A variety of additional features are also provided, including a condensed BOM, a cost of ownership calculator, and a power report.

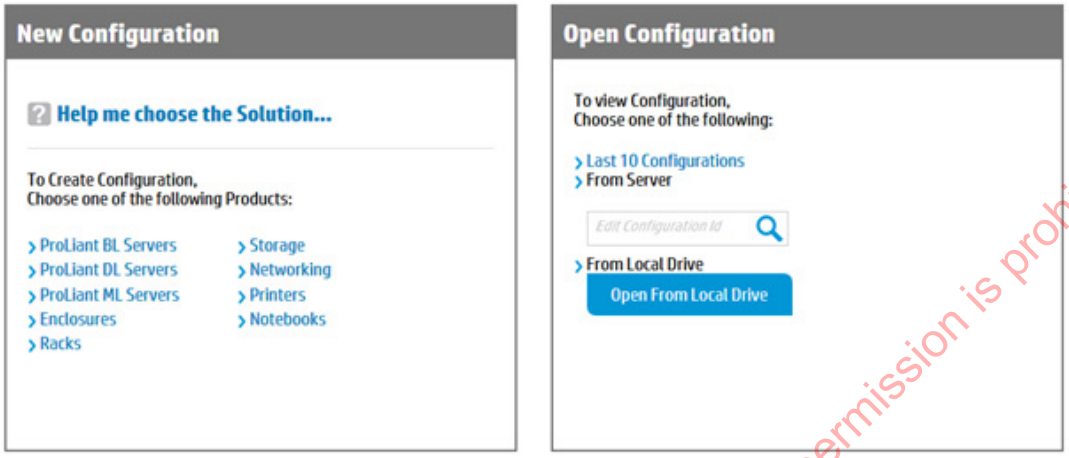
HP Power Advisor is a downloadable, Windows-based application that operates on your desktop.

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Simplified Configuration Environment



The Simplified Configuration Environment (SCE) is an HP tool that replaces several older configuration tools. SCE is a guided self-service tool to help you provide customers with initial configurations in three to five minutes. You can then send the configuration on for special pricing or configuration help, or use in it your existing ordering processes.

This configuration application has many advantages over earlier HP tools:

- Easy to use, self-service environment
- Fast initial solution configurations (three to five minutes)
- Localized part and SKU numbers
- Available in 10 languages
- Local list pricing
- Guidance to proper solutions
  - Solution wizards based on applications
  - Listings of popular configurations that can be modified
- Ability to export configurations to Microsoft Excel file format

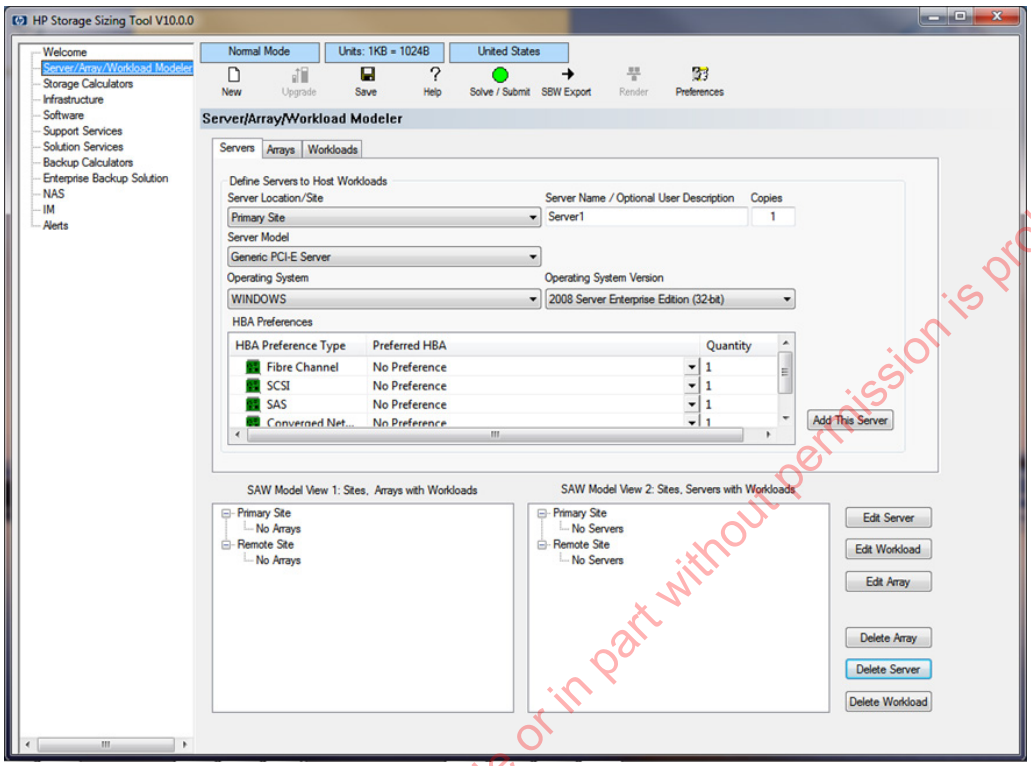
SCE uses a Guided Solution Wizard to help you choose a solution based on the applications for which the solution will be used. After you make your selections, the wizard generates a preliminary BoM, complete with price quote.

Note
The Systems Selling Guide (SSG) provides ProLiant server, Integrity server, storage, services, and software solutions and upsell offerings for customers based on their application and server environment.

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HP Storage Sizer



The HP Storage Sizer is a downloadable sizing tool that helps you design a storage infrastructure to meet specific needs. The sizer:

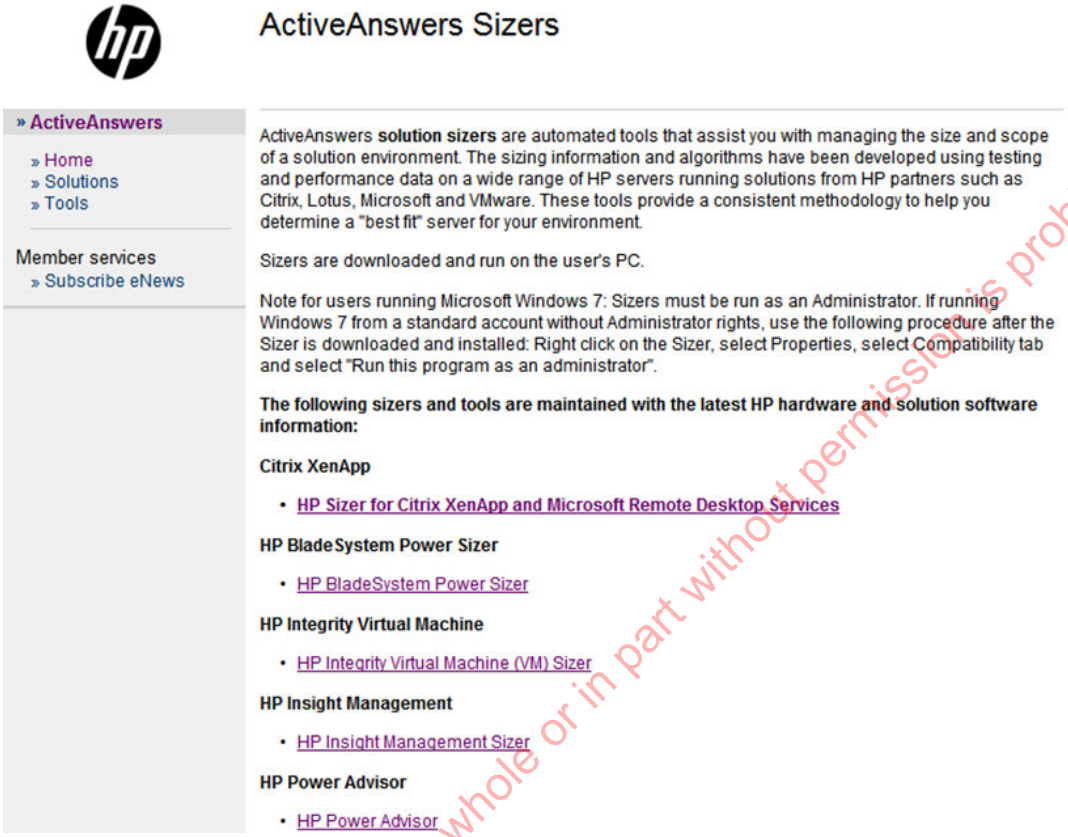
- Simplifies the process of designing a storage solution
- Applies storage design, licensing, and service rules
- Produces a valid, supported configuration
- Provides localized parts and pricing for Americas, APJ, and EMEA
- Encompasses the HP Storage family
- Updates at every new product launch

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Other sizers



HP ActiveAnswers is an online portal that provides various tools to help you configure, size, use, and analyze the performance of HP products and solutions.

ActiveAnswers solution sizers are automated tools that help you manage the size and scope of a solution environment. The sizing information and algorithms are based on testing and performance data from a wide range of HP servers running solutions from HP partners such as Citrix, Lotus, Microsoft, and VMware. These tools provide a consistent methodology for determining the best server for an environment.

The sizers are downloadable and freely accessible on the HP website. You can run them on your PC.

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SPOCK



The HP Single Point of Connectivity Knowledge (SPOCK) portal provides detailed information about supported HP storage product configurations.

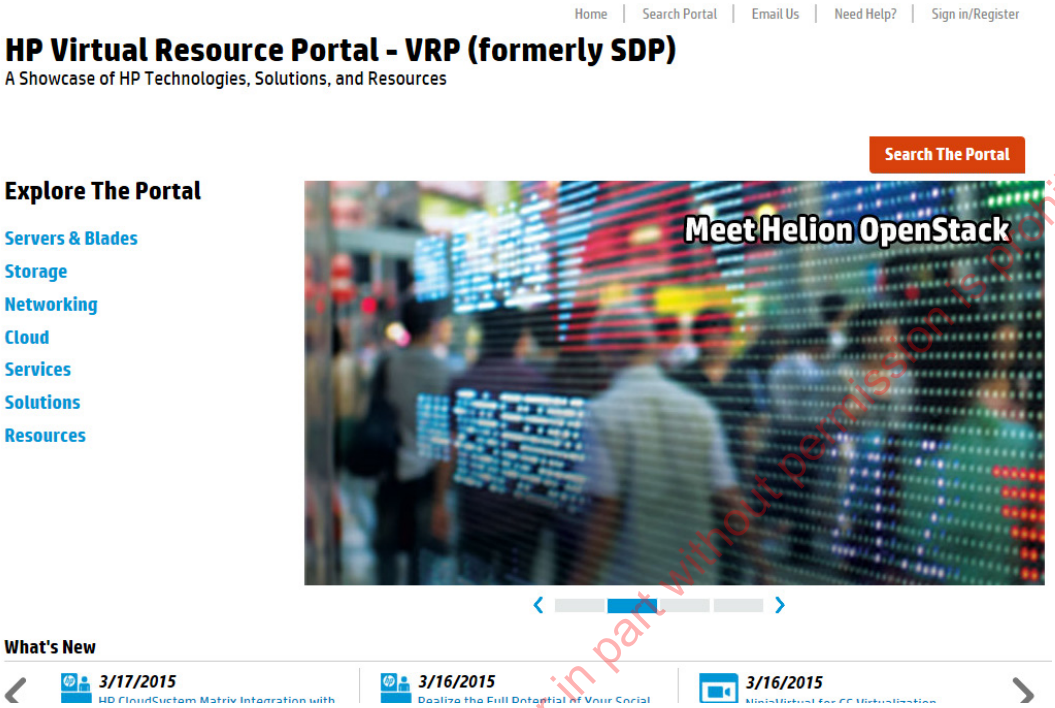
You need an HP Passport account to enter the SPOCK website.

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HP Solution Demo Portal (now HP Virtual Resource Portal)



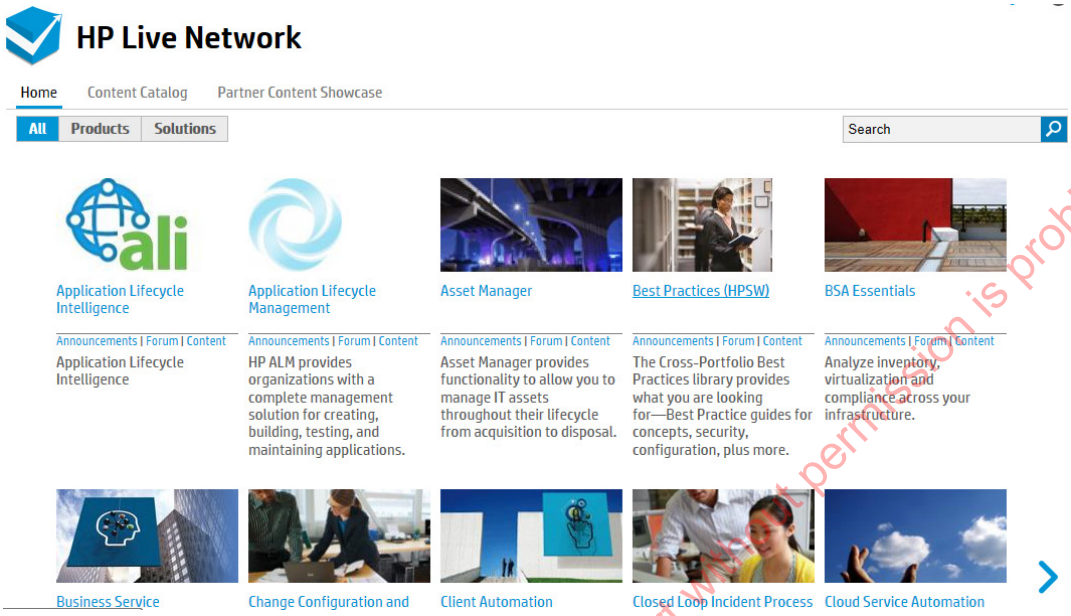
The HP Solution Demo Portal provides a central location for all demonstrations, webinars, and supporting collateral that showcase how HP technologies lead, innovate, and transform enterprise business. Live and prerecorded demonstrations feature HP hardware, software, services, and partnerships in an exciting multimedia format, illustrating how HP can help solve business and IT problems.

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HP Live Network



HP Live Network (HPLN) is a complimentary value-added service available to customers who purchase products enabled through HPLN. Through HPLN, customers can access the most current content add-ons and extensions for their HP IT Performance Suite products.

Content is delivered in one of the following ways:

- Manually through the HPLN Portal

- Downloaded automatically using the HP Live Network connector (LNc)

The HPLN Portal offers valuable features for customers:

A large content repository

- Content announcements, discussion forums, and RSS feeds
- Review and rate content
- A community of more than 10,000 users

The Live Network connector provides additional conveniences, including:

- Unattended download and installation of content into HP products
- Scheduled automatic content updates
- Direct UI integration with several HP products: Client Automation, UCMDB, HP Anywhere, and more upcoming

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Content is defined as information or data that enhances the capability or knowledge of an HP Software product. It is decoupled from the base product and usually optional to install. It is available independent of core product releases and is often released more frequently (daily, weekly, monthly, or quarterly).

Content can take on almost any form, depending on the product it connects with. Common examples include:

- Discovery patterns
- Adapters
- Security updates
- Application signatures
- Device drivers
- Definitions
- Workflows
- Plug-ins
- Report templates

Content on HPLN is gathered from three main sources: HP Research & Development, customers, and HP partners.

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HP Solution Centers



After a solution has been proposed, HP Solution Centers provide the expert support to test, demonstrate, and benchmark the solution. With more than 80 installations around the world, HP Solution Centers provide a global reach, with access to hundreds of technical experts, hundreds of terabytes of data storage, and thousands of servers from single-processor systems to 64-processor HP Integrity Superdome servers.

HP Solution Centers take a tiered approach:

- **Tier I**—Proof-of-concept testing, porting services, web testing, solution benchmarking, product/solution demonstrations and training, customer briefings
- **Tier II**—Solution benchmarking, product/solution demonstrations and training, customer briefings
- **Tier III**—Product/solution demonstrations and training, customer briefings

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HP Solution Centers can show customers how to keep their IT infrastructure under control, how to enhance availability and performance, how to outsource part of their business activities, how to exchange data with partners or customers, how to mobilize a workforce, and how to monitor the business and bill customers—appropriately, safely, and securely. Services include:

- **Proof-of-concept**—This service allows a customer to experience the demonstrated and measurable benefits of potential new solutions. Each proof-of-concept project has dedicated technical consultants from HP and HP partners, secure and private access to IT resources, and an independent meeting room. Proof-of-concept requires two to three weeks and includes:
  - **Definition of the project**—A test plan created and agreed upon by all parties
  - **Infrastructure setup**—Based on the organization's requirements and ready to use upon delivery
  - **Technical checkpoints**—Including briefings and project reviews
  - **Technical recommendations**—Based on results and data analysis
  - **Detailed report**—With comprehensive results

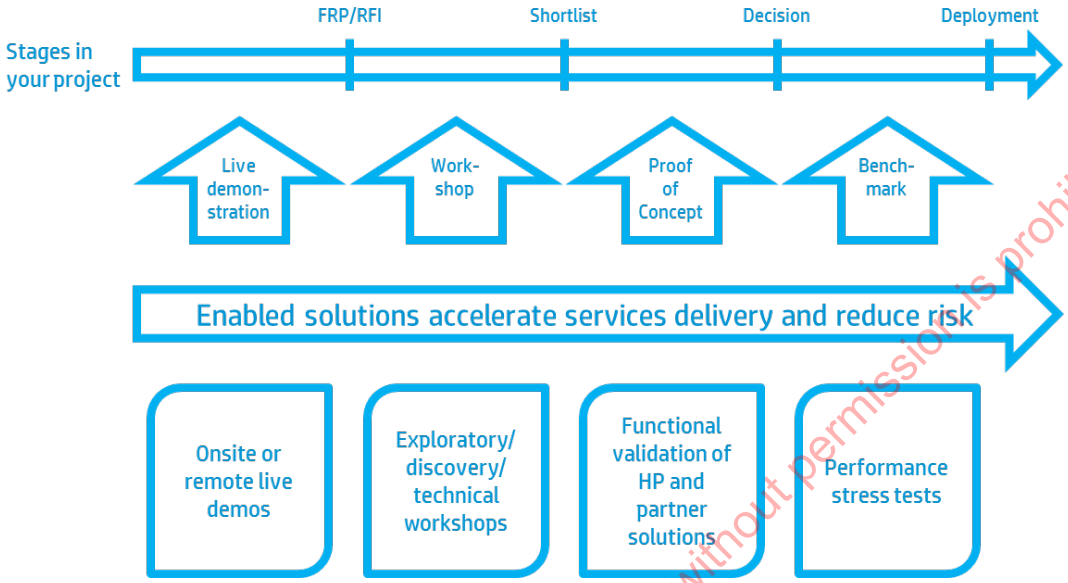
  The proof-of-concept demonstrates the actual performance your solution can hope to achieve, and helps to make sure it supports your expected workload. Proof-of-scale is particularly useful for capacity planning when considering the purchase of new hardware.
- **Virtual Demo Center**—HP has a long history of proven expertise in solution development and deployment. Benefits of this service include:
  - Market-leading track record and expertise in mission-critical disciplines
  - Creativity and expertise in solving problems and developing solutions
  - Proven success with partners and support suppliers
  - Proven history of quality and customer satisfaction
  - Flexible and innovative pricing
  - Proven results in helping customers achieve their goals
  - Global reach and resources

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HP Intel Solution Centers



Companies seeking to expand and improve their services and systems can use the HP Intel Solution Centers. Customers can access the latest technology using practical e-services and an Internet infrastructure, and can also access the signaling and voice infrastructure of the telecom network. Solution Centers can help customers determine quickly whether a particular solution will work for the company or what the best solution is.

Solutions can be tested at Solution Centers in Grenoble, France; Shanghai, China; and Richardson, Texas, USA. These centers provide the essential people, facilities, tools, and services to help build, fine-tune, and control an IT infrastructure. They offer:

- Technical facilities, including a completely outfitted Internet data center environment with onsite dedicated technical expertise from HP, Intel, and other key partners
- Deep expertise in critical areas of today's business environment, including security, consolidation, outsourcing, network development, Converged Infrastructure, and storage
- A unique collaborative working environment where technical consultants from HP and Intel share years of experience, knowledge, and expertise with the customer

The Solution Centers have specific network service provider expertise in billing, revenue assurance, and fraud management, in addition to customer retention management, service delivery and quality management, and IT infrastructure architecture.

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Teams of consultants can save time implementing horizontal and vertical solutions. With an extensive knowledge of the latest technologies, the Solution Center works closely with companies to meet their exact needs. This unique combination of equipment and technical expertise at the centers offers a full set of services to:

- Perform proof-of-concept testing, sizing exercises, and scalability tests
- Benchmark new products and services
- Investigate alternatives for optimizing a solution or architecture
- Test and tune solutions based on Intel architecture, including the Itanium processor

In addition, the Solution Center provides tools to simulate loads, stress applications, and replicate environments. It also provides a connection to the Internet to allow pilots, business trials, remote access to an IT infrastructure, and real-life environment tests.

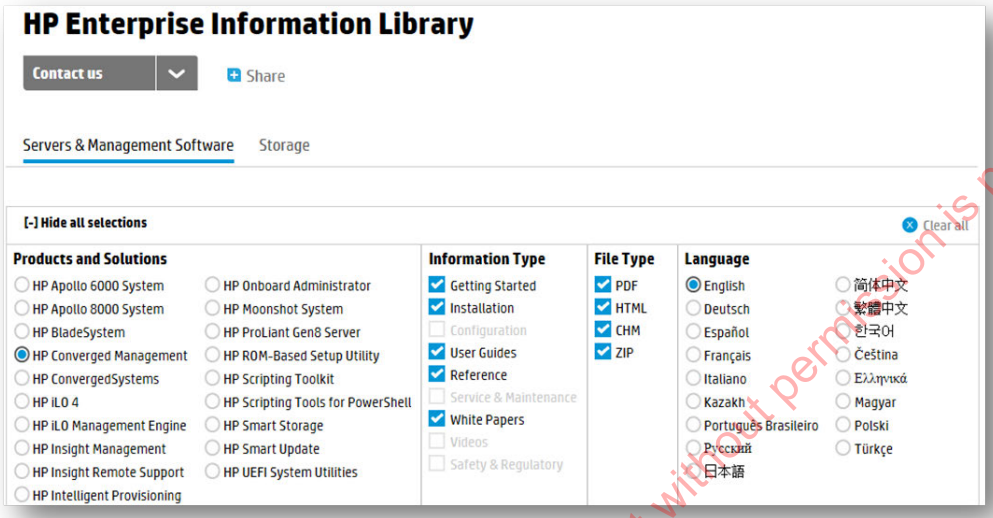
INTERNET For more information, scan this QR code or right-click it and open the hyperlink:

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Other HP tools and resources

HP Enterprise Information Library



The HP Enterprise Information Library is a search-based tool used to access user guides, technical documentation, and other collateral for a variety of products and solutions.

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Learning check

Your facilitator will lead a class discussion to capture key insights and challenges from the module. To prepare for the discussion, answer each of the following questions. Write your answers here and be prepared to share them with the group.

1. SalesBuilder for Windows can only be used to configure and customize technical solutions for upgrades and add-ons.

   ☐ True

   ☐ False

2. The HP Simplified Configuration Environment (SCE) uses a Guided Solution Wizard to build a solution based on the applications for which the solution will be used.

   ☐ True

   ☐ False

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Summary

Customers want to transform IT in order to react quickly to major positive or negative changes in the business environment. However, they need to be able to reliably assess revenue gains and cost savings from proposed investments in new technologies and services (such as mobile applications, use of cloud services, and big data analytics). HP provides TCO and ROI tools to help customers with these assessments.

HP also provides several tools that are useful for designing complete customer solutions, from server configuration tools to storage and backup solutions.

HP collaborates aggressively with all types of partners to help them build their business. Taken all together, HP provides not only the hardware, software, storage, networking, and expertise that can help customers gain a competitive edge in their industry, but also the configuration tools and partner ecosystem to help companies explore their options and chart the development that will take IT to the cloud, and business to the next level.

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Activity—Exploring HP configuration tools

To become more familiar with the configuration tools that HP provides, select two of the tools that were covered in this module. Select tools you are not familiar with, and perform these steps.

1. Access these tools online and spend three to five minutes reading the descriptions and exploring the tools.
2. Write down the key features, benefits, and impressions. Record the situations in which you would use each tool.

_____

_____

_____

_____

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_____

3. Share with your peers or within a small group what you have learned.

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HP Converged Infrastructure Management Tools

Module 7

What's in this module for you?

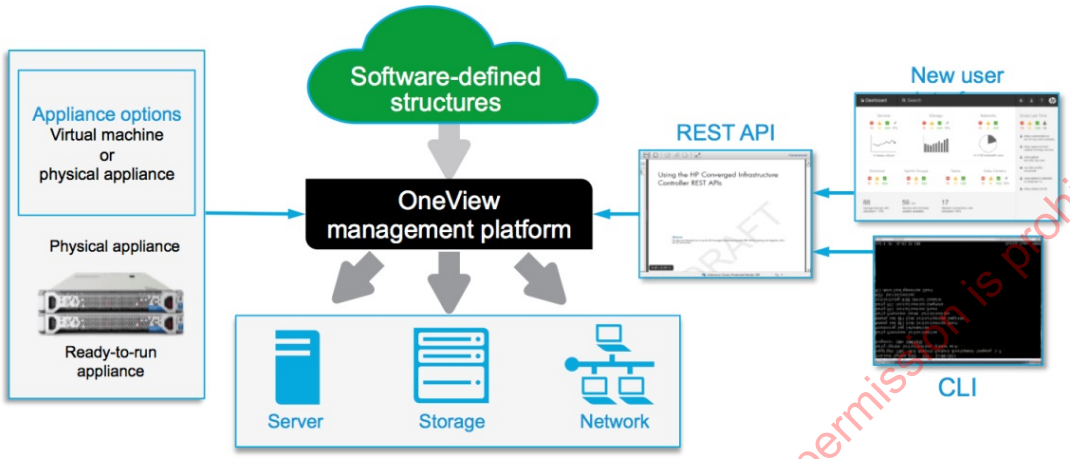
After completing this module, you should be able to:

- Provide an overview of HP OneView features and functions
- Provide an overview of the updated features and functions of HP Insight Control server provisioning (ICsp)
- Describe the integration of HP OneView with HP ICsp

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HP OneView



HP OneView visual overview

HP OneView is a software-defined management platform that deliberately addresses the challenges of manual operation, human error, and limited extensibility in virtualized BladeSystem and rack server environments. It is an optimal management platform for BladeSystem environments. By capturing processes, configurations, and best practices in software, OneView creates a modern collaborative management approach that automates the deployment and management of infrastructure—repeatedly, reliably, and at scale.

The software-based approach to lifecycle management in OneView automates operations to reduce the cost and time to deliver IT services. This approach includes a fully programmable interface for easily creating customized workflows and scripts, as well as configuration profiles for push-button builds that instantly deliver resources without mistakes or variation.

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HP OneView features and functions

HP OneView offers the following features:

- Converged Infrastructure groups and server profiles
- Enclosure groups and logical interconnect groups
- Network sets and uplink sets
- Pervasive Smart Search and Map View
- System health monitoring
- Firmware management and updates
- Environmental management (such as power, thermal)
- Remote management (through HP integrated Lights-Out (iLO) Advanced)
- Easy-to-set up management appliance
- Full access through the Representational State Transfer (REST) API and a State-Change Message Bus (SCMB)
- Optimized for HP ProLiant Gen8 servers

OneView provides the following functions:

- A single, integrated management environment for a converged infrastructure that enables IT teams to work and collaborate in a more natural and automated way
- A software-based approach to lifecycle management, which automates operations to reduce the cost and time to deliver IT services
- An intuitive interface and powerful search capabilities
- Open architecture and a software development kit (SDK) for integration with enterprise management tools and applications

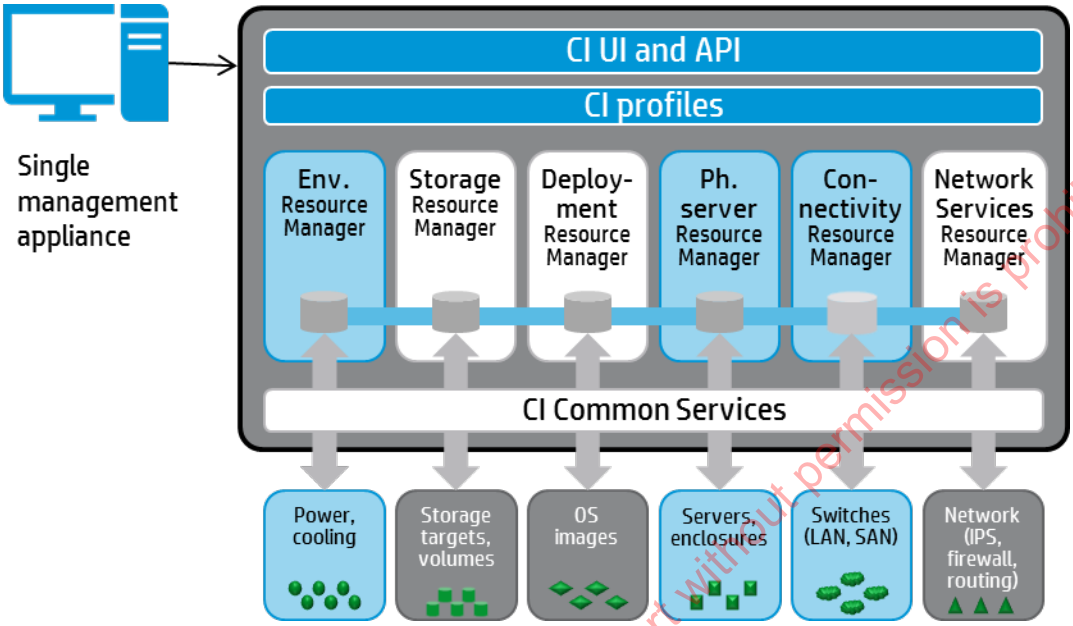
In addition to remote management and environmental management of the data center, OneView enables efficient, reliable, non-disruptive, and simple firmware management across the data center with firmware baseline capabilities.

Note
HP OneView is intended to replace the capabilities found in HP Systems Insight Manager (HP SIM), HP Insight Control, and HP Virtual Connect Enterprise Manager (VCEM).

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HP OneView architecture



Connectivity in HP OneView architecture

HP OneView is designed from inception to provide a resource-oriented solution focused on the entire hardware lifecycle—from initial configuration to ongoing monitoring and maintenance of both logical resources (such as server profiles, networks, and connections) and physical resources (such as servers, interconnects, and enclosures).

This advanced architecture connects the resources with a common representation of servers, networks, storage, and the other elements comprising the converged infrastructure. The domain-specific representation of resources also models their associations and interdependencies; each area contributes to the “one view” of the converged infrastructure. The OneView modern architecture also separates the management and data backplanes in accordance with good industry practices, which can be particularly critical in stopping denial-of-service (DoS) attacks.

OneView is a resource-oriented solution focused on the entire hardware lifecycle—from initial configuration to the ongoing monitoring and maintenance of both logical and physical resources. Logical resources might include server profiles, networks, and connections. Physical resources might include servers, interconnects, enclosures.

OneView features an integrated resource model that is highly interconnected and consistent. You can easily navigate within it, and you will not have two versions of the same resource that are slightly askew. OneView is designed with a single, consistent model across different resources to present a simplified view to the user. You do not need to use four different tools with four different views and models of the same thing.

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REST API

OneView features an open development platform designed to adapt rapidly to business needs. This programmable platform, built on the REST API, allows enterprises to scale beyond data center walls to the cloud. REST is a web service that uses basic create, read, update, and delete (CRUD) operations performed on resources using HTTP POST, GET, PUT, and DELETE. You can use the REST API to automate, integrate, and customize anything you can do from the UI using your favorite scripting or programming language. Applications conforming to REST constraints are known as *RESTful*.

The REST API is designed for those who want to access the full power of the management architecture. A consistent API, a common data model, and an SCMB replace the more random approach found in traditional systems. REST APIs provide a simpler, stateless, and scalable approach, so users can easily integrate, automate, and customize on their own. Developers are also interested in REST APIs because they are common to two-thirds of today's top web environments.

After you set up the OneView appliance, you can configure the software-defined templates automatically. For example, you do not have to set up clustering on your own, establish the heartbeat network, install the management server operating system, install the application, or configure separate services.

OneView is designed with an Open API and an SCMB to enable easy integration into the full capabilities of the management architecture. The SCMB is an interface that allows custom scripts/integrations to be notified of changes to managed resources (both logical and physical resources) through asynchronous messaging. For example, integration scripts could be notified whenever new server hardware has been added to the managed environment or when the health status of physical resources has changed—without having to continuously poll for status through the REST APIs.

All communication between external data consumers and internal components is conducted through the RESTful interface.

Open integration can address a variety of user needs, including:

- Automating standard workflows and troubleshooting steps
- Automating integrations (for example, a configuration management database)
- Connecting to service desks
- Monitoring resources, collecting data, and mapping and modeling of systems
- Exporting data to formats that suit individual needs
- Attaching custom databases, data warehouses, or third-party business intelligence tools
- Integrating in-house user customizations

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INTERNET For information about the PowerShell and Python libraries for HP OneView, scan these QR codes or right-click them and open the hyperlink:

Resource managers

OneView has a resource-oriented architecture that provides a uniform REST interface. Every resource has one Uniform Resource Identifier (URI) and represents a physical device or logical construct. You can use REST APIs to manipulate resources.

A single, consistent resource model is embodied in an HTML5 user interface and the REST API.

OneView 1.0 includes several resource managers that manage dedicated physical and logical components and interact with other components to make OneView work. The following resource managers are available:

- Environmental Resource Manager (data centers, racks, power delivery devices, unmanaged devices, and so on)
- Physical Server Resource Manager (servers and enclosures)
- Connectivity Resource Manager (interconnects, storage area networks, and local area networks)
- Profile Resource Manager

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HP OneView appliance

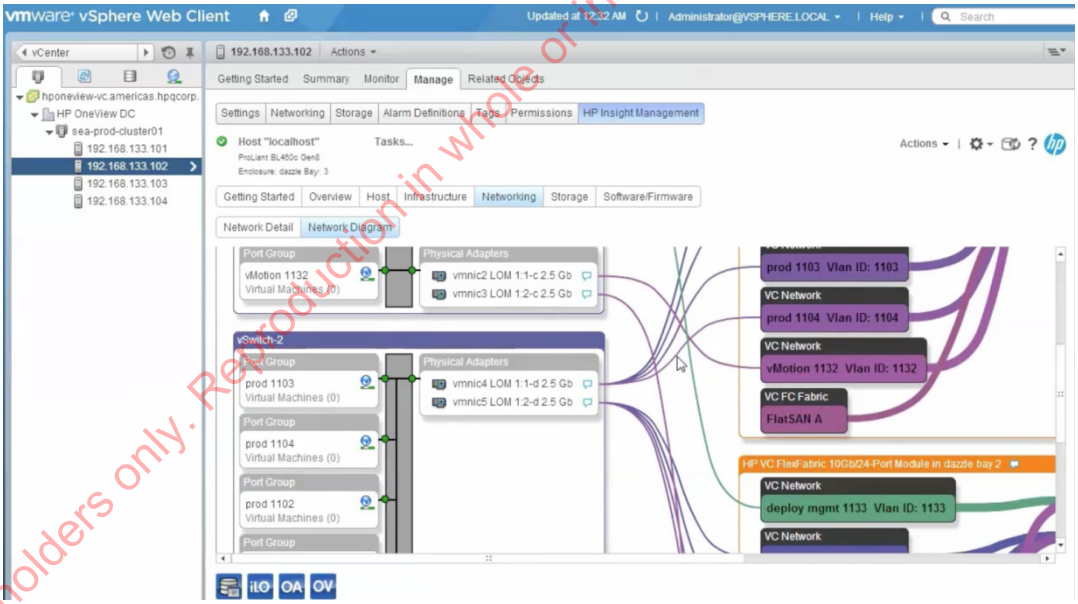
HP OneView is delivered as a virtual appliance running in a VMware ESXi virtual machine. This appliance is operating system agnostic. For example, it can manage servers running Microsoft Windows or Linux operating systems. Support for other hypervisors will be added over time.

Note
In the past, configuration of the management server has been challenging for customers. By using an appliance, HP provides a predefined system that is pre-configured and tuned to provide a high quality, highly secure, and highly available management appliance.

The OneView appliance comprises both Open Source components and custom HP internally developed components. It is delivered as an Open Virtual Format (OVF) package for installation on a vSphere Hypervisor host. The HP OneView OVF package is distributed in Open Virtual Appliance (OVA) format.

To install OneView, you must have VMware vSphere Hypervisor Client installed on the host system, and you must have access to a VMware vCenter server to install OneView.

HP OneView vCenter plug-in



An HP OneView vCenter plug-in helps system administrators more efficiently manage their VMware vCenter operations with OneView functionality. The vCenter plug-in, which works through the vCenter console, enables administrators to manage and automate operations around vSphere hosts and clusters.

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The plug-in can save time by being used to deploy a cluster more quickly. Setting up a new cluster in vSphere can be time-consuming. The process can involve configuring single sign-on (SSO), configuring the file settings, updating the server firmware, and deploying the hypervisor. With OneView, creating a cluster takes only five steps, and is 12 times faster than doing it manually.

OneView can also provide advanced visualization capabilities that can help understand how resources are configured. With vCenter deployments, OneView allows the administrator to trace a connection visually through the physical layers to the virtual layers. For storage systems, the vCenter console shows how virtual machines are mapped to data stores and individual disk volumes.

HP OneView and Virtual Connect

HP Virtual Connect provides a wire-once, change-ready environment to make it easy for administrators to manage dynamic network environments at the server edge. HP ProLiant servers and HP BladeSystems enjoy simplified monitoring by using a streamlined, modern alert management architecture that automatically sets up monitoring for managed resources.

When you add an enclosure to the environment, the OneView appliance automatically detects all of the hardware seated in the enclosure and prepares it for you to bring under management. The appliance:

- Updates the enclosure Onboard Administrator, Virtual Connect interconnect module, and server iLO firmware to the minimum version required
- Configures each Virtual Connect interconnect module
- Configures the Onboard Administrator, which includes configuring Network Time Protocol (NTP) and an SSO certificate for UI access
- Configures each server iLO, which includes configuring an SSO certificate for UI access
- Configures the hardware for monitoring, which includes configuring the automatic registration of Simple Network Management Protocol (SNMP) traps
- Automatically detects and presents HP Intelligent Power Distribution Unit (iPDU) power devices so that you can bring them under management.

The OneView appliance provides several networking features to streamline the provisioning of networking resources for server blades and to manage configuration changes, including firmware updates, to Virtual Connect interconnect modules.

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Transitioning existing infrastructure from being managed by Virtual Connect Manager (VCM) to being managed by OneView requires inventory and evaluation of the current environment before initiating the transition. After the inventory has been completed, you can evaluate when and how the environment should transition to OneView management.

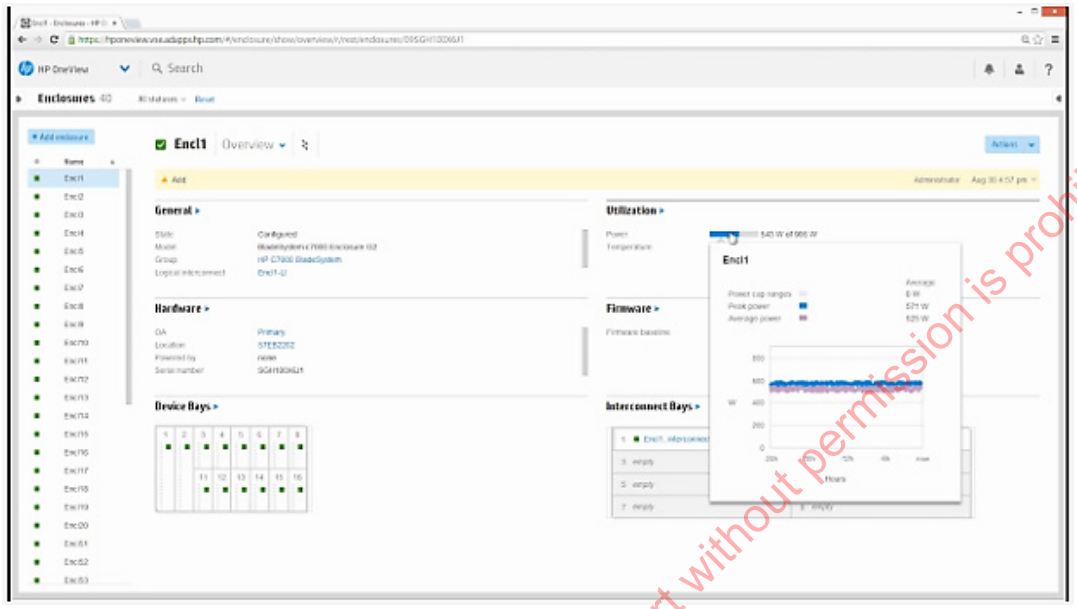
! **Important**
OneView cannot import existing HP Virtual Connect domain configurations; therefore, enclosures added to OneView should not be part of the existing Virtual Connect domain. If an enclosure is managed by VCM, remove it from the Virtual Connect domain before adding it to OneView. Do not select a host system located in an enclosure that you plan to manage with OneView. You can, however, select a host system located on a ProLiant DL rack-mount server that you plan to manage with OneView.
If you attempt to import an active VCM configuration into OneView, the configuration will be removed.

OneView 1.X can manage up to 40 enclosures (640 servers). You can deploy multiple OneView appliances to manage larger environments until this limit is raised. OneView 1.X is not a manager of managers and does not support federation of OneView appliances.

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Using HP OneView



Resource detail view

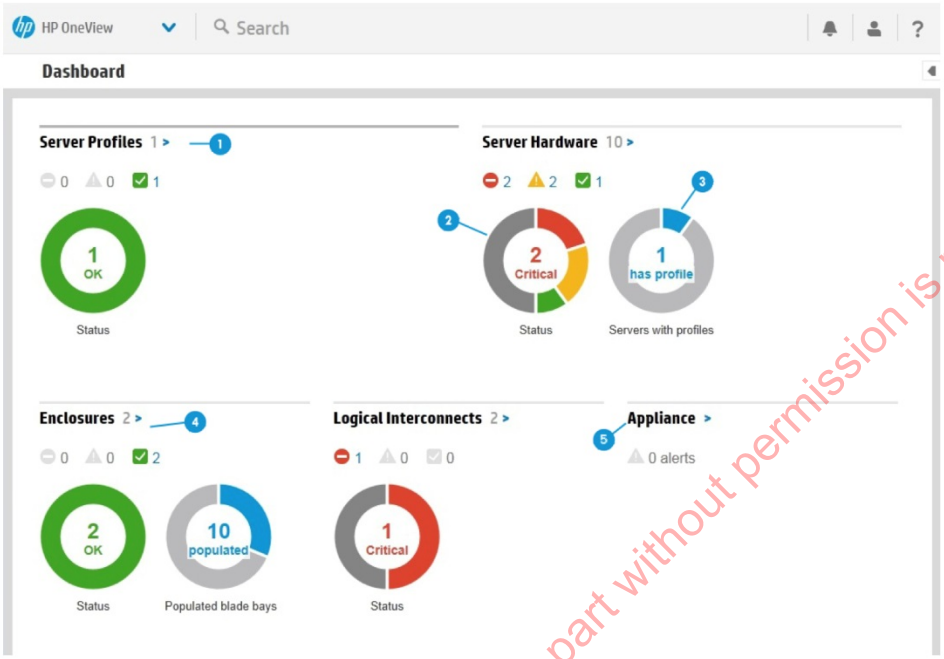
HP OneView provides a fast and modern user interface. The OneView UI streamlines the number of steps required to accomplish key tasks in the data center and provides a variety of powerful, easy-to-use tools:

- **Dashboard** gives you capacity and health information at your fingertips.
- **Groups, profiles, and templates** automate configuration of key server, storage, and network resources.
- **Map View** allows you to visualize the relationships between devices, up to the highest levels of the data center infrastructure.
- **Smart Search** instantly gets you the information you want for increased productivity, with search support for all the elements in your inventory (such as alerts).
- The **Activity screen** allows you to display and filter all system tasks and alerts.
- **Group management** facilitates the administration, troubleshooting, and monitoring of large enterprises as though they were a fraction of their size.

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HP OneView Dashboard



HP OneView Dashboard

When you log in to the appliance, you can view the Dashboard, which provides an overview of system activity and alerts. The Dashboard provides an at-a-glance visual health summary of the appliance resources you are authorized to view, such as:

- Server profiles
- Server hardware
- Enclosures
- Logical interconnects
- Appliance alerts

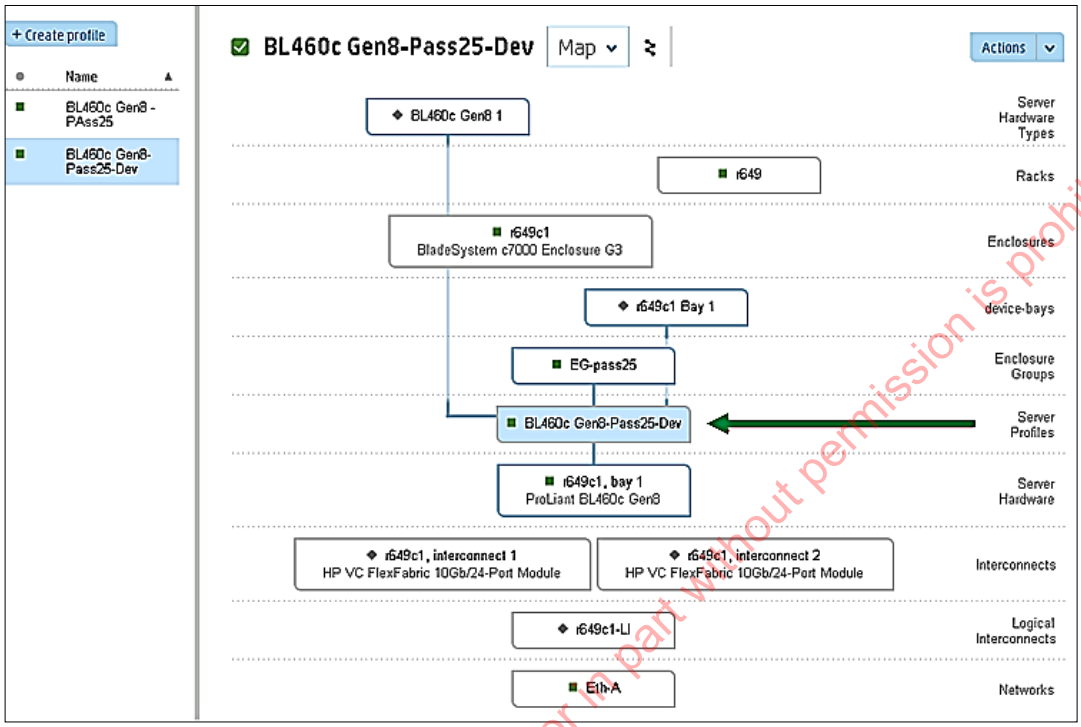
You can link to the resource screens in the UI for more information by clicking the status icons displayed for each resource. The status of each resource is indicated by a color:

- **Green**—Healthy status
- **Yellow**—An event has occurred that might require attention
- **Red**—A critical condition has occurred that requires immediate attention
- **Blue**—The percentage of resource instances that match the data being measured (a solid blue graph indicates 100%)
- **Light gray**—The remainder of resource instances that do not match the data being measured (used in combination with blue)
- **Dark gray**—Resource instances reporting status other than OK, warning, or critical; that is, they are disabled or unknown

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HP OneView server profiles



Server Profiles screen

Server profiles capture key aspects of the server configuration in one place, enabling you to provision converged infrastructure hardware quickly and consistently according to your best practices.

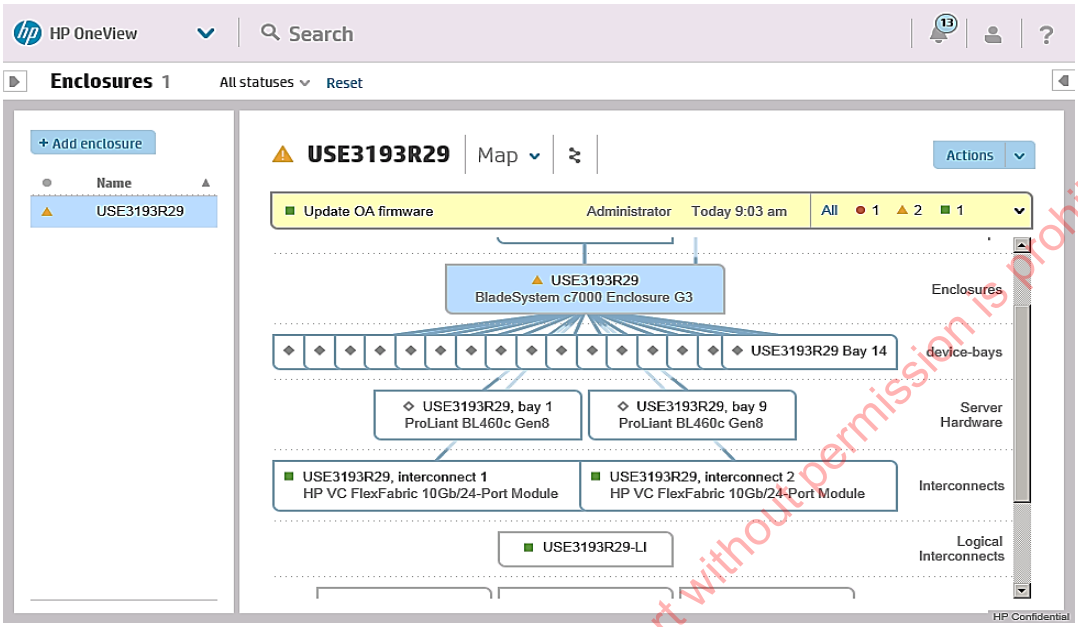
A server profile can contain the following configuration information about the server hardware:

- Basic server identification information
- Connections to Ethernet networks, Ethernet network sets, and Fibre Channel networks
- Firmware versions
- BIOS settings
- Boot order
- Physical or virtual UUIDs, media access control (MAC) addresses, and World Wide Name (WWN) addresses

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Map View



Map View

Map View enables you to examine the configuration and understand the relationships between logical and physical resources in your data center. This view gives you immediate visibility into your resources from the individual Ethernet and Fibre Channel networks all the way up to the enclosure, rack, and top-level physical data center. Map View was designed to be highly interactive and useful even at scale.

Note
Map View is resource-centric. Everything above the selected resource is an ancestor. Everything below the selected resource is a descendant. A line connecting boxes indicates a direct relationship, such as server blades in an enclosure. Other items can be indirectly related to the resource, such as logical interconnect groups and server profiles.

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Smart Search

The banner of every screen includes the Smart Search box, which enables you to find resource-specific information such as specific instances of resource names, serial numbers, WWNs, and IP and MAC addresses. Smart Search makes locating resources by model as simple as entering the model string (for instance, BL660), enabling you to inventory or take action on a desired set of devices.

Perhaps you are looking for all resources in a given enclosure, or you need to find one server using a certain MAC address. Smart Search instantly gives you the information you are looking for.

The default search behavior is to focus on the resource you are currently viewing. However, to broaden the scope of your search across all resources, you can select **Everything**.

Certain resources do not include the option to choose between the current resource or **Everything**, in which case the default search is for **Everything**.

When you start entering text, search suggestions are provided based on pattern matching and previously entered search criteria.

- Select a suggestion to change your filter to the suggestion and submit it (as if you had pressed **Enter**).
- Press **Enter** to see the list of search matches.
- If you are doing a resource match, the master pane is filtered to match your search input.

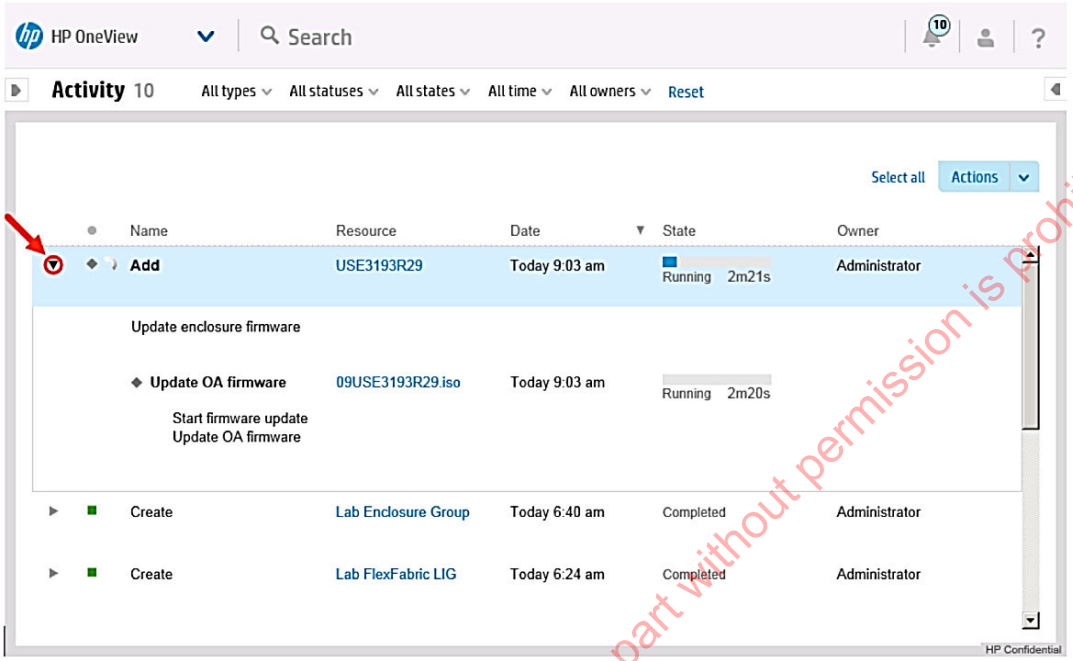
Note
Enter complete words or names as your search criteria. Partial words or names might not return the expected results.

If you enter a multi-word search term, results show matches for all words you enter.

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Activity screen



The Activity screen

The Activity screen provides a log of health and status notifications. The appliance verifies the current activity of resources in your environment, and it posts alerts to the Activity screen and to the associated resource screens for you to review.

The Activity screen is also a database of all tasks that have been run—either synchronously or asynchronously—and initiated by the user or system. It is similar to an audit log, but provides more detail and is easily accessed from the UI.

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Group management

An enclosure group is a group of enclosures that use the same configuration, such as network connectivity and firmware versions for the OA and interconnect modules. All members of an enclosure group use the same logical interconnect group.

When you add an enclosure to the appliance and assign an enclosure group, the interconnects in the enclosure are configured automatically according to the logical interconnect group associated with the enclosure group. Enclosure groups enable administrators to provision multiple enclosures in a consistent, predictable manner in seconds.

A logical interconnect group is a group of logical interconnects that share the same configuration for network connectivity. A logical interconnect group is the set of physical interconnects and their links, including:

- Uplinks to data center networks as mapped by their uplink sets
- Downlinks to the servers
- Stacking links (connections to each other)

When you define configurations using logical interconnect groups and enclosure groups:

- Administrators can provision multiple enclosures with consistent network configurations in seconds.
- Network administrators are not required to take action every time an enclosure is installed because the network configuration is defined by the enclosure group.

Adding an enclosure

Adding an enclosure brings the rack, the enclosure, and the enclosure's contents of server hardware and interconnects under managed control. You add an enclosure by providing the HP Onboard Administrator (OA) IP address or host name, along with the OA credentials.

As part of the add operation, you also specify an enclosure group with an associated logical interconnect group that defines a single logical interconnect within the enclosure. A logical interconnect represents collection of all of the physical interconnects and their shared connectivity within an enclosure. Interconnects within an enclosure share resources on their uplinks, share available networks, and have the same connectivity available to servers on their downlinks.

To make the enclosure manageable by the OneView appliance, the firmware (OA, Virtual Connect, and blade iLOs) must be updated to the required versions. Select a supported firmware bundle from the OneView repository (embedded by default or uploaded subsequently) to create a baseline for the enclosure.

After adding the enclosure, verify that all the resources in the enclosure have been imported. Examine physical and logical interconnects, server hardware, server hardware types, and mapped relationships.

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Firmware management baselines

When you add enclosures and servers to the managed environment, you can specify a firmware baseline for the OA and iLO modules.

If you do not specify a firmware baseline, the OA and iLO modules are updated automatically to have the minimum firmware versions required to be actively managed by the appliance.

Note
The HP Virtual Connect module firmware update is a separate process that you manage at the logical interconnect resource.

OneView supports only Virtual Connect firmware 3.15 and later as the minimum firmware version for adding a logical interconnect to the appliance. If an interconnect module has an earlier version of Virtual Connect firmware, HP recommends using the Virtual Connect Support Utility (VCSU) to update the firmware to version 3.15 before adding the device to the appliance.

OneView can manage and configure Virtual Connect interconnect modules that have a minimum firmware version of 4.10. Any module that has an earlier firmware version when it is added to the appliance is flagged for a firmware update. The flagged modules remain in an unmanaged state until you update the firmware.

INTERNET Navigate to **http://www.hp.com/go/oneviewupdates** to obtain OneView software updates and product-specific firmware bundles.

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User accounts and roles

The appliance provides default roles that customers can use to separate responsibilities in an organization. A user role allows access to specific resources managed from the appliance.

A role is defined based on a list of actions (such as view, add, edit, and delete) that can be performed on a resource. Users must have, at a minimum, view (read-only) privileges for a managed object to see that object in the user interface.

User roles enable you to assign permissions and privileges to users based on their job responsibilities. You can assign full privileges to a user, or you can assign a subset of permissions to view, create, edit, or remove resources managed by the appliance.

At the initial appliance startup, there is a default administrator account with full access (Infrastructure administrator) privileges. You can assign roles (privileges) from the Add User screen.

User roles:

- Infrastructure administrator (has full privileges)
- User with specialized access (a role-based specialist)
  - Backup administrator
  - Network administrator
  - Server administrator
- User with read-only access—Can only view appliance information

Certificate management

The appliance uses a certificate for authentication over Secure Sockets Layer (SSL) encryption. The certificate contains a public key, and the appliance maintains the corresponding private key, which is uniquely tied to the public key.

A self-signed certificate indicates that a host vouches for itself, which, in some cases, might be adequate. By default, browsers do not trust self-signed certificates and display a warning.

A more secure alternative is a certificate issued by a third-party certificate authority (CA), a trusted party that issues a certificate that enables others, who trust the CA, to also trust the host. In essence, the CA vouches for the host.

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Patching and updating

Patches and updates for the OneView appliance are released when new features or fixes for the current OneView appliance version are available. In general, updating a configured appliance does not affect the existing settings.

Customers should check the HP website for available patches and updates, examine the associate release notes, and apply the patch or update if needed.

Updating the OneView appliance

After a patch upload finishes, a pre-upgrade script runs that:

- Verifies that the update image has a .bin suffix
- Validates the digital signature
- Unpacks the tar ball
- Validates the digital signatures of the rpms (belt and suspenders)
- Verifies whether the version of the update is newer than the currently installed version of the firmware on the appliance
- Displays the current appliance version on the Settings page (`/ci/etc/version`)
- Includes an update.properties file that has the version of the update
- Verifies that sufficient disk space exists compared to the requirements from update.properties
- Redisplays the end-user license agreement (EULA)

If any failures occur, the logs are preserved at `/updatelogs/update.log`.

After the script runs, click **Install Update**. A warning displays if any users are logged in who might be disrupted by the installation.

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Backing up and restoring the OneView appliance

OneView provides services to back up an appliance to a backup file and to restore an appliance from a backup file. One encrypted backup file is created for both the appliance and its database. Backup files are encrypted and contain configuration settings and management data—there is no need to create separate backup files for the appliance and its database.

You can create backup files while the appliance is online. Also, you can use the REST APIs to:

- Schedule a backup process from outside the appliance
- Collect backup files according to site policies
- Integrate with enterprise backup and restore products

A backup file is a snapshot of the appliance configuration and management data at the time the backup file was created. HP recommends that you create regular backups, preferably once a day and after you make hardware or software configuration changes in the managed environment.

Important
On a ProLiant server running OneView, the backup and restore files are OneView version specific, which means the backup and restore operations must occur on the same version of OneView.

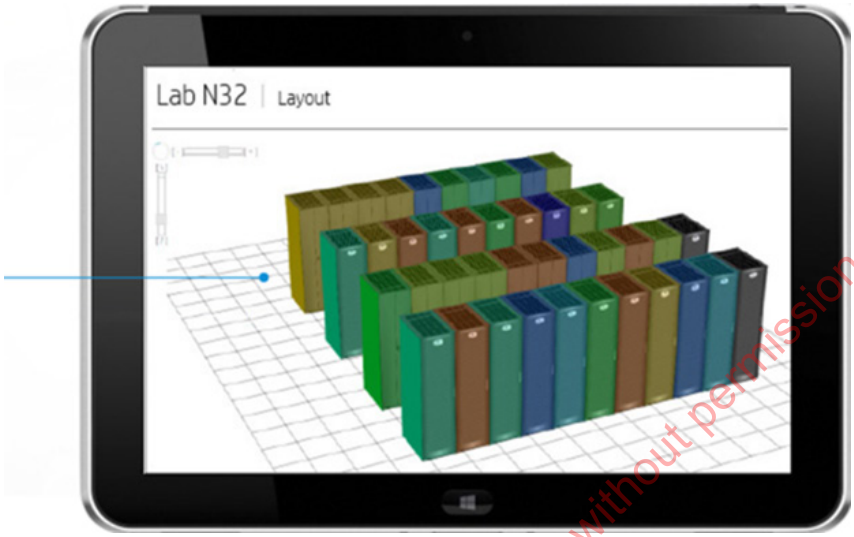
INTERNET For additional information about HP OneView REST API scripting, search for the *HP OneView 1.05 REST API scripting* document on the web.

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Advanced functions

Data Centers screen



OneView enables you to define the physical attributes of your data centers and power systems. The Data Centers screen provides a 3-D model of the environment, which you can use for planning and organization. It also displays power and temperature data so you can monitor the consumption rates and health of your data center.

The appliance monitors and displays peak temperatures for your racks and their components, which can help identify potential cooling issues in a data center.

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iLO Advanced for HP OneView remote management

OneView licenses iLO Advanced, which is a comprehensive iLO remote management solution for ProLiant servers. This environment management solution includes numerous key features to help solve complex IT problems, including:

- Remote access to server power control and event logs.
- Graphical Remote Console, which turns a supported browser into a virtual desktop, giving the user full control over the display, keyboard, and mouse of the host server. The operating system-independent console displays remote host server activities (for instance, shutdown/startup operations) and works with a standard browser on the remote server or client system without additional software.
- Shared console and console replay, which allow up to six team members to view and share control of a single virtual keyboard, video, or mouse (KVM) session, capturing and saving screen video for later review of failure sequences and easy documentation of complex configurations and tasks.
- USB-based Virtual Media, which allows an IT administrator to boot the remote server from the client machine (or anywhere on the client's network) and execute functions remotely.
- Integration with Microsoft Terminal Services, which provides a graphical remote console when the operating system is fully loaded/available on the host system; and a secure, hardware-based iLO console for remote access to the host server when the operating system is not operational.
- Serial record and playback saves the text-based output data for later access and can show exactly what activities or actions occurred.
- Remote system logs keep a log of everything being done, which can later be used for troubleshooting.

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Enterprise directory integration

Instead of creating and maintaining locally defined (on the OneView appliance itself) users and their roles, you can use Lightweight Directory Access Protocol (LDAP) or Active Directory for authentication, where authentication is confirmed by comparing the user login information to an enterprise directory. The appliance support for OpenLDAP and Microsoft Active Directory is conceptually similar to that for the OA and iLO processors.

You can add a user who is authorized to access all resources managed by the appliance (a full-access user) or a user who has access based on their job responsibilities (a role-based specialist). For each of these users:

1. From the main menu, open the Users and Groups page.
2. Select **Add Directory User or Group**.
3. Enter the name of the directory service that authenticates logins.
4. Enter the credentials of the authentication directory service administrator account.
5. Click the **Connect** button to log in to the directory service.
6. Provide the user data and reveal the roles for that user.

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Monitoring system health

Efficient data views and effective control enable you to respond to issues for managing the health of ProLiant servers. OneView simplifies monitoring by providing a streamlined, modern alert management architecture.

When managed resources are added to the appliance, they are automatically set up for monitoring, including the automatic registration of SNMP traps and scheduling of health data collection. They are touch free—that is, they are monitored immediately without requiring you to invoke additional configuration or discovery steps.

All monitoring and management of data center devices is agentless and out-of-band for increased security and reliability. No operating system software is required, no open SNMP ports on the host operating system are required (for Gen8 servers), and zero-downtime updates can be performed for these embedded agents. ProLiant Gen8 and later servers support agentless monitoring through iLO. ProLiant G7 servers require host operating system SNMP agents.

You can view all alerts, filter your alerts by severity or by system, and search your alerts using HP Smart Search. Alerts can be assigned to specific users and annotated with notes from administrators. Email notifications or traps can be automatically forwarded to enterprise monitoring consoles or to centralized SNMP trap collectors.

A single user interface provides summary views of the detailed hardware and firmware inventory information on servers, storage, networks, and firmware revisions. The data includes Smart Search support for elements of inventory and is visible through the user interface and REST API.

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Resources for management and support

Helpful HP resources for OneView management and support include:

- Infrastructure management

- HP OneView online user forum
  - The HP OneView interactive online forum enables you to share your experiences and pose and answer questions related to using OneView.
  - This forum also hosts PowerShell and Python libraries that use the comprehensive OneView RESTful APIs to perform any operation.

INTERNET To join the discussion, scan this QR code or right-click it and open the hyperlink:

- Software technical support and software updates
  - OneView software products include three years of 24 x 7 software technical support and update services, which provides access to technical assistance to resolve software implementation or operations problems.
  - With this service, you benefit from expedited problem resolution as well as proactive notification and delivery of software updates.
-

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- Registering for software technical support
  - When you order OneView, you receive a license entitlement certificate by physical shipment or email, which you must redeem online in order to obtain the license activation key.
  - Gather information before contacting an authorized support representative.
  - After redeeming your license certificate activation key, you are prompted to register for software technical support and update services. Licenses that are embedded in the hardware are automatically registered.

INTERNET For more information, scan this QR code or right-click it and open the hyperlink:



  - After you are registered, you receive a service contract in the mail containing the customer service phone number and your Service Agreement Identifier (SAID). You need the SAID when you phone for technical support.

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What's new in HP OneView releases

The summary of most significant enhancements and changes is provided below. For additional details and explanation, refer to the Learner Guide appendix titled *HP OneView.*

HP OneView 1.1 (release date of June 2014):

- Server profile support for SAN storage provisioning
- Automated SAN zoning
- Configuration support for DL servers
- Automation of enclosure configuration
- Support for non-Virtual Connect environments (within the BladeSystem enclosures)
- Hyper-V appliance as a host
- Support for native Fibre Channel-based Virtual Connect modules
- Integration with VMware vCenter, MS System Center, RH Enterprise Virtualization
- Instant-on licensing, factory-embedded licensing, and enterprise (AKA) licensing

HP OneView 1.2 (release date of December 2014):

- Licensing changes—free Standard offering and for-fee Advanced offering
- ProLiant Gen9 support
- Predefined reports, exportable to CSV and Microsoft Excel
- Automated zoning for the HP 5900CP switches
- Ephemeral HP 3PAR volume support
- Monitoring of Cisco Nexus 6001 switches
- HP Operations Analytics for HP OneView
- Updated 3rd party monitoring tool integration (VMware vCenter, Microsoft System Center, and Red Hat Enterprise Virtualization)

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HP Insight Control server provisioning

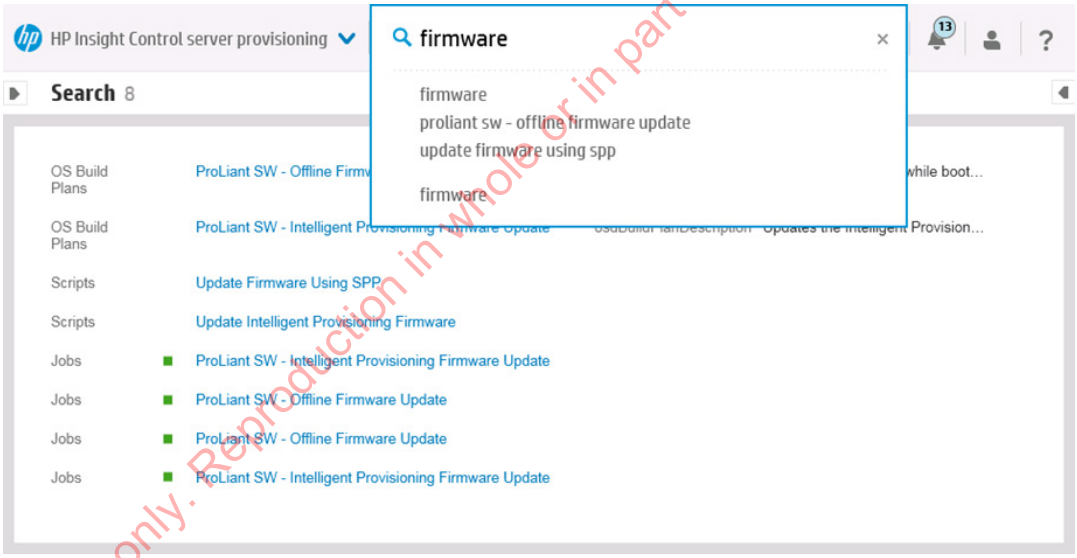
HP Insight Control server provisioning (ICsp) introduces updated server provisioning capabilities designed to help customers simplify and reduce the time associated with server provisioning tasks.

ICsp is a complete provisioning solution for HP servers, with capabilities for multi-server operating system and firmware provisioning to ProLiant and BladeSystem servers. Server provisioning automates the process of deploying and provisioning server software, enabling an IT team to adapt to changing business demands quickly and easily.

ICsp is optimized for ProLiant Gen8 servers (server blades and rack-mount servers).

Note
You can run ICsp on VMware vSphere/ESXi 5.0 Update 3 and 5.1 Update 2 hypervisor versions.

User interface features



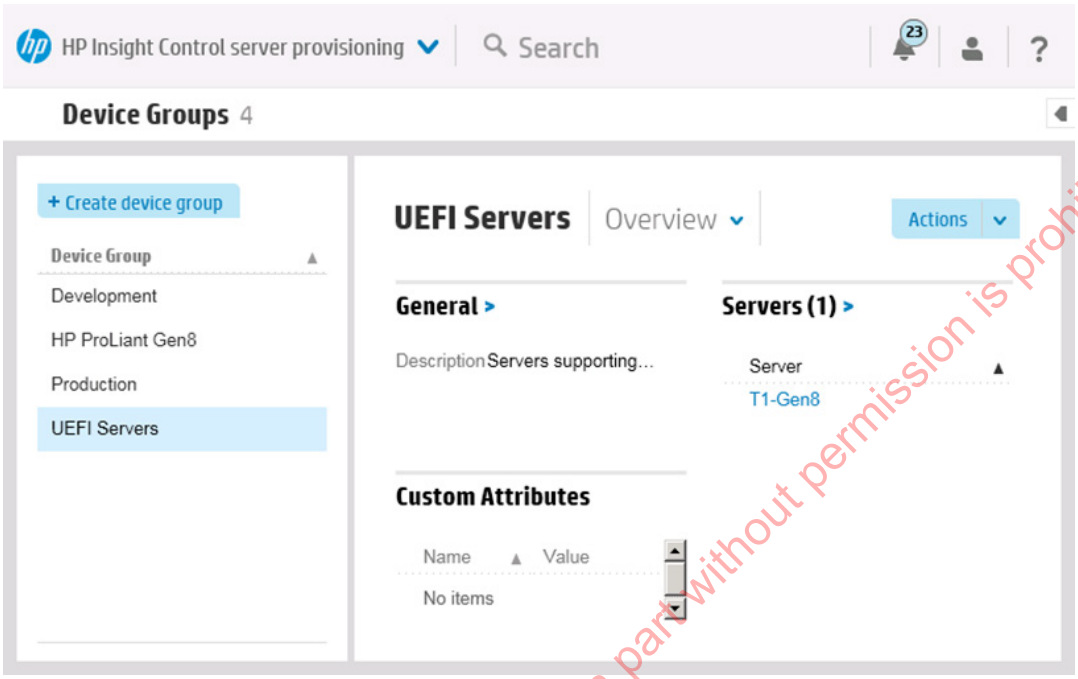
The ICsp user interface features include improved search and improved special character processing for media server.

The search feature from the main screen has been enhanced to search more fields faster and provide suggestions as you type. In order to account for strong password requirements, the processing of the media server information has been modified to allow nearly all special characters in the password field.

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Device groups



You can now create and manipulate device groups, which are simple, user-defined groups of servers used for organizing servers in ways that are meaningful to you and acting on them together.

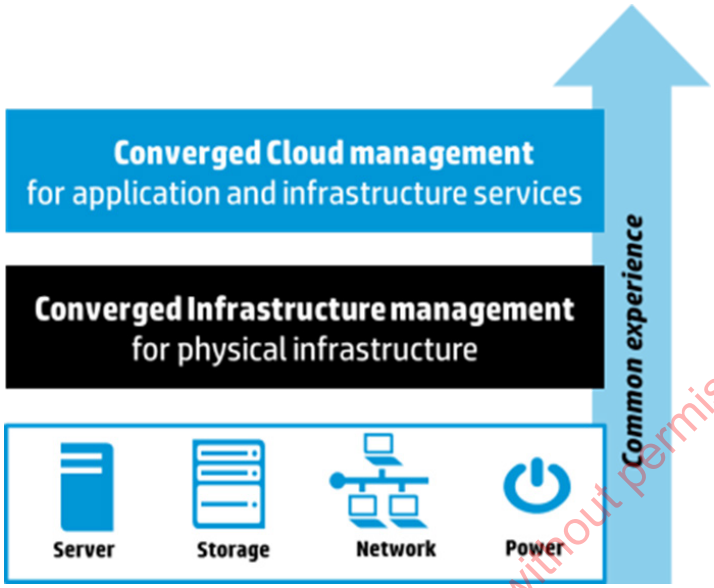
Features include:

- You can create many device groups.
- A server can be in more than one group.
- You can add a server to a group from the group view or the server view.
- You can run a build plan against all the servers in a group.

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Transitioning physical to cloud management



HP OneView and Insight Control server provisioning represent the current Converged Infrastructure management tools from HP. Moving toward cloud, HP Helion CloudSystem adds applications and infrastructure services management layer that provides:

- Self-service portal
- Multi-tiered services
- Physical and virtual provisioning

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HP OneView and ICsp integration

OneView gives you the right to use ICsp. OneView can perform the following functions that can also be performed using ICsp OS Build Plans:

- Configure BIOS settings
- Manage firmware updates
- Configure SAN boot

If a OneView appliance is managing these aspects of the servers, then you might not want ICsp to run OS Build Plans that perform those same actions. ICsp needs to be aware of OneView appliances. You can identify the OneView appliances using the OneView Appliances screen in ICsp.

OS Build Plans integrated with HP OneView

Type	For packages, this is Install ZIP. For configuration files, this is Config File.
History	
Date	Date and time the Action occurred.
Action	
Description:	Describes what happened with the Build Plan.
Examples:	• Create OS Build Plan • Run OS Build Plans • Update OS Build Plan
Custom Attributes	
Name	
Description:	Name of the name/value custom attribute pair associated with this specific Build Plan.
Value	This is the value of the name/value custom attribute pair associated with this Build Plan. The value is not initially shown, but can be displayed by expanding the entry.

HP ICsp Build Plans use the plan Type field to identify what services they manage. This Type field is used when integrating with OneView to identify where the services managed by a Build Plan might overlap services of OneView appliances.

When ICsp runs an OS Build Plan, it checks to see if you have identified OneView appliances and if the OS Build Plan Type is one of the following three types:

- HW—SAN Configuration
- HW—BIOS Configuration
- SW—Firmware

ICsp then compares the list of servers and Build Plans selected with the OneView appliances listed to see if there is a conflict. If a conflict is found, a notification appears where you can cancel and make corrections or choose to force run the Build Plan anyway. See Notifications of conflicts when running a Build Plan for details on these notifications.

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HP provided Build Plans that already have the plan Type field set so no additional configuration is required. Examples of HP provided OS Build Plans that already have the plan Type field set include:

- **HW**—SAN Configuration plan Type is set in the HP provided ProLiant HW — Fibre Channel HBA Configure Boot Device and ProLiant HW — Fibre Channel HBA Display Configuration Build Plans
- **HW**—BIOS Configuration plan Type is set in the HP provided System ROM capture, System ROM enable BFS and Erase server Build Plans
- **SW**—Firmware plan Type is set in the HP provided Firmware Upgrade Build Plan

If you are integrating with OneView and you make custom Build Plans, you must set the plan Type correctly so that ICsp identifies OneView conflicts as it does with HP provided Build Plans. For Build Plans you create that configure BIOS settings, manage firmware updates, or configure SAN boot, you must specify one of the plan Types. If one or more of the HP OneView appliances is unavailable at the time an OS Build Plan is run, that will be treated as a conflict with OneView and the same options will be provided.

You can check the OneView Appliances screen in the ICsp UI to see the status of the OneView appliances. The status indicates whether ICsp could communicate with the OneView appliance.

Notification of conflicts when running a Build Plan

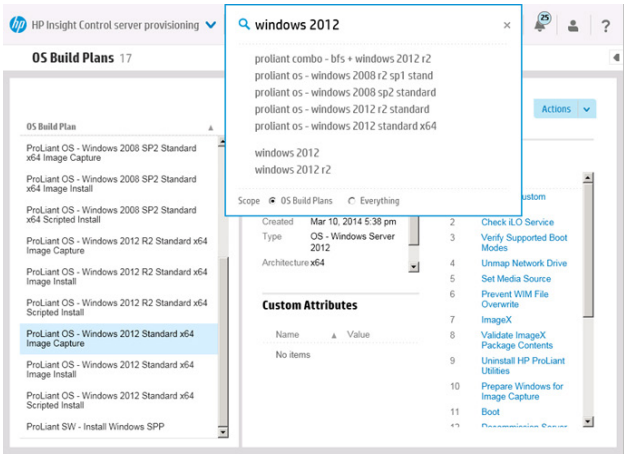
When you have configured the integration with OneView and you run a Build Plan, if conflicts are identified, a notification is displayed on the Run OS Build Plan screen. The notifications are described as follows:

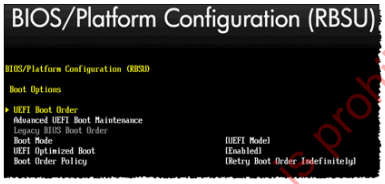
- If an OneView server cannot be reached, or has other communication errors, an error message is displayed with instructions to verify that all the OneView appliances are running and try again, or force the run and ignore the conflicts. You can select **Yes**, **force** or **Cancel**.
- If the Build Plan and the OneView appliances have conflicts on specific servers, an error message is displayed with instructions to correct the conflicts or force the run and ignore the conflicts. You can select **Yes**, **force** or **Cancel**.
- If checking for conflicts might take a significant amount of time, a message is displayed with a time estimate, giving you the option to select **Yes**, proceed with the checks or **Run without checking** or **Cancel** and retry with fewer servers.
- If checking for conflicts is estimated to exceed the ten minute time limit, a message is displayed giving you the option to cancel and retry with fewer servers or force the run without checking for conflicts. You can select **Yes**, **force** or **Cancel**.

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Updated OSBP features





All HP provided build plans are updated to use the latest drivers and tools. Out-of-the-box OS Build Plan support is provided for image capture and installation of Windows Server 2012 R2.

All OS Build Plans have support for UEFI in addition to standard BIOS. HP is producing ProLiant servers that support UEFI. Extensive work has gone into all the HP provided build plans to make sure they work in either UEFI or Legacy BIOS mode. As a result, you do not need to run different build plans depending on your server and how it is configured.

Important
If you are upgrading from a previous release, it is very important that you read the ICsp Build Plan Reference Manual appendix for a complete list of all build plan changes that might affect your existing build plans.

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HP OneView Appliances screen details

Screen component	Description
Host name	The fully qualified host name or IP address of the system the HP OneView appliance is hosted on
User	The user for accessing the HP OneView appliance
Description	A description entered when adding the HP OneView appliance in ICsp

Information displayed on the HP OneView Appliances screen

The OneView Appliances screen displays information on the OneView appliances you identified in ICsp.

If no OneView appliances are listed, select the **Add appliance** button in the left pane.

For each OneView appliance, a message in the right pane indicates the status, that is, whether ICsp can communicate with the OneView appliance and if access is authorized.

INTERNET For information on adding a OneView Appliance, scan this QR code or right-click it and open the hyperlink:

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HP OneView with ICsp Installation and Startup Service

HP OneView with ICsp Installation and Startup Service is a basic fixed-price, fixed-scope installation and startup service. The service includes the installation of OneView on a supported VMware vSphere Hypervisor (ESXi) host virtual machine (VM), the first-time setup of the appliance, and configuration and setup of all managed devices within a single BladeSystem c7000 enclosure. This includes bringing the enclosure under management, updating the enclosure to a specified firmware baseline, defining the enclosure's network configuration (networks, network sets, SAN connectivity, and so forth), and creating and assigning server profiles for the server blades in the enclosure.

This service also includes:

- Installation and startup of the ICsp appliance on another separate supported VMware ESXi host VM
- Installation and startup of the ProLiant Media Server on a separate supported ProLiant server running Windows Server

As part of this service, HP will also provide the customer's organization with a test and verification session to help ensure that everything has been configured and set up properly, along with a brief customer orientation session.

Service benefits are:

- Availability of an HP service specialist to answer basic questions during the delivery of this service
- Delivery of the service at a mutually scheduled time convenient to your customer's organization
- Verification before installation that all service prerequisites are met
- Installation and configuration of OneView
- A customer orientation session

Service feature highlights are:

- Service planning
- Service deployment
  - HP OneView installation and startup
  - ICsp installation and startup
    - Installation verification tests (IVT)
    - Customer orientation session

INTERNET To read the technical paper titled *HP OneView with InsightControl server provisioning Installation and Startup*, scan this QR code or right-click it and open the hyperlink:

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VMware ESXi for HP Helion CloudSystem Foundation

Customers with an existing management node for OneView and ICsp can have a second management node with VMware ESXi for Helion CloudSystem Foundation. The two management nodes will be configured as a VMware ESXi cluster. VMware ESXi versions must be supported by Helion CloudSystem Foundation.

Deploy Management Hypervisor Cluster with two nodes with a supported VMware ESXi version or Red Hat Enterprise Linux version.

Note
Customers requiring a two-node Red Hat Enterprise Linux cluster with KVM enabled must order an additional HP Implementation day.

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Learning check

Your facilitator will lead a class discussion to capture key insights and challenges from this section of the module. To prepare for the discussion, answer the following questions about HP Converged Infrastructure, cloud fundamentals, and reference architectures. Record your answers here and be prepared to share them with the group.

1. Which management features/tools is HP OneView replacing? (Select three.)
   a. Insight Control
   b. iLO
   c. Agentless Management Service
   d. Virtual Connect Enterprise Manager
   e. Virtual Connect FlexFabric
   f. Insight Diagnostics
   g. HP Systems Insight Manager
   h. Intelligent Provisioning
2. How does the software-based approach to lifecycle management in OneView reduce the cost and time to deliver IT service?
   a. By consolidating management tools
   b. By removing bottlenecks
   c. By automating operations
   d. By increasing performance
3. Which advanced HP OneView function provides a 3-D model of an environment?
   a. iLO Advanced for HP OneView
   b. Enterprise directory integration
   c. Graphical Remote Console
   d. Data Centers screen
4. What are some of the benefits of the HP OneView and ICsp Installation and Startup Service? (List at least three.)

   _____

   _____

   _____

   _____

   _____

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Summary

This module provided an overview of Converged Infrastructure tools, with a focus on OneView and Insight Control server provisioning (ICsp). OneView is built to manage the converged infrastructure needed to support virtualization, big data, and cloud computing, all from a single operating pane. ICsp introduced new server provisioning capabilities designed to help customers simplify and reduce the time associated with server provisioning tasks. ICsp is optimized for HP ProLiant Gen8 server blades and rack-mount servers in IT data centers.

The final section presented information on the integration of OneView appliances with ICsp, Build Plans, and installation services offered to the customer.

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HP Helion CloudSystem 8 Enterprise

Module 8

What's in this module for you?

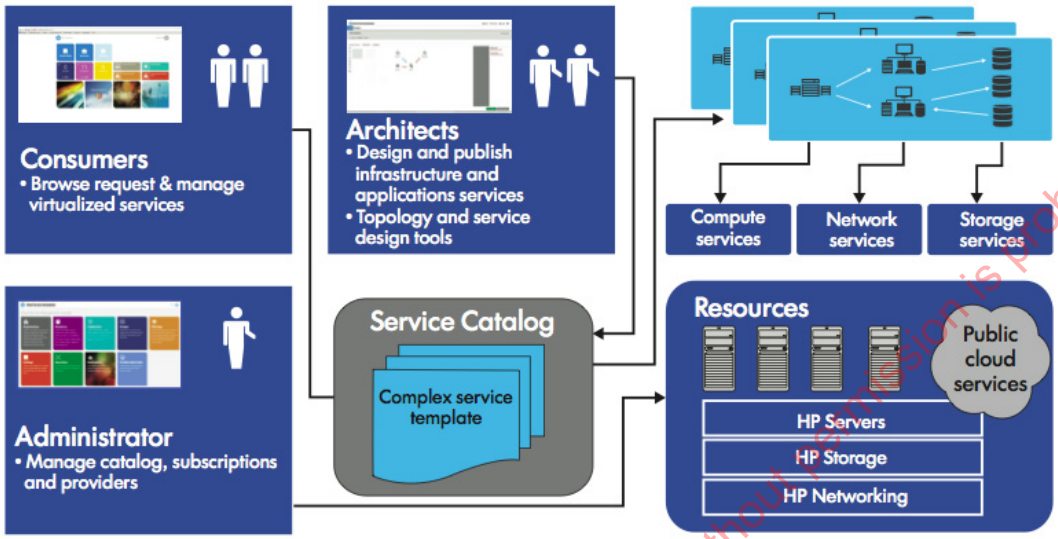
After you have completed this module, you should be able to:

- Describe the components and functionality of HP Helion CloudSystem 8 Enterprise
- Use HP Helion CloudSystem 8 Enterprise to:
  - Manage the Marketplace service offerings
  - Create a service design and deploy an offering
  - Configure multi-tenancy

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HP Helion CloudSystem 8 Enterprise



HP Helion CloudSystem 8 Enterprise expands on HP Helion CloudSystem 8 Foundation to integrate servers, storage, networking, security, and management to automate the lifecycle for hybrid service delivery. Template architects can use Enterprise to create infrastructure templates and offer them as services in a Marketplace Portal. Users select services from a catalog and manage their subscriptions.

When a service is requested, Enterprise automatically provisions the servers, storage, and networking. Enterprise also includes an enhanced set of HP Operations Orchestration (OO) workflows. Through the addition of HP Cloud Service Automation (CSA), Enterprise offers additional design tools and provider integration; and, with the Marketplace Portal, users have secure access to these services.

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About the HP Helion CloudSystem 8 Enterprise appliance

Although Enterprise and Foundation are separate virtual appliances, OpenStack functionality included in Foundation is also available to Enterprise. Appliance management tasks are performed through the Cloud Service Automation Console. Services are consumed through the Marketplace Portal.

To account for the operation of the Foundation software underlying Enterprise, consider the maximum supported configuration for Foundation appliance when planning an Enterprise cloud.

CSA maps user roles through membership in lightweight directory access protocol (LDAP) groups configured through the LDAP service for the organization. CSA does not directly manage the creation or maintenance of individual users. When the CSA administrator creates organizations within CSA, the corresponding LDAP group membership must exist or be created.

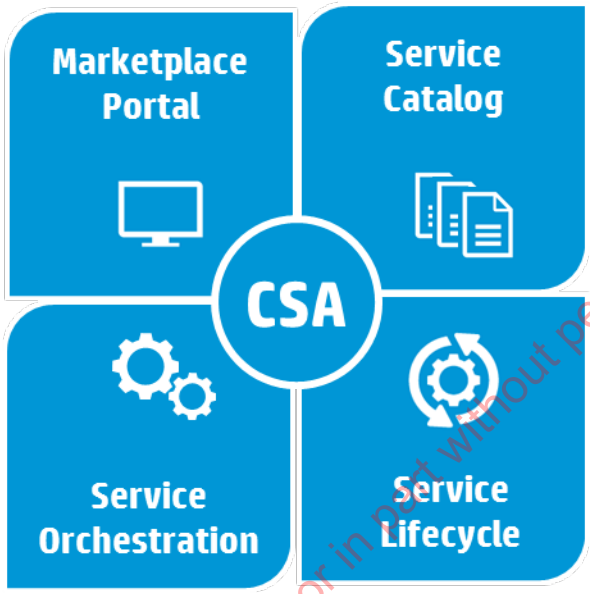
When users log in, LDAP authenticates login credentials and verifies the appropriate role through group membership. LDAP directories must be pre-configured for the access process to function correctly in CSA.

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HP Helion CloudSystem 8 Enterprise components

HP Cloud Service Automation



HP CSA is a unique platform that orchestrates the deployment of compute and infrastructure resources and of complex multi-tier application architectures. CSA integrates and leverages the strengths of several HP data center management and automation products, adding resource management, service offering design, and a customer portal to create a comprehensive service automation solution.

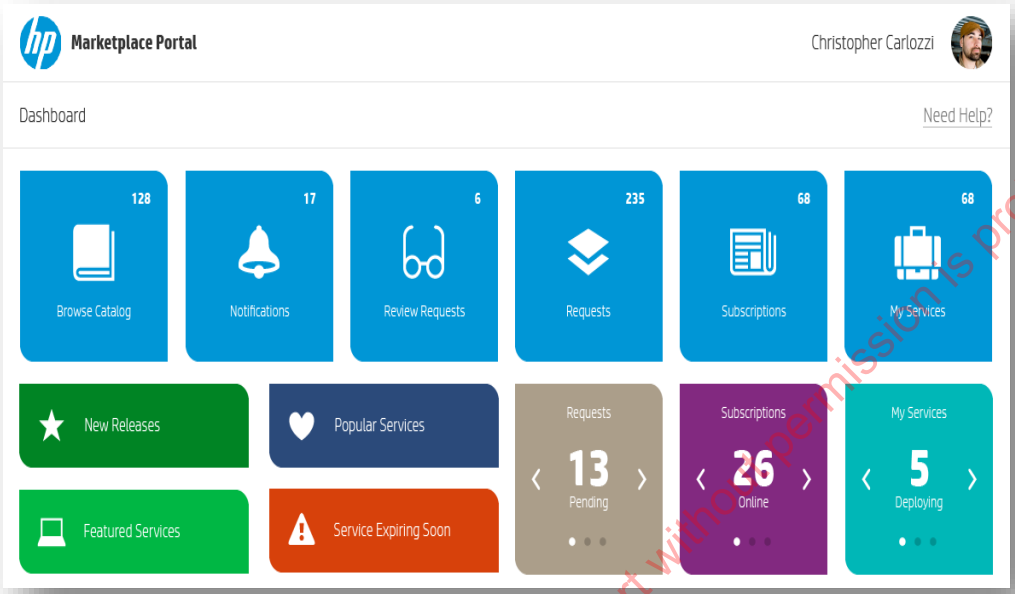
The CSA subscription, service design, and resource utilization capabilities address three key challenges:

- The CSA Marketplace Portal provides a customer interface for requesting new cloud services and for monitoring and managing existing services, with subscription pricing to meet business requirements.
- The CSA graphical service design and content portability tools simplify developing, leveraging, and sharing an array of service offerings that can be tailored to customers' needs.
- The CSA lifecycle framework and resource utilization features ease the complexity of mapping a cloud fulfillment infrastructure into reusable, automated resource offerings for on-time and on-budget delivery.

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Marketplace Portal



HP CSA delivers cloud services to customers through an innovative enterprise-ready design with the Marketplace Portal. The Marketplace Portal provides a customer interface for requesting new cloud services and for monitoring and managing existing services, with subscription pricing to meet business requirements.

In this design, users order services tailored specifically to their needs, based on offerings in service catalogs associated with each user's organization.

Customers can request new cloud services and manage their existing services with the CSA Marketplace Portal. Customers can complete the following tasks.

- Request subscriptions for services offered to their groups
- View status of pending requests, pending approvals, and approved subscriptions, including detailed component information
- Request service modifications and other actions for their cloud services
- Cancel subscriptions

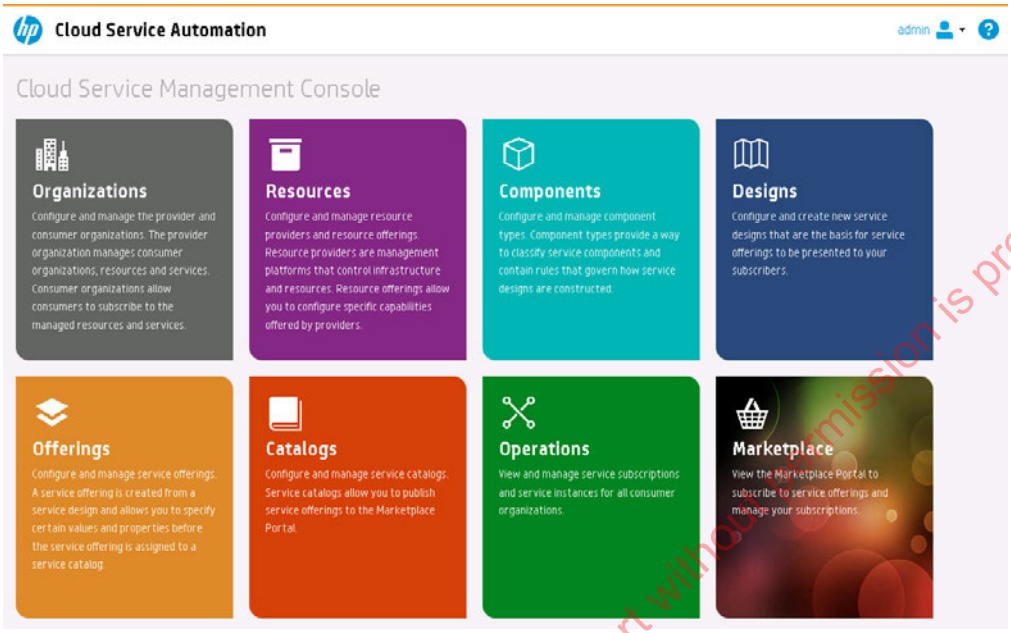
Marketplace Portal users include these groups:

- **Consumers** use cloud services.
- **Subscribers** request cloud services for themselves or on behalf of others.
- **Approvers** grant others' requests for services when an approval is required.

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Management Console



CSA orchestrates the deployment of compute and infrastructure resources and complex multi-tier application architectures. CSA and its user interface, the CSA Management Console, integrates and leverages the strengths of several HP data center management and automation products, adding resource management, service offering design, and a customer portal to create a comprehensive service automation solution.

Tailor service offerings to customers' needs using these areas of the Cloud Service Management Console:

- **Designs**—Create service designs in the Designs area. Here you assemble hierarchies and layouts of service components that define how to instantiate an orderable service. Add resource bindings, subscriber options, lifecycle actions, and custom properties to sequenced designs. Create profiles for topology designs. Leverage designs provided with CSA, or import designs from your own or others' collections with the CSA content portability tools.
- **Components**—In the Components area, create reusable component types as starting points for the components of sequenced designs. Add pricing, images, and other specific information to create service offerings based on service designs.
- **Offerings and Catalogs**—Associate service offerings with specific consumer groups and approval processes in service catalogs. To provide on-demand automated service delivery, you can create, configure, and modify service designs comprising reusable components. You can also reuse designs for multiple service offerings, each customized to meet the needs of different consumer organizations and groups.

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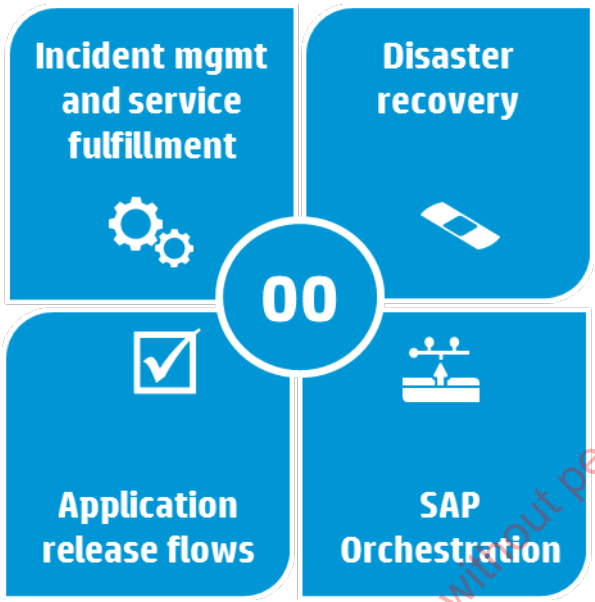
The CSA Cloud Service Management Console provides tailored views for these design and business management roles:

- Service designers build topologies and automation sequences that define the components and optionally lifecycle actions for realizing a service. Service designers collaborate with resource supply managers to create service designs that call upon existing resource providers and resource offerings.
- Service business managers create and manage service offerings and service catalogs.
- Consumer service administrators configure and manage consumer and provider organizations.
- Service operations managers view and manage subscriptions and service instances for their organizations.

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Operations Orchestration



HP Operations Orchestration (OO) helps reduce operational costs and improve service quality by automating routine IT tasks, such as repetitive maintenance, change provisioning, and incident resolution. OO integrates with IT environments to ensure minimal impact on current procedures and tools while fully using existing IT investments.

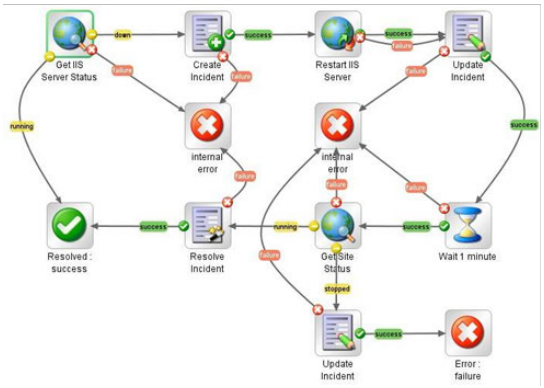
CSA can trigger actions for realizing services on a variety of fulfillment platforms. With sequenced designs, CSA may use a process engine such as HP OO to execute actions on the fulfillment platform. When CSA invokes actions through a process engine, the actions interact with the programmatic interface exposed by the fulfillment platform. These actions deploy resources, reconfigure them, manage their state, or retire them.

You can leverage the OO actions—known as *flows*—shipped with CSA. You can also create your own actions within the process engine itself. Alternatively, you might work with fulfillment platform administrators to coordinate use of their process engine actions. You must import process engine actions into CSA to employ them in sequenced designs.

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Incident management with Operations Orchestration



Automatic-actions to fix common problems

Automate advanced troubleshooting

Corrective actions using complex workflows

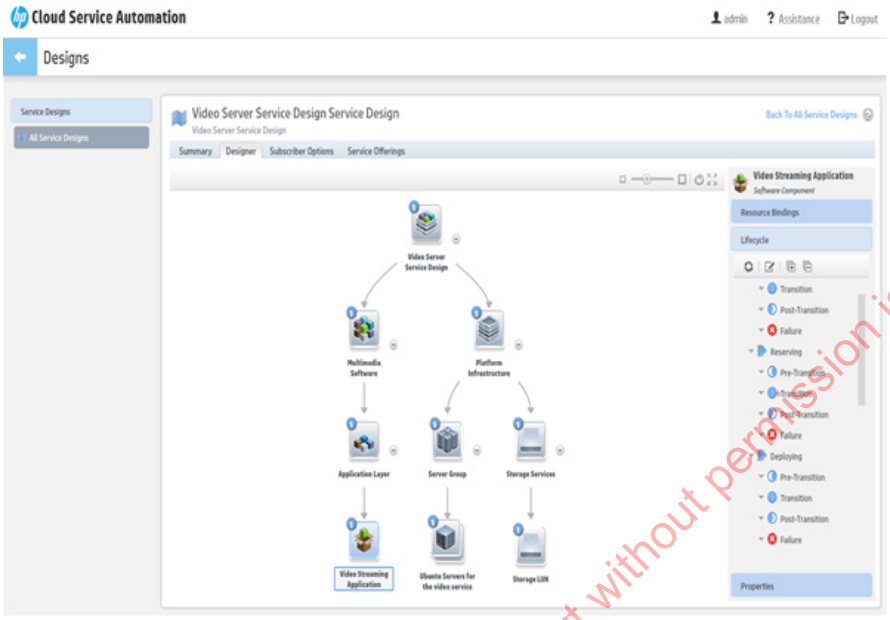
With OO, you can remediate most alerts automatically. Based on the type of alert, OO automatically goes through the steps to diagnose and identify the problem (such as check server, check network connectivity, check application/service). When the problem is identified, OO automates the repair and resolution steps (such as restart the service).

Part of this process is the automatic opening and closing of the incident ticket in the service desk regardless of the vendor (both HP and third-party vendors). OO takes the details from the alert, opens the ticket in the HP Service Manager with the information from the alert, and updates the ticket number. As each step in the diagnosis and repair workflow is run, OO updates the ticket with the status of every step and detailed information on the resolution, including a link to the full OO audit trail/report for future reference within the ticket before automatically closing it and the alert after it is resolved.

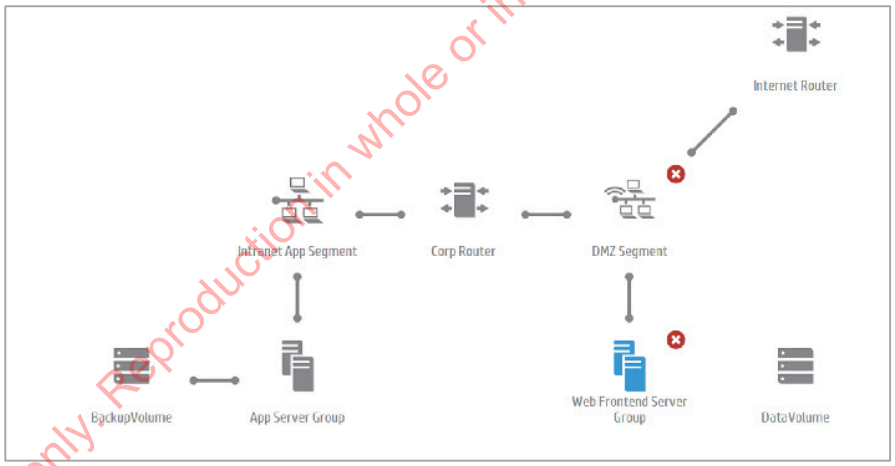
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Topology Designer and Sequenced Designer



Sequenced Designer



Topology Designer

CSA 4.0 introduces Topology Designer, which supplements the existing Sequential (or Sequenced) Designer.

Note
Topology Designer is currently only supported in Helion CloudSystem 8 Foundation.

The CSA graphical service design and content portability tools simplify developing, leveraging, and sharing an array of service offerings that can be tailored to users' needs. You can use two different designers to design new cloud services with reusable service design templates. The designs created through both designers appear as service offerings that Marketplace Portal users can select and provision.

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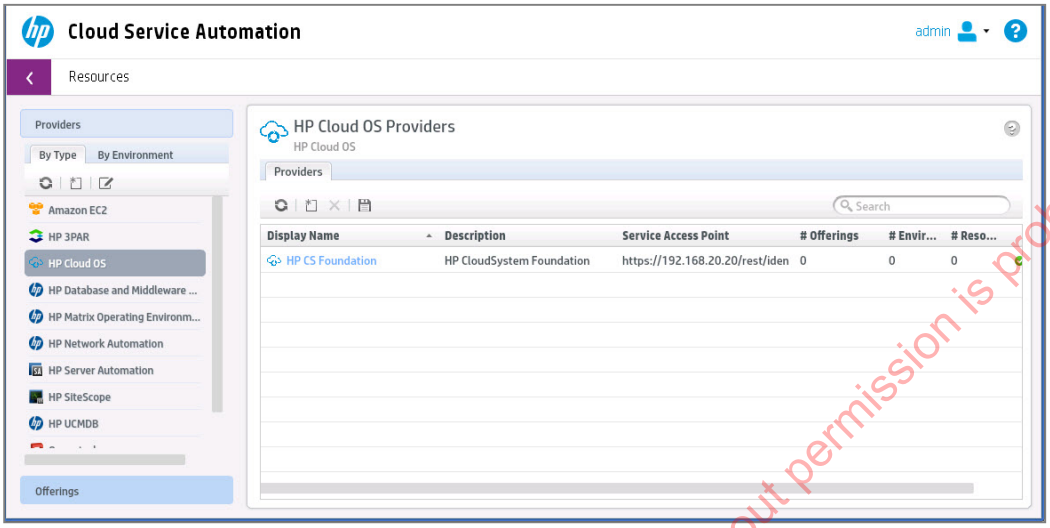
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- Topology Designer
  - Creates infrastructure service designs
  - Is an intuitive designer tool
  - Provides a flexible service design
  - Has re-useable design components
  - Provides infrastructure, platform, and application services
  - Features import/export service designs
- Sequential Designer
  - Creates more complex application service designs
  - Designs Infrastructure as a Service (IaaS) services for Helion OpenStack
  - Allows rapid content development
  - Supports TOSCA vocabulary for describing a service design

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HP Helion CloudSystem 8 Enterprise use cases



Helion CloudSystem 8 Enterprise use cases include:

- Administrator use case
  - Configure and manage the provider and consumer organizations
  - Configure and manage resource providers and resource offerings
  - Configure and manage component types
  - View and manage service subscriptions
- Designer use cases
  - Create designs using the Sequenced and Topology Designers
  - Configure and manage service offerings
  - Configure and manage service catalogs (published offerings)
- Consumer use cases
  - Browse service catalogs
  - Request subscriptions
  - Monitor own services

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Learning check

Your facilitator will lead a class discussion to capture key insights and challenges from this section of the module. To prepare for the discussion, answer the following questions about HP Converged Infrastructure, cloud fundamentals, and reference architectures. Record your answers here and be prepared to share them with the group.

1. What is the relationship between HP Helion CloudSystem 8 Foundation and HP Helion CloudSystem 8 Enterprise?

   a. Helion CloudSystem Foundation provides the design and provisioning capability for Helion CloudSystem Enterprise.

   b. Helion CloudSystem Foundation provides the Marketplace Portal for services designed in Helion CloudSystem Enterprise Topology Designer.

   c. Helion CloudSystem Foundation provides appliance management tasks and OpenStack functionality for Helion CloudSystem Enterprise.

   d. Helion CloudSystem Foundation supports Cloud Service Automation, and Helion CloudSystem Enterprise controls access to services and offerings.

2. Topology Designer is used for more complex application service designs than can be designed using Sequential Designer.

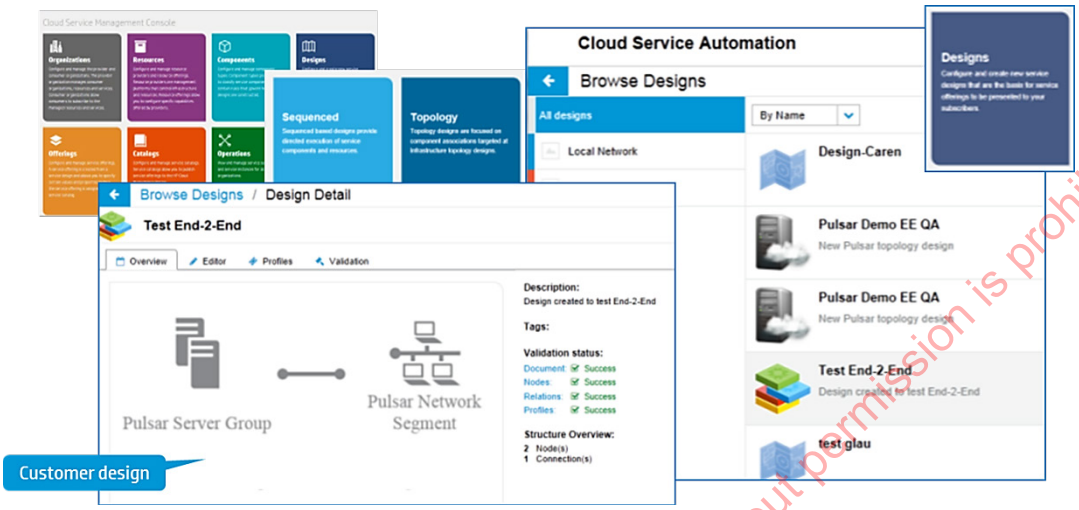
   ☐ True

   ☐ False

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Using the CSA Management Console



CSA supports many of the advanced features of Helion CloudSystem 8, including:

- Approval
- Billing
- Hybrid cloud
- Platform as a Service (PaaS)

Customers can use CSA 4.0 with CloudSystem version 7.x. Designs built on CSA 4.0 and CSA 3.2 for CloudSystem 7.x can be imported into Helion CloudSystem 8 Enterprise.

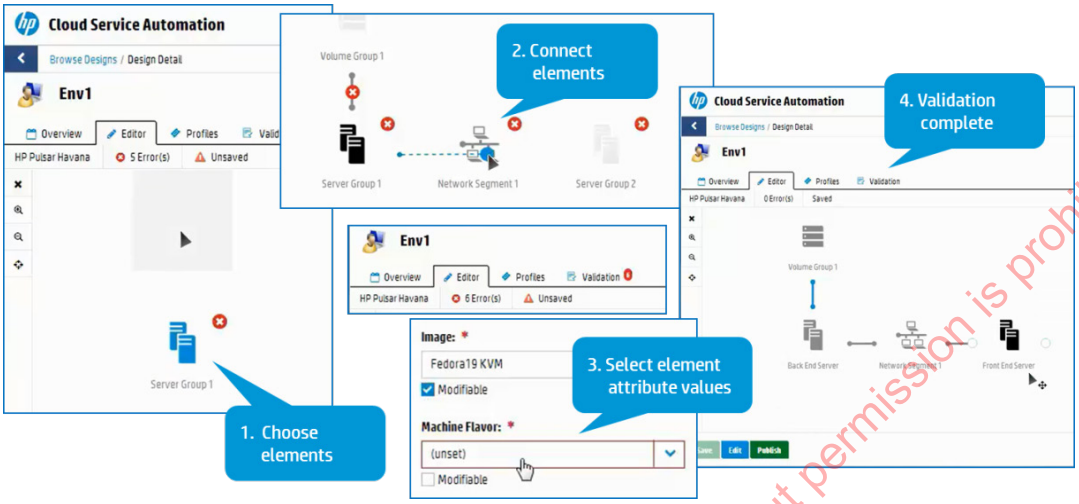
Using CSA, administrators present computing services to users in unique ways:

- **Service Design**—A set of server, storage, networking, and application resources that are provided to users on demand
- **Service Offering**—The service that can be tailored to the end user's needs, and is offered through the marketplace
- **Catalog/Marketplace**—The repository through which offerings are provided by administrators and requested by users
- **Subscription Services**—Subscription is the method by which a user reserves the infrastructure resources defined in a service design and offered in a service offering. By reserving the resources, IT prevents oversubscription and resource contention.

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Using CSA to create a design and deploy an offering



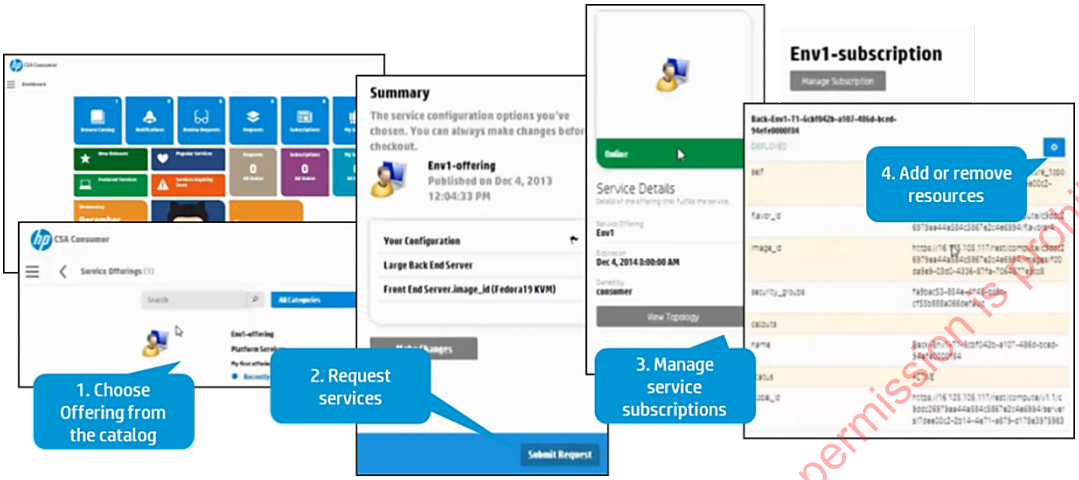
When the HP Helion OpenStack provider is configured in CSA, you can create a design, which defines the instance characteristics and network details. When a design is saved, it can be published and made into an offering that other users can purchase and provision from the Marketplace Portal.

Important
If you added additional providers, such as HP Server Automation, HP Matrix Operating Environment, or VMware vCenter Server, make sure the providers are added to an environment, and that the environment is associated with each catalog where you plan to publish offerings.

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Provisioning and management with the Marketplace Portal



After Enterprise is installed and configuration in CSA is complete, you can use CSA to create designs and the Marketplace Portal to launch instances. These instances can be managed from the CloudSystem Console and the CSA Management Console.

After services and offerings have been added to Helion CloudSystem Enterprise, they are available through the Marketplace Portal. To use services:

1. Choose offering from catalog.
2. Request services.
3. Manage service subscriptions.
4. Add or remove resources.

Enterprise design prerequisites

When a user logs in to the Marketplace Portal, selects a design, and then checks out, Enterprise sends the design criteria to Foundation.

In order for a design to be provided, the following prerequisites must be met:

- Enterprise is successfully installed from Foundation
- A provider network exists in Foundation
- An image exists in Foundation
- A key pair exists in Foundation

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Multi-tenancy in HP Helion CloudSystem 8 Foundation and Enterprise

Tenants, also known as *projects*, are organizational units in the cloud to which you assign users and roles (member or admin) and set limits (quota) on cloud resources usage for those tenants. Users can be members of one or more tenants. Users can also be assigned the role of administrator for a given tenant. To manage HP Helion CloudSystem tenants and users, ensure that the Admin tab is selected and navigate to the Identity Panel.

Multi-tenancy terminology differs, depending on whether you are in a Foundation or Enterprise interface:

- Foundation → Projects
- Enterprise → Organizations

Considerations when connecting organizations to projects include:

- Organizations must be manually connected to projects.
- The relationship is based on the project name.
- LDAP is required for this to work.

> **Note**
> You should configure Enterprise and Foundation to enable multi-tenancy before using CSA to deploy offerings.

Configuring multi-tenancy

To configure multi-tenancy, perform these steps:

1. Configure Foundation to use LDAP.
   - In CloudSystem Console, select **Settings** → **Security** → **Add Directory.**
2. Create projects in Foundation.
   - In CloudSystem Portal as Administrator
     - Select the **Admin** tab.
     - Select **Projects.**
     - Add a project.
     - Add users.
3. Configure Enterprise to use LDAP.
   - In CSA, select **Organizations** and then click **Create Organization.**
   - Use same case-sensitive project name from Foundation.
   - Enter LDAP server information (same directory service used for Foundation).
   - Add groups using their Distinguished Names (DNs) as necessary.

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Learning check

Your facilitator will lead a class discussion to capture key insights and challenges from this section of the module. To prepare for the discussion, answer the following questions about HP Converged Infrastructure, cloud fundamentals, and reference architectures. Record your answers here and be prepared to share them with the group.

1. Customers can no longer use CSA 4.0 with CloudSystem version 7.x.

   ☐ True

   ☐ False

2. What are the prerequisites for a design to be provided?

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Summary

HP Helion CloudSystem Enterprise integrates servers, storage, networking, security, and management to automate the lifecycle for hybrid service delivery. Helion CloudSystem Enterprise can be used to create infrastructure templates and offer them as services in a Marketplace Portal, where users can select services from a catalog and manage their subscriptions. When a service is requested, Enterprise automatically provisions the servers, storage, and networking.

Enterprise also includes an enhanced set of OO workflows, and the addition of CSA provides additional design tools and provider integration.

Designers can tailor service offerings to end users' needs using the Topology Designer and Sequential Designer. These designs are made available through the CSA Management Console.

CSA maps user roles through membership in LDAP groups configured through the LDAP service for the organization.

Multi-tenancy can be configured in Foundation and Enterprise using LDAP.

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Planning and Designing HP Converged Infrastructure and Cloud Solutions

Module 9

What's in this module for you?

After completing this module, you should be able to:

- Prepare a proposal for an HP Converged Infrastructure or cloud solution
- Explain HP Helion CloudSystem 8 licensing
- Describe an HP Customer Intent Document (CID) and explain its purpose, benefits, and who is responsible for its creation
- Describe the HP Helion CloudSystem sizing and configuration process

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Preparing a proposal for an HP Converged Infrastructure or cloud solution

Designing an appropriate Converged Infrastructure solution to meet customer requirements requires a systematic approach. The steps you need to take to develop a proposal for your customer are:

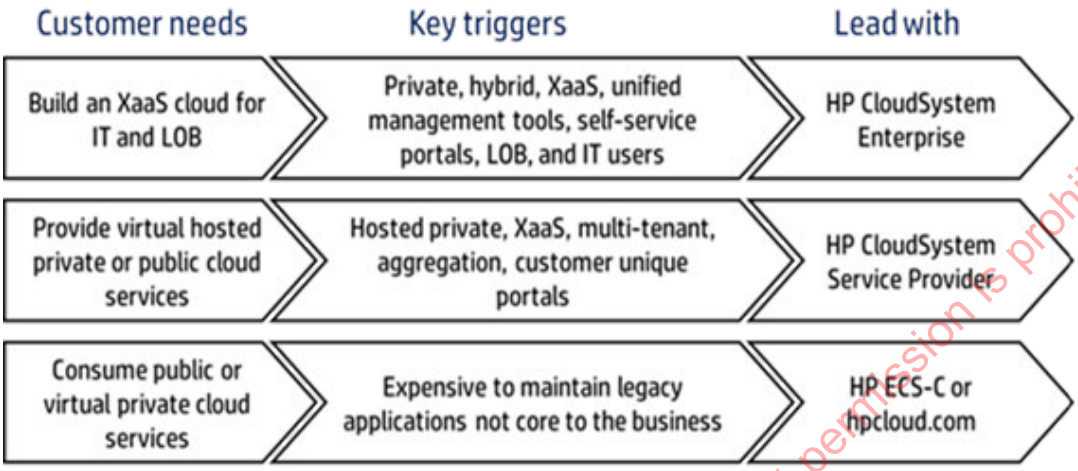
1. **View the big picture**—With awareness and insight, help customers get the big picture for a Converged Infrastructure. Make sure they understand the business, economical, and technical advantages that a Converged Infrastructure can bring to their organization.
2. **Gather requirements**—There are many methods to engage customers and gather their requirements. All methods are designed not only to elicit information, but also to educate customers and stimulate their imaginations.

   By the time you sit down to generate your proposal, you should have already gathered information during your meetings with the chief executives (CEO, CIO, and CFO) of your customer's organization.
3. **Design the proposed solution for the customer**—The design of your customer's converged infrastructure can evolve into a private, public, or cloud-type environment chosen according to their needs. Based on the HP Reference Architecture for Cloud and best practices, the solution will address key architectural and transitional issues. These topics include functional and technical design, organizational design, technology governance, and change management to enable a smooth transition across the entire organization.
4. **Write a scope of work**—The data gathered is compiled to concisely describe the current environment, the steps needed to implement the change to the proposed environment, and the resources necessary to accomplish the change.

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Viewing the big picture



Solution selection criteria are multidimensional, and they depend on the customer situation and business needs. To select the most appropriate solution, you need to ask questions in several important areas:

- **Scalability**—Is the customer global? Does the customer have multiple data centers?
- **Heterogeneity**—Does the customer prefer third-party or rack-mounted hardware?
- **Time to implement**—Does the customer need cloud services to be up and running in a very short time?
- **Green field or existing infrastructure**—Is the customer willing to purchase new hardware, or do they have existing infrastructure that they want to reuse?
- **Build only on private cloud or use hybrid resources**—Does the customer need to use both private and public cloud services?
- **Key cloud characteristic**—Does the customer need infrastructure as a service (IaaS), platform as a service (PaaS), software as a service (SaaS), everything as a service (XaaS), a service catalog, hybrid cloud, monitoring, billing, and so forth?
- **Workload characteristics**—What are the characteristics of the customer's typical workload? Understanding the nature of the workloads early in the process can reveal the components that should be present in the solution. For example, if the customer wants to deploy a simple Linux Apache MySQL PHP (LAMP) stack, HP ProLiant server blades might be sufficient. However, if the customer wants to deploy a highly scalable mission-critical environment, HP Integrity server blades running HP-UX might be indicated. After the workloads are understood, an associated HP Cloud Map can be located to see which infrastructure components are included.

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Reviewing customer requirements

Before you can plan the solution, you must confirm that a Converged Infrastructure solution is right for the customer. This process includes verifying whether the customer's current IT environment can support the solution. The two major components of the review are a technical analysis and an application analysis. There are also some nontechnical considerations to take into account.

Technical analysis

The technical analysis includes a review of several areas, including:

- **Performance**—Specifies in terms of the number of concurrent users, benchmark results, response times, or any other relevant metrics
- **Availability**—Specifies in terms of hours of downtime per year, maximum duration of downtime, acceptable performance degradation in a failure situation, protection against failures (server, disk subsystem, network, and power), and 24x7 availability
- **Disk connectivity**—Specifies the usable space for system and application storage, preferred disk and storage area network (SAN) technology, performance requirements, data protection, and so forth
- **Network connectivity**—Indicates the type of network infrastructure required for the solution and the type of network that is available (LAN, WAN, MAN)
- **Backup**—Indicates time limit, frequency and type of backups (offline, online, local, or across the network), preferred device and backup software, whether the existing environment will be used and possibly extended, and so forth
- **Disaster recovery**—Indicates whether disaster recovery is part of the solution, and specifies failover times and automatic features
- **Planned growth**—Specifies the percent of growth per year, expectations for growth rate and maximum size, and so forth
- **System software and system management tools**—Describes any current tools used in the customer's environment
- **Other**—Adds any other known requirements such as partitioning

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Application analysis

The application analysis determines which applications are being considered by the customer. You should consider several factors, including:

- The number of users for the application
- IT resources required by the application
- Applications that can be consolidated
- SLAs that might be in place for the various business organizations

Note
Servers that host the application workloads are also known as the *tenant arrays*.

Nontechnical considerations

In addition to the technical analysis and the application analysis, you should also take into account nontechnical considerations such as:

- Are there any open service calls or other customer sensitivities?
- Who will you work with within the customer's organization?
- Are the customer's applications standardized?
- Is there a long-term IT strategy in place?
- Are there any rules in place for hardware isolation between business units?

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Service level agreements

Service level agreements (SLAs) provide a common understanding about services, priorities, responsibilities, guarantees, warranties, and penalties.

SLAs that customers expect from their private cloud might be different from those that are offered by traditional public cloud providers. Several factors need to be determined and agreed upon with the customer:

- What performance levels are expected? Consider needs for CPU, memory, networking, and storage performance.
- What availability is expected? How will it be calculated?
- Are there any legal compliance requirements?
- How will the systems and data be secured?
- What are the data retention policies? Consideration needs to be given to the location of the data and the legal implications of storing data in a different jurisdiction. When data is deleted (either accidentally or on purpose), is it really deleted, or can it be recovered?

The key consideration is whether the design is focused on perfection or on price. With an unlimited budget, it might be possible to come close to perfection, but how many customers are prepared to pay the price? Attempts could be made to modify the SLA to enable the deployment of less equipment and therefore reduce the price.

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Ensuring the success of cloud implementations

Customers who are evaluating whether cloud computing is right for their business needs have many questions that need to be answered. These might include:

- Are we ready for cloud computing?
- How cost-effective is cloud computing?
- What should we be doing in terms of evaluating and planning?
- What steps should we take and when?
- What is the business case for cloud computing?

Many IT managers are unsure about the best way to begin their cloud journey and about the return on investment (ROI), total cost of ownership (TCO), and risks that might be associated with a transition to the cloud. They will be asking questions such as:

- Will cloud services cost less than similar services from internal sources?
- Will the business be able to roll out new services faster than the competition?
- Will these services be secure enough to protect business and customer data?
- Will IT have sufficient governance and control to meet service levels?
- Will the organization be able to comply with policies, regulations, and audits?

To ensure the success of cloud implementations, customers must understand their state of readiness for cloud computing. In addition, they need to understand the key factors that lead to success. Readiness can be assessed by helping the customer to answer questions such as:

- Is the organization's IT fragmented? Does shadow IT exist anywhere within the company? Shadow IT can be described as IT solutions that are built and used without the appropriate organizational approval, and can have a negative impact on IT governance, control, and accountability.
- Is the customer ready for data center and IT transformation? Cloud computing has an impact on people, process, and technology; therefore, the scale of the impact needs to be understood.
- Is there a compelling business case and an understanding of the true ROI for the project? Without these two elements, it is difficult to measure whether the goals of the project have been met.
- What is the current state of the IT infrastructure? Where are they in their evolution toward a Converged Infrastructure? Customers currently at early stages will have a more extensive journey ahead than those with a foundation of virtualization and orchestration.

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- What is the plan for transitioning application workloads to the cloud environment? Will the existing applications be integrated, re-hosted, re-architected, or replaced?
- Are there any new application workloads that will be introduced? Where will they be located?
- Does the project have clear goals and key performance indicators (KPIs), or is it just the next big IT project, which is being undertaken for a vague reason such as ‘everyone knows that you have to do cloud’?

HP has gained valuable experience during many successful cloud implementations, and these experiences have shown that success relies upon several key factors. These factors include:

- Company executives have bought into and accepted ownership of the project. They have clear KPIs, and communicate them to all associated parties.
- A central online service catalog is used to order services from one or more providers.
- Effective governance is achieved by eliminating shadow IT. The organization is transformed and adopts new business processes.
- The lines of business have a clear view of the real cost of the services that they are consuming.
- IT maturity is enhanced. The organization is moving towards the higher levels of the CI-CM.
- A simple plan for introducing new workloads and transitioning existing workloads is present.

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Designing the proposed customer solution

Designing a Converged Infrastructure solution involves organizational design and technology governance to enable a smooth transition to a shared-services, cloud-type environment based on converged infrastructure.

During the design phase, you must analyze progress throughout the transition with a comprehensive implementation plan for the long-term success of the change. The design of your converged infrastructure solution can evolve through this process into a private, public, or cloud-type environment. Based on HP Reference Architecture for Cloud and best practices, this solution addresses key architectural and transitional issues. These include functional and technical design, organizational design, technology governance, and change management to enable a smooth transition across the entire organization.

Matching the challenge with the opportunity

When designing a Converged Infrastructure solution, it is important to identify the business objective the customer hopes to accomplish, and then tailor your approach to address that objective. For example, explain that by running SAP for the accounting team, the company can add 400 SharePoint users as a consequence. Then apply a technical solution to solve the problem by:

- Developing a logical architecture that will host the solution
  - Network layout
  - Server requirements
  - Application services
  - Storage space requirements
- Sizing the solution
- Building the configuration

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Forming a strong value proposition



If a customer is also exploring other companies' cloud solutions, be sure to clarify the leadership position HP has attained in cloud solutions. Some reasons why HP is the market leader in cloud include:

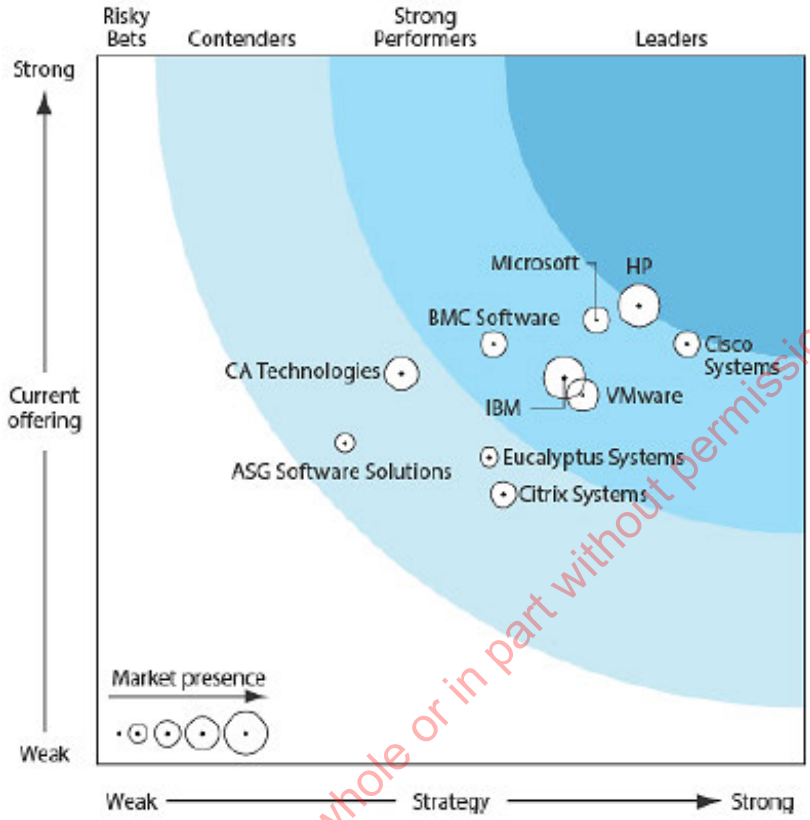
- The HP vision for hybrid IT gives customers the agility, openness, and security they need to be successful. HP is committed to OpenStack, which will make it possible to deploy, manage, and consume workloads in a hybrid environment.
- HP Helion CloudSystem was the industry's first integrated cloud solution. Recently, it was enhanced with OpenStack. HP Cloud Service Automation (CSA) and Hybrid Cloud Management software offer a cloud management platform for heterogeneous environments.
- HP has made significant commitments to OpenStack by participating on the board and the technical committee. HP offers a no cost, downloadable version of OpenStack—HP Helion OpenStack Community edition. Through HP, customers can get direct access to OpenStack experts and indemnification.
- HP has backed its commitment to hybrid IT with a billion-dollar investment.
- As a result of this commitment, HP has worked with more than 2,000 customers, including one-third of the Fortune 100. HP has helped companies from around the world on their journey to the cloud, with services ranging from advisory and strategy services to implementation and operations services.
- The Helion portfolio of products and services makes it easy for customers deploy hybrid IT environments that integrate private cloud, public cloud, and traditional IT. With hybrid IT, IT organizations can match applications to the right delivery model. In some cases, it might be best to deploy a public cloud. It other cases, a private cloud might be best. In yet other cases, the best model might be a mix of private and public cloud services, or a mix of traditional IT and private cloud.

The main point is that HP can help ensure that applications are deployed to the right deployment model, based on each company's business requirements.

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HP leads the pack for private cloud



In a report published by Forrester Research in November of 2013, analysts assess the state of the private cloud solutions market and see how the vendors stack up against each other. They selected 10 vendors—ASG, BMC, CA, Cisco, Citrix, Eucalyptus, HP, IBM, Microsoft, and VMware. They evaluated their private cloud offerings on 61 criteria.

Forrester's conclusion was that HP leads the pack, with the highest scores for both its current offering and market presence.

HP is rated number 1 in 8 out of the 15 categories:

- Service creation
- Service management
- Self-service access
- Providing additional hosting options
- Third-party ecosystem
- Installed base
- Revenue
- Global presence

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To quote from the report, “HP stands out from the crowd by providing a clean and navigable interface that wraps substantial breadth and depth of capabilities into the fewest number of interfaces.”

INTERNET

The Forrester Wave is a graphical representation of Forrester's call on a market and is plotted using a detailed spreadsheet with exposed scores, weightings, and comments. Forrester does not endorse any vendor, product, or service depicted in the Forrester Wave. Information is based on best available resources. Opinions reflect judgment at the time and are subject to change.

Writing a scope of work

A scope of work is a document that captures the plan, time frame, resources required, and completion milestone of a project. It is crucial for ensuring a mutual understanding between you and a customer.

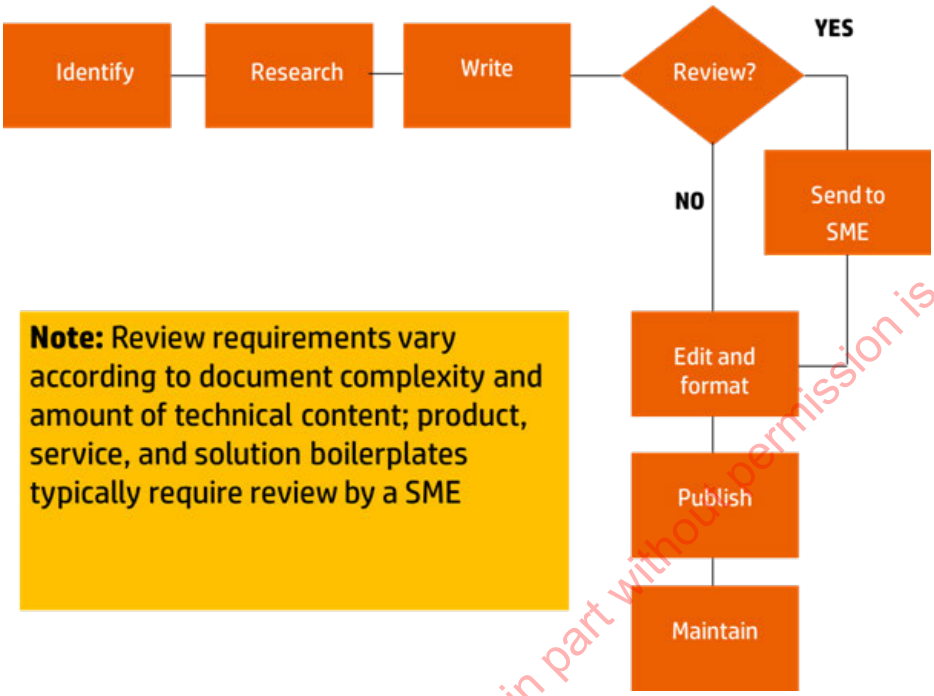
A scope of work is a pre-project overview prepared for a proposal. It should not be confused with a statement of work, which is a final project overview prepared for billing.

Among other things, a scope of work must list resources critical to success. Executive support is essential. Without leadership from management, it can be difficult to implement an IT project.

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Proposing the solution



After you have assembled the business and technical information you need from the customer, you can begin to propose a solution. The creation of timely, accurate, and high-quality proposal-ready content requires the application of a rigorous development and maintenance process. From a content perspective, proposal-ready documents typically include:

- Key benefits and differentiators
- Latest HP marketing messages
- Customer and analysis quotes
- High-level technical Information
- Proof points

The majority of proposal-ready content must be reviewed before publication to ensure accuracy. Reviewers can include:

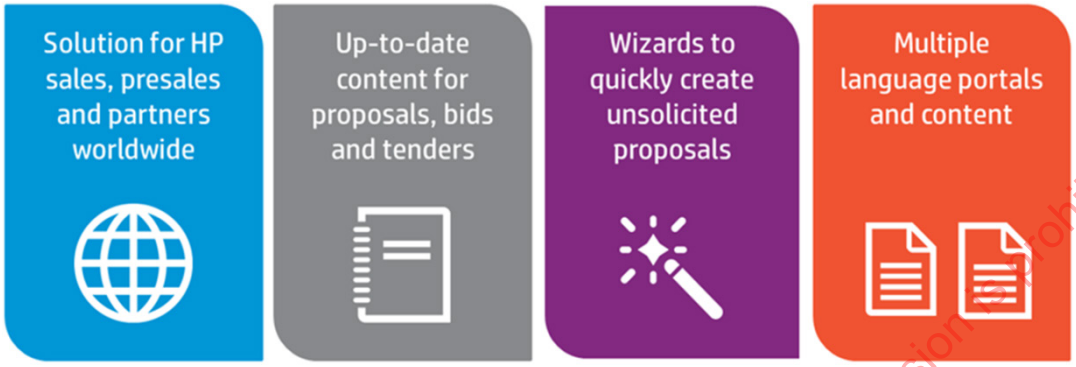
- Product and program managers
- Marketing specialists
- Special Interest Groups—Consolidation Group
- Solution Architect community
- Ambassador program

Proposal-ready content that is based on nontechnical, external sources such as the HP website does not require review by a subject-matter expert (SME). After review, you need to incorporate the changes from the reviewers and ensure that the content passes a final editing process.

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HP Proposal Web



HP Proposal Web is a single source for ready-to-use content and time-saving wizards, providing everything needed to create winning customer proposals. It is a solution accessible by HP sales, presales, and channel partners worldwide, and provides:

- The latest content for proposals, bids, and tenders
- Wizards to create unsolicited proposals quickly
- Multiple language portals and content

INTERNET The HP Proposal Web can be accessed at: **https://proposalweb.hp.com**

The types of content available in the Proposal Web includes:

- Product and service overviews (boilerplates)
- FAQs
- Cover letters and executive summaries
- Business value content

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Learning check

Your facilitator will lead a class discussion to capture key insights and challenges from this section of the module. To prepare for the discussion, answer each of the following questions.

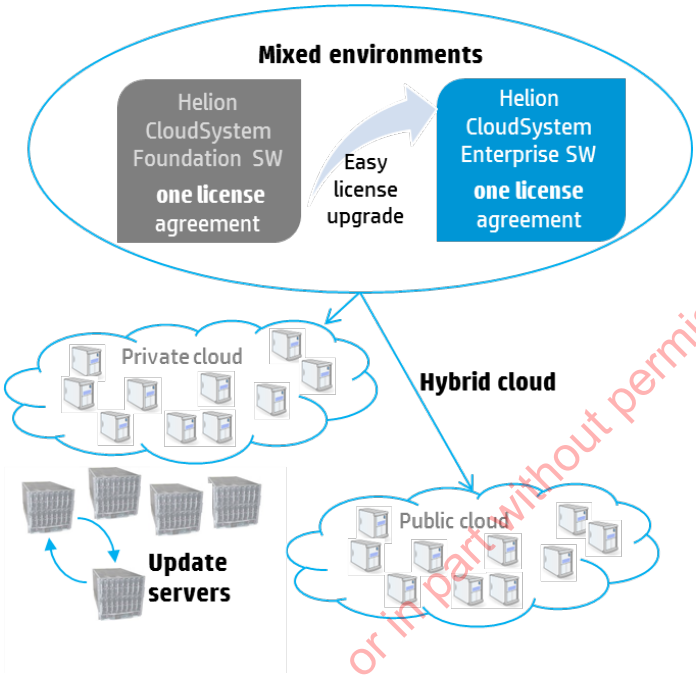
1. What are the steps you need to take to develop a proposal for a converged infrastructure or cloud solution for your customer?

2. List three nontechnical considerations you should take into account when planning a customer solution.

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Simplified Helion CloudSystem 8 software licensing

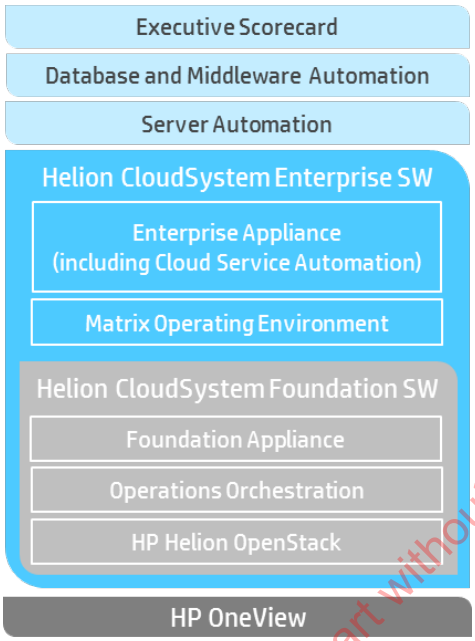


- One license agreement covers all Helion CloudSystem software components
  - Easier to buy, sell, manage
- Consistent licensing across Helion CloudSystem software
  - Simplifies upgrade from Foundation to Enterprise
  - Easy-to-manage mixed-edition environments
- License model options
  - Per-operating system instance (OSI)—Supports cloud business models
  - Per-server—Supports data center management business models

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Holistic Helion CloudSystem 8 software licensing



Helion CloudSystem software is now one product, not a bundle of many. It provides a single license agreement for all included software, in a non-decomposable product offering that must be supported, updated, and upgraded as a unit.

The rights to use (RTU) for included technologies are specific to Helion CloudSystem. They include:

- Allowed use of included Cloud Service Automation (CSA) and HP Operations Orchestration (OO), limited to
  - Support administration of the Helion CloudSystem environment
  - Managing infrastructure services (Helion CloudSystem Enterprise only)
  - RTU for Matrix Operating Environment (OE) is transferable to replacement server under a Helion CloudSystem per-OSI license agreement

The license does not cover other bundled software. Separate product licenses apply to:

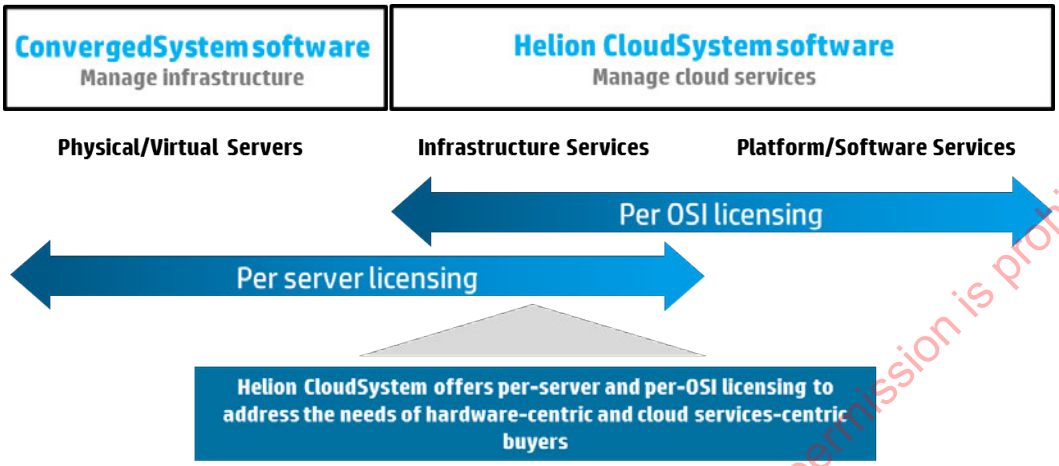
- Add-on HP software (such as Helion CloudSystem Enterprise Premium software)
- OneView

> **Important**
> Rights to use OneView are not granted by the Helion CloudSystem Foundation or Enterprise software license. Although Helion CloudSystem and OneView are delivered as part of some Helion CloudSystem solution offerings, OneView and Helion CloudSystem are separate products, and are licensed independently under their respective license agreements.

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Helion CloudSystem 8 software licensing options



Helion CloudSystem software licensing is based on one of the following options, as recorded in the license terms in the purchase agreement:

- The number of active OSIs
- The number of servers in the cloud

The software license type you purchase enables you to manage the environment in different ways:

- OSI licenses allow a fixed number of virtual machine instances to be deployed on any server in a private, hybrid, or public cloud infrastructure.
- Server licenses allow an unlimited number of virtual machine instances to be deployed only on the licensed servers.

You can manage licenses from the CloudSystem Console. You can add more licenses at any time to increase your OSI or server capacity.

Each Helion CloudSystem software license includes rights to use the Helion CloudSystem software to manage up to the licensed number of OSIs or servers concurrently.

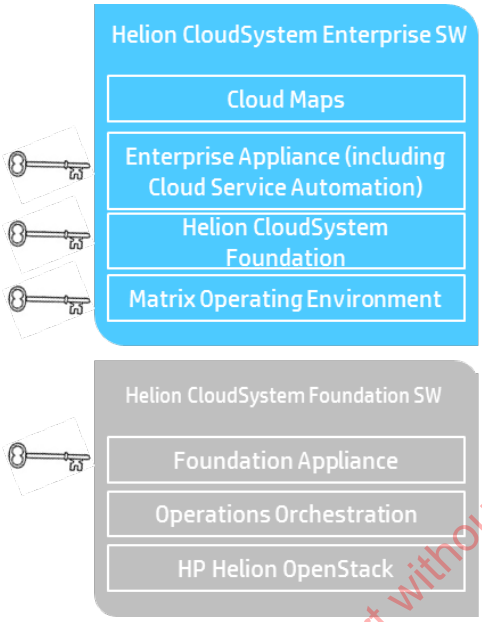
Refer to your license entitlement for the number of instances included in your stand-alone or solution license.

Before adding license keys, you can configure resources in Helion CloudSystem Foundation and install Helion CloudSystem Enterprise. Deploying and managing instances requires a license.

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Per-OSI licensing—Implementation



In the per-OSI licensing model, customers are granted the right to manage up to licensed number of instances concurrently. This model is server-independent, and rights do not expire when a server is retired. Capacity can be shifted between private and public resources. The per-OSI model also includes the right to use one Matrix Operating Environment (OE) server per 10 OSI licenses.

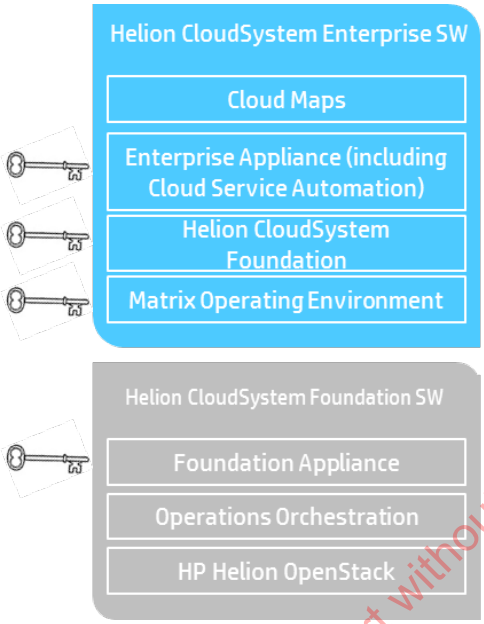
License key management includes:

- Per-OSI keys provided for Helion CloudSystem Foundation and CSA
- Per-server keys provided for Matrix OE (including Insight Control server provisioning [ICsp] and HP Integrated Lights-Out [iLO])

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Per-server licensing—Implementation



In the per-server licensing model, the customer is granted the rights to manage unlimited instances on licensed servers. But the right to use is tied to a specific server, and it is not transferable on server replacement. The per-server model also gives customers the right to manage one public cloud OSI, which is included with each per-server license.

License key management includes:

- Per-OSI keys provided for Helion CloudSystem Foundation and CSA
  - 50 OSI key simulates “unlimited” OSI, and prevents nagging
  - OSI keys support implementation only—RTU is per server
  - No enforcement—Customer cannot manage unlicensed servers
- Per-server keys provided for Matrix OE (including ICsp, iLO)

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License key management

Use the Cloud Service Management Console in the Enterprise appliance to view, add, and remove CSA license keys. In the free trial period (the first 90 days), if you have not yet added a license key, CSA limits the number of new instances you can create.

To add CSA license keys, first install Helion CloudSystem Enterprise from the **CloudSystem Console** → **Enterprise** screen. Then click the link for CSA to launch the management console. From the Options menu, select **Licensing**.

Helion CloudSystem Enterprise software is offered under a single license entitlement. All embedded technologies are licensed, sold, and supported together as a single, non-decomposable product. The Enterprise software license also includes rights to use the embedded Matrix OE software to manage an unlimited number of OSIs on the specified number of servers.

The Helion CloudSystem Enterprise software license includes:

- Helion CloudSystem Foundation (including Operations Orchestration and HP Helion OpenStack)
- HP Cloud Service Automation
- HP Matrix Operating Environment
- HP Insight Control

Your per-OSI licensed environment must account for instances provisioned by all technologies. Instances provisioned or managed by both Helion CloudSystem Foundation and Helion CloudSystem Enterprise are counted only once.

Migrating your license to a new server

When you purchase a Helion CloudSystem Enterprise per-OSI software license, you can transfer your rights to manage a server with Matrix OE (including Insight Control) to a replacement server. To migrate your license to a new server:

- Add the existing Matrix OE license key to the new server.
- Add the replacement Insight Control license key to the new server. (The replacement license key is included with the original license key when you purchase a Helion CloudSystem Enterprise software license.)

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How to decide which license you need

Cloud licensing rules include:

- Customers can only use one license model per cloud
- No mixing per-OSI and per-server licenses within a single cloud

Acceptable use cases include:

- All managed clouds are licensed under either a per-server or a per-OSI model
- One on-premises cloud is licensed per-server and another is licensed per-OSI
- On-premises cloud is licensed per-server, and public cloud management is licensed per-OSI

When converting from per-server to per-OSI, the conversion must be performed for an entire cloud. For example, a customer cannot replace Matrix OE server licenses when managed servers are retired.

Compliance management

There is no license enforcement for Helion CloudSystem:

- Trust model
- License keys used to enable functionality—not to enforce limits of rights granted

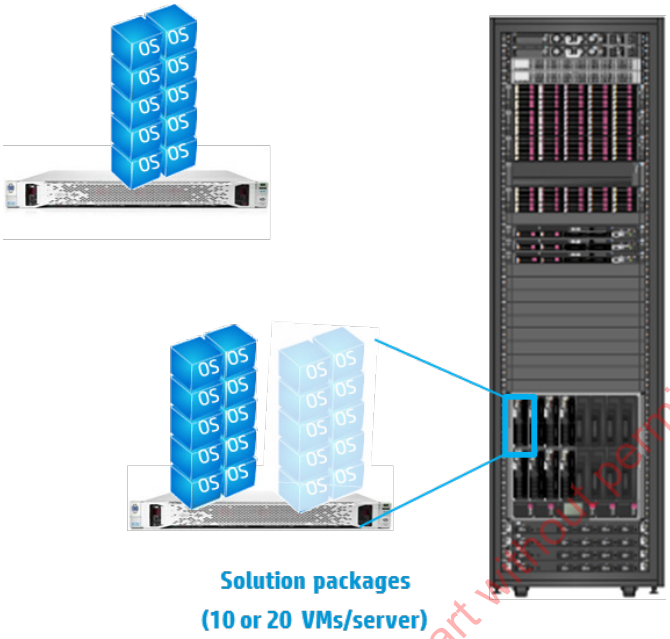
The approach allows customers to exceed license allotment if needed to address critical needs. However, no enforcement does not mean compliance is not important:

- Customers are required to purchase additional licenses to cover overuse, and return to compliance.
- HP reserves the right to audit compliance.

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License packaging—New per-OSI software licenses



- Stand-alone software
  - 10 OSI + 1 Matrix OE managed server*
- CloudSystem solutions with 8 blades
  - 80 OSI + 8 Matrix OE managed servers*
  - 2 x = 160 OSI + 16 Matrix OE managed servers*
- CloudSystem solutions with 16 blades
  - 160 OSI + 16 Matrix OE managed servers*
  - 2 x =320 OSI + 32 Matrix OE managed servers*

Note
*RTU Matrix OE to manage VMs on specified number of servers is granted with Helion CloudSystem Enterprise software licenses only. It is not included with Helion CloudSystem Foundation licenses.

Nuances of per-OSI licensing

If a customer replaces a Helion CloudSystem server blade, the customer must:

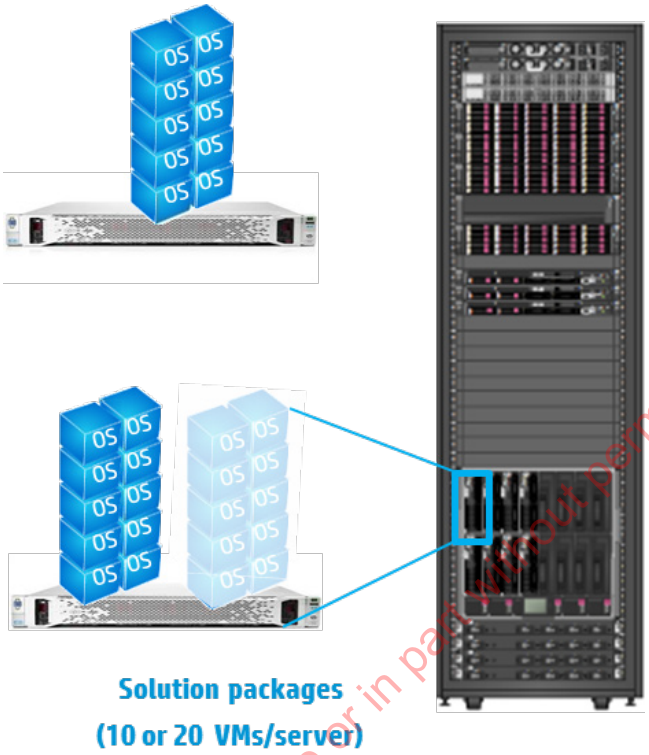
- Purchase a new HP OneView license with the replacement blade
- Migrate Matrix OE managed server license to the replacement blade

The customer needs twice the number of Matrix OE licenses in 8-blade/160 OSI and 16-blade / 320 OSI solutions.

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License packaging—Per-server software licenses



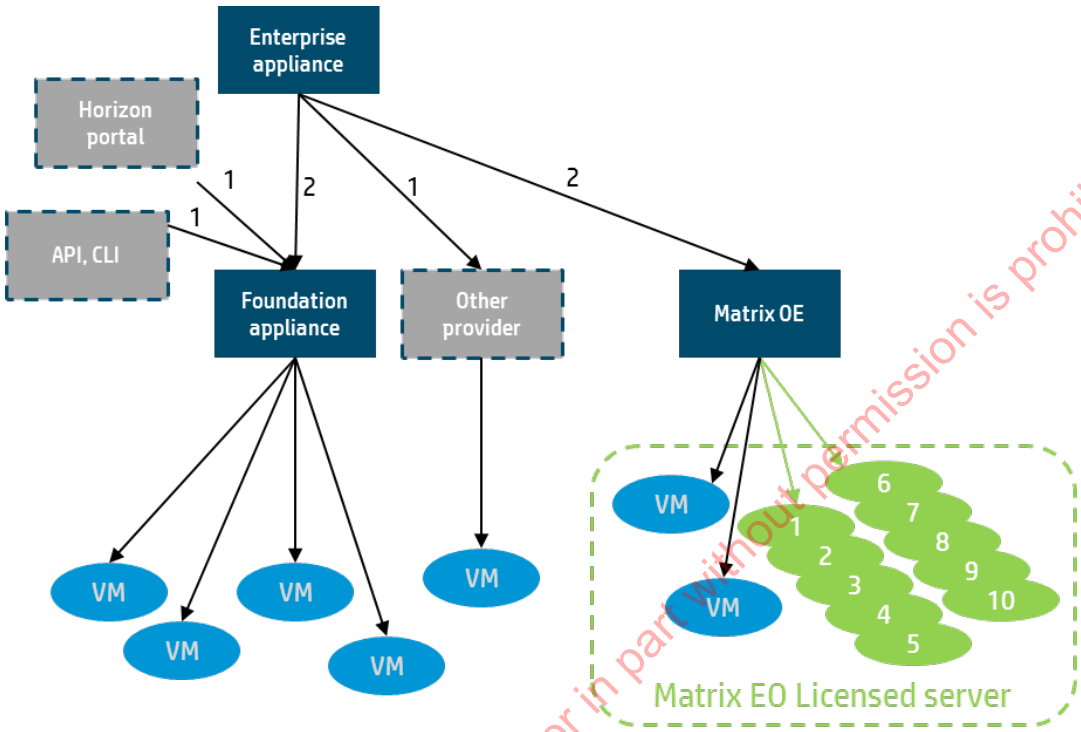
- Stand-alone software
  - One managed server (includes one Matrix OE managed server)
  - CloudSystem solutions
    - 8 blades = 8 managed servers (includes 8 Matrix OE managed servers)
    - 16 blades = 16 managed servers (includes 16 Matrix OE managed servers)
  - Matrix-to-Helion CloudSystem Enterprise upgrade
    - One managed server (including one Matrix OE managed server) per original Matrix OE server license
- License must be replaced with a managed server refresh

Note
*RTU Matrix OE to manage VMs on specified number of servers is granted with Helion CloudSystem Enterprise software licenses only (not included with Helion CloudSystem Foundation licenses)

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Helion CloudSystem OSI license consumption example



The total number of instance licenses consumed in this example is seven.

- Provisioned with Enterprise appliance: five
  - Two with Foundation
  - One with other provider
  - Two with Matrix OE
- Provisioned with Foundation appliance: two
  - One with CloudSystem Portal
  - One with API (or CLI)
- Provisioned with Matrix OE:
  - 10 allotted per Matrix license
- Matrix OE servers licensed: one

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HP Customer Intent Document for integrated solutions

What is the HP CID and why is it necessary?



Without Factory Express



With Factory Express

HP Integration Centers deliver targeted, integrated solutions through HP Factory Express services (services associated with the integration work performed in the HP Integration Centers). This enables consistent, rapid system delivery with faster time to production in the customer environment.

The HP Customer Intent Document (CID) is a key requirement that enables successful delivery of a solution. The CID details how the technical design is to be built, integrated, and configured. The build and configuration requirements are collected from the customer by HP Sales, HP Presales, and channel partners working with the HP Integration Center project manager and documented within the CID so that the order can be processed, integrated, and deployed.

The CID contains one or more of these items:

- Customer contact details
- Visio diagrams containing logical and physical view of the hardware layout and connectivity
- Questionnaire containing software configuration details
- Site survey checklist
- Bill of materials
- Any other relevant documentation or materials

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The associated benefits include:

- Reduced overall cost of the installation due to lower labor rates in the HP Integration Center and better resource utilization
- Reduced onsite deployment time and disruptive activities at the customer site (systems are preconfigured and ready to deploy when delivered)
- Reduced time to utilization and faster time to production, ultimately helping the customer achieve a faster ROI

HP Factory Express allows HP to complete and deploy a complex solution from order to operations in as little as 20 days. However, it is possible to achieve this goal and meeting customer expectations only if an accurate and complete CID is provided in a timely manner.

At the end of the engagement, after the system is built and configured, Integration Center project manager generates a Solution Information Manual. This document contains all information in the CID, installation documents, log files, and other documentation generated during the build process.

What is covered and not covered?

Is	Is not
A separate, complementary process from the system design	A system design and solution sizing process (is owned by HP Presales or the channel partner)
Applicable for HP Direct and HP Indirect Go To Market • For HP Direct, HP sales/presales is engaged • For HP Indirect, the channel partner is engaged	Creation of the budgetary or legal quote
	Performing solution design for integration with customer environment
	HP IC PM engagement in presales activities outside of the CID

The CID process is a separate, complementary process from the system design. The system design and sizing of the solution are not part of the CID process but are owned by HP Presales or the channel partner.

CID is applicable for both HP Direct and HP Indirect Go To Market. For HP Direct, HP sales/presales are engaged. For HP Indirect, the channel partner is engaged.

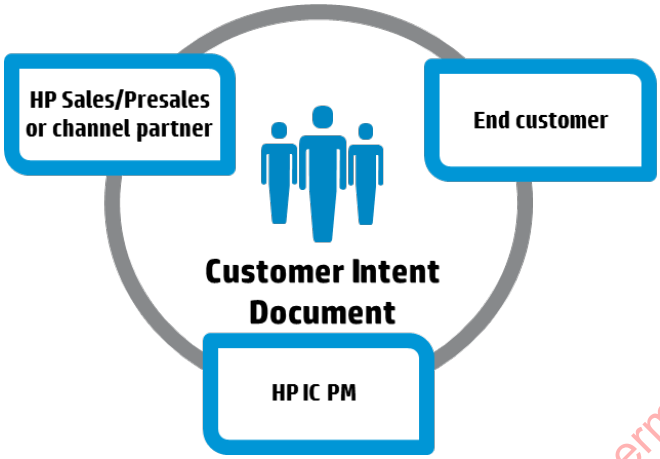
Furthermore, the following items are also excluded from the CID process:

- Creation of the budgetary or legal quote, which is part of the standard sales cycle.
- Performing solution design for integration with the customer environment, which is part of the HP presales/channel partner role. If the customer requires a more complex design, appropriate consulting services can be purchased.
- HP Integration Center project manager engagement in presales activities outside of the CID. The Integration Center project manager only supports the validation of the quotes and CID details. The Integration Center project manager does not support other presales activities.

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Roles and responsibilities—How to engage



The CID process involves the customer, HP Sales/Presales and channel partner, and the HP Integration Center project manager, all working closely together.

HP Sales/Presales and/or channel partner collaboratively own the CID and need to work together with the end customer to complete the CID. The Integration Center project manager provides necessary support and assistance when required.

Early engagement with the HP Integration Center ensures that an Integration Center project manager is assigned upfront. After being assigned, the project manager assists HP Sales/Presales and channel partners in completing the CID. The assigned project manager also manages the solution end to end, from factory build to onsite deployment.

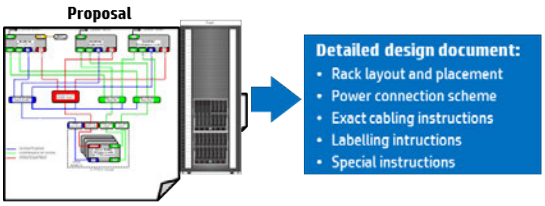
To engage with the HP Integration Center and get a project manager assigned, send an email to the regional HP Integration Center Factory Express engagement desk at:

- sol_eng_support@hp.com (for EMEA)
- AICEngagementProjectMgmtTeam@hp.com (for AMS)
- apic-sg.pdl@hp.com (for APJ)

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Examples



Network Settings

Please enter here the networks settings for the cluster. Note that without inputs from your end, the values list

Cluster CP3000

		Admin network			
		hostname	IP	netmask	hostname
Control node	Control node NIC 1	manager	10.128.0.1	255.255.0.0	
Compute nodes	Compute node 1	cn01	10.128.1.1	255.255.0.0	cnmgt-01
	Compute node 2	cn02	10.128.1.2	255.255.0.0	cnmgt-02
	...			255.255.0.0	
	Compute node 128	cn128	10.128.1.128	255.255.0.0	cnmgt-128
Network Switches	Console switch	cosw	10.128.3.1	255.255.0.0	
	Admin switch	admsw	10.128.3.2	255.255.0.0	

(external or customer network)	hostname	IP	netmask	Gateway	DNS 1
Control node NIC 2					
Control node management card					

Starting with the architectural and high-level drawings that are established at the presales stage, detailed assembly and cabling instructions are developed. These are needed by the factory and the onsite teams.

For software, details for software configuration must be defined with the customer. The software installation and configuration is then executed centrally at the HP Integration Center.

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Learning check

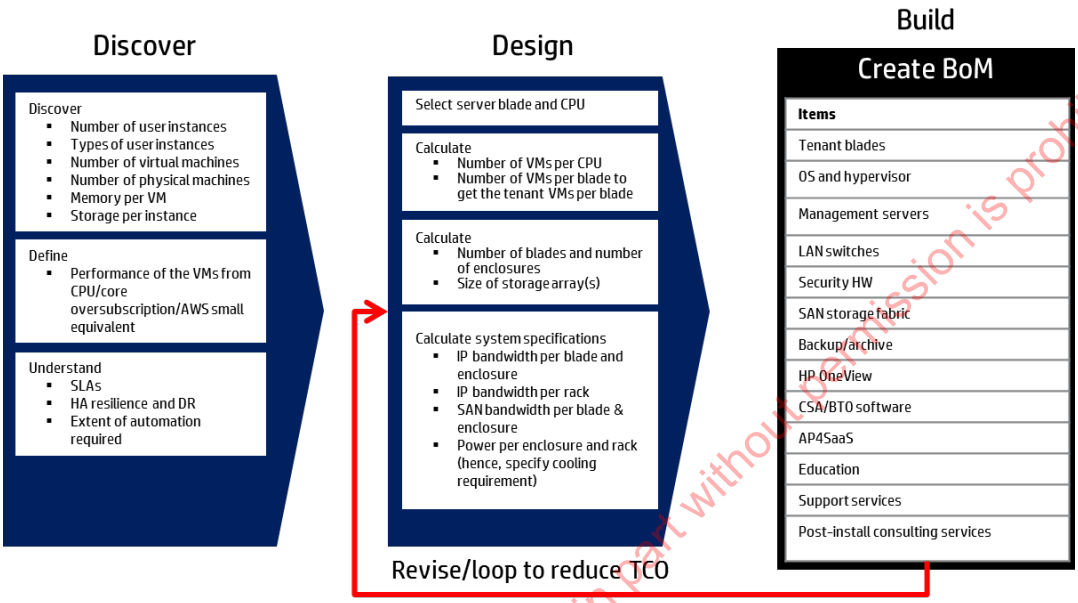
Your facilitator will lead a class discussion to capture key insights and challenges from this section of the module. To prepare for the discussion, answer the following questions about HP Converged Infrastructure, cloud fundamentals, and reference architectures. Record your answers here and be prepared to share them with the group.

1. Each of the components in HP Helion CloudSystem 8 software can be supported, updated, and upgraded independently.
   - ☐ True
   - ☐ False
2. The Helion CloudSystem 8 licensing rules permit mixing of per-OSI and per-server licenses within a single cloud.
   - ☐ True
   - ☐ False
3. Within the HP CID process, who is responsible for obtaining and completing the CID document? (Select all that apply.)
   a. Customer
   b. HP Sales
   c. HP Presales
   d. Channel partner
   e. HP Integration Center project manager
4. What is contained within the HP CID? (Select all that apply.)
   a. Bill of materials
   b. Pricing
   c. Site survey checklist
   d. Software licenses
   e. Customer contact details
   f. Visio diagrams of the hardware layout and connectivity

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HP Helion CloudSystem sizing and configuration process



The Helion CloudSystem sizing and configuration process comprises three main phases:

- **Discover**—Focuses on understanding the customer needs for the number and type of workloads, number and type of instances (a single instance could comprise several virtual machines [VMs], networks, and storage tiers), number of physical and virtual servers, and the amount of memory and storage required.
- **Design**—Focuses on the selection of CPUs and server blades, the calculation of the number of VMs per server blade, the number of server blades, the number of enclosures, the choice of storage systems, system specifications such as IP and SAN bandwidth, and power and cooling requirements.
- **Build**—Is where the bill of materials (BOM) is prepared. The BOM should include all software, hardware, and services required by the solution.

The graphic on this page illustrates the process of discovering the customer needs, selecting servers, and building a BOM. It also shows an example of the process.

Note
There could be many more products that would need to be added to the configuration, based on specific customer needs.

It might be necessary to go through the design phase several times because the design might be focused on price, rather than perfection.

Note
The term *physical machine* in the graphic refers to a physical server that runs an application workload, not to a VM host system.

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Discover

The first stage of the Discover phase focuses on determining the number and type of user instances, the number of VMs and physical nodes, how much memory the VMs should have, and how much storage is needed per instance.

The second stage focuses on defining the performance of the VMs. This involves mapping the VM to a physical machine, which might be a fraction of a standard server. Amazon has defined what they call a *standard compute unit* based on a particular Intel Xeon processor/clock speed, and this definition can be used as a standard reference point for a VM.

Note
Amazon Elastic Compute Cloud (EC2) is a web service that provides resizable compute capacity in the cloud. It is designed to make web-scale computing easier for developers.

This definition can be used to calculate how many VMs can be placed on each core, and from each core, how many VMs can be placed on each processor, and from each processor, how many VMs can be placed on each server blade. As an alternative, the customer might have already decided on the overprovisioning ratio, and they will define how many VMs they would like per core.

As a result, either the customer knows how many VMs they want on each core, or the number can be calculated using the AWS EC2 standard compute unit, where one EC2 compute unit (ECU) provides the equivalent CPU capacity of a 1.0-1.2 GHz 2007 AMD Opteron or 2007 Xeon processor. It is very important to get this calculation right, because it will have a direct impact on the cost of the solution. For example, doubling the number of VMs per physical server results in needing half the number of servers, which then results in a reduction in hardware costs.

The final stage of the Discover phase aims to build an understanding of the requirements for high availability and disaster recovery. An understanding of the level of automation the customer requires is important and depends on the skill of the users. As an example, imagine that the customer is implementing a private cloud based on Helion CloudSystem built on ConvergedSystem 700x, and the users accessing the service through the portal are reasonably sophisticated. These users can be given a great deal of control over their decisions with fewer functions requiring automation. Contrast this with a customer implementing a public cloud solution, where the user is not at all sophisticated and needs to be presented with a very simple, completely automated experience.

After all data in the Discovery process has been discovered, the Design phase can begin.

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Design

Certain server blades and CPUs are recommended because they have been used repeatedly, and experience suggests that their power and performance characteristics will translate into a good solution. For example, server blade and CPU choices are made according to the need for AMD or Intel processors and for power and speed. When new CPUs and server blades are introduced, the choices change to include the new models. PassMark analysis can then be used to calculate the number of server blades that are needed to meet the VM requirements. After the number of server blades has been calculated, the number of enclosures can be determined.

The choice of the storage arrays depends on the required capacity, availability, and need for features such as thin provisioning and virtual domains (which allow for secure isolation of application data on a consolidated multi-tenant storage system).

- **Small**—One BladeSystem c7000 enclosure, 8 server blades (ProLiant BL46x Gen8), and optional HP 3PAR StoreServ 7200
- **Medium**—One BladeSystem c7000 enclosure, 16 server blades (ProLiant BL46x Gen8), and optional HP 3PAR StoreServ 7400
- **Large**—Four BladeSystem c7000 enclosures, 64 server blades (ProLiant BL46x Gen8), and optional HP 3PAR StoreServ 10800

The system specifications now need to be calculated. The amount of network bandwidth per server blade and per enclosure needs to be considered. Failing to do this can result in network bottlenecks. It is also important to consider the SAN bandwidth per server blade and the power per enclosure. These systems can be very dense, and it is possible to load an enclosure from top to bottom and consume approximately 25 kW. It would be wise to check that the data center has the capability to supply the required amount of power and cooling.

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VM design guidelines

There are four considerations when designing the VM oversubscription ratio:

- Processing capacity per VM
- Memory per VM
- IO per VM
- Licensing cost

Together they produce a balanced design of virtualization for cloud.

Processing capacity per VM

To enable customers to make a fair comparison of VM solutions, HP uses an absolute VM processing capability. This is equal to Amazon AWS EC2 compute units m1.small (1 ECU, 1 CPU core, and 1.7 GB RAM), and is close to the ratio that customers often use. A ratio of 36:1 works well with loads that typically use 2-3% of a dedicated server. If there are loads with lower typical use, and no correlated peaks in traffic, then customers have been known to use in excess of 100:1, but this can cause an imbalance with other cloud design constraints. Also, using very high virtualization oversubscription ratios requires consideration of the number of threads supported. This depends on the CPU choice and knowledge of the workloads, which is difficult with general-purpose clouds.

Memory per VM

HP recommends sizing memory using guidance from VMware and Microsoft (3 GB and 4 GB, respectively) plus RAM for the operating system (500 MB for Linux and 1 GB for Windows). Additional memory might be required to satisfy the needs of the applications hosted on the VM, but exercise caution when specifying memory, because increasing server memory to add more VMs has two significant downsides:

- The use of high-density, high-power devices to achieve very large amounts of memory can significantly increase the cost of memory. High-density DIMMs such as 16 GB and 32 GB are expensive when compared with lower-density ones such as 2 GB and 4 GB. The current and future requirements for RAM need to be assessed and the most cost-effective DIMMs selected.
- Microsoft recommends accounting for the overhead required by Hyper-V virtualization technology by configuring an additional 10 to 25% of hardware resources.

INTERNET

To find more details, scan this QR code or right-click it and open the hyperlink:

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- VMware states that ESX VM overhead memory depends on the number of virtual CPUs, the configured memory for the guest operating system, and whether a 32-bit or 64-bit guest operating system is being used.

INTERNET

To find a table listing the overhead for each case, scan this QR code or right-click it and open the hyperlink:

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IO per VM

The final technical constraint on oversubscription of VMs is on the IO bandwidth from the server to the core switch. Gartner recommends 200 Mb/s storage and 100 Mb/s IP for each VM. Based on dual-resilient high availability and using converged network adaptors, each 10 Gb/s port pair can support 33 VMs. HP uses dual converged network adaptors (CNAs); therefore each server blade can support 66 VMs in high-availability configurations.

Additional CNAs can be added if required. HP cloud system design splits off the Fibre Channel traffic in the enclosure; therefore, with 50 Gb/s resilient uplinks to the core switch and approximately 20% local IP traffic, 40 VMs per server blade can be supported. Adding a second pair of Virtual Connect modules in the rear of the c7000 enclosure will increase this to 65 VMs per server blade. Larger numbers of VMs per server blade can be supported if the demand for IP traffic is lower than the Gartner recommendation.

Licensing cost

The cost constraint on VM oversubscription is based on the cost of the hypervisor licenses. Without considerable discounts, they dominate the cost of the raw compute elements and might cost more than the servers they run on. In this case, a joint calculation on hypervisor and server cost will reveal the best oversubscription ratio.

! **Important**
It is important to stress the need of a balanced design.

With cloud, HP uses a general-purpose set of rules on VM oversubscription. Exceeding the design recommendation has caused instability in workloads. In some cases with bare metal hypervisors, such as ESX, exceeding the design recommendation has resulted in crashing all the VMs on a single server.

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VM design goals

The goal is to design VMs that have no bottlenecks and that will adequately meet the needs of the users. To assist in the sizing process, an equivalent of the Amazon EC2 VM instance can be used. All Amazon EC2 instances are priced based on hourly usage and instance type. Each instance type consists of a certain number of ECUs and a set RAM size. The EC2 Standard Instances—well suited for many applications—are:

- **Small**—One ECU (one virtual core with one ECU), 1.7 GB memory, and 160 GB instance storage
- **Large**—Four ECUs (two virtual cores with two ECUs each), 7.5 GB memory, and 850 GB instance storage
- **Extra-large**—Eight ECUs (four virtual cores with two ECUs each), 15 GB memory, and 1,690 GB instance storage

One Amazon ECU is roughly equivalent to a PassMark CPU score of 400. The EC2 equivalent of a particular processor can be calculated by taking the PassMark CPU score and dividing it by 400. For example, the PassMark score for the 2.00 Xeon E5-2620 is 9,081. Divide this by 400 to get a score of 22 ECU. This means that the Xeon E5-2620 processor in this example should be able to host approximately 22 small, five large, or two extra-large EC2-equivalent VMs.

INTERNET To access the CPU PassMark scores, scan this QR code or right-click it and open the hyperlink:

The cpubenchmark.net website shows data for dual CPU or quad CPU systems (the term CPU being synonymous with the term processor—a package containing one or more cores). To calculate the ECU per processor, take the PassMark CPU Mark and, for a dual CPU system, divide by 2 to get the PassMark score per processor. Divide this number by 400 to find the ECU-equivalent score for a single processor.

For example, the cpubenchmark.net website shows the dual CPU Opteron 6174 as having a PassMark score of 15,498. Because it is a dual processor system, divide by 2 to find the PassMark score for one processor of 7749. Divide this number by 400 to find the ECU-equivalent for the processor of 19.3725. Round down to find the nearest integer of 19.

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The recommended network bandwidth for each VM, according to Gartner, should be at least 100 Mb/s for IP traffic and 200 Mb/s for SAN traffic.

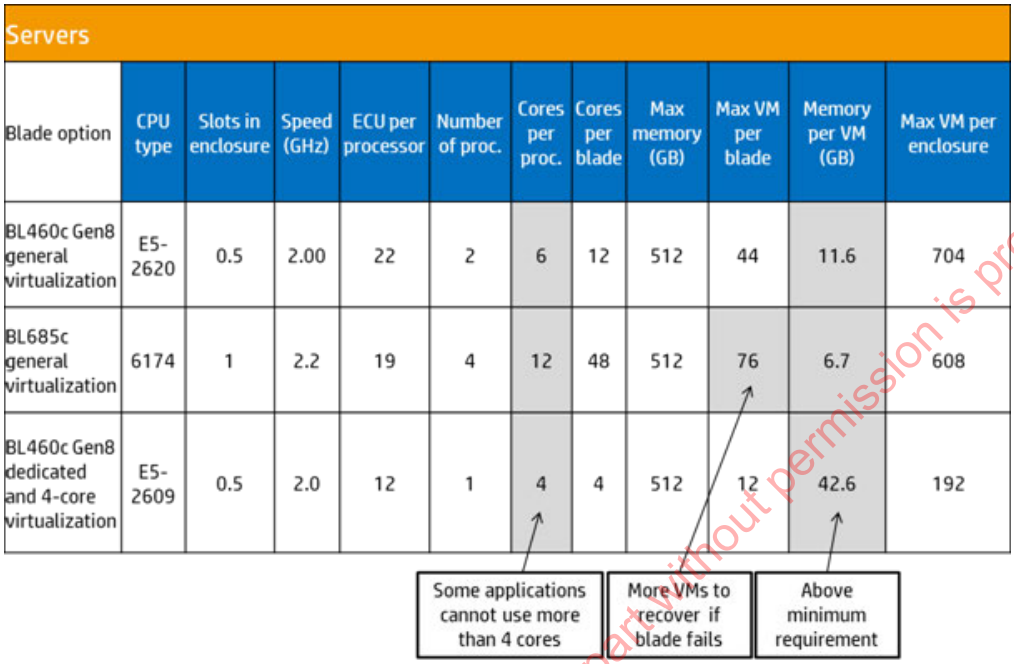
Note
iSCSI is all IP traffic so it becomes 300 Mb/s for IP traffic.

100 Mb/s for IP traffic is considered by some to be insufficient, but it is generally acceptable as a starting point. In a highly virtualized environment, a very large amount of IP traffic coming from the system can result in a large number of cables emerging from a single enclosure. In this scenario, it might be necessary to specify a switch such as the HP 5900 or HP 125xx.

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Server guidelines



The graphic shows the number of CPUs, cores per CPU, cores per server blade, and other numbers for a selection of HP server blades. These choices will change as new CPUs, DIMM densities, and server blades are introduced. It is for this reason that the focus should be on the principle, rather than on the model numbers.

Several checks should be made:

- **How many CPU cores can the application make use of?** Certain applications cannot use more than four cores, so there is no point in configuring a VM with more than four cores because the rest will be wasted.
- **How many VMs are going to be hosted on a single server blade?** If a server blade fails, the recovery process needs to be considered. The ProLiant BL685 in the example can host up to 76 VMs, and in the event of a server blade failure, it is possible that the recovery process would be too slow. In certain environments, it is possible that the business could cope with slow recovery from failure whereas in other environments, rapid recovery might be a requirement.
- **Is the server blade capable of supporting the required amount of memory?** Divide the maximum memory supported by the server blade by the maximum VM per server blade to reach the memory per VM estimate and ensure that it meets the RAM requirements for the VMs.

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General principles that apply to the sizing process include:

- Use HP server blades in c7000 enclosures to get lower power consumption than rack-mounted servers.
- Use Virtual Connect/FlexFabric to reduce ownership costs and number of cables.
- Use one or two standard server blades with options limited to memory and disk wherever possible. Ideally, local storage would be replaced by SAN storage.
- Use memory DIMM configuration rules to get best performance.

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Build

The BOM can be created either manually or, for HP employees and registered HP partners, with a tool such as HP SalesBuilder for Windows (SBW).

After the BOM has been completed, the cost of ownership should be checked and a decision made whether to go back and change some of the numbers to bring the cost down. For example, the mix between physical and virtual servers could be adjusted. The customer might not have specified the mix, and this is the time to fine-tune it to optimize the cost.

Another way to optimize the cost of the solution is by increasing the resilience of the system and specifying a reduced level of support. For example, adding several spare server blades to the configuration might mean that, rather than requiring a 24 x 7 level of support, a next-day fix is sufficient. In the event of a server blade failure, one of the spare server blades can take over from the failed server blade, resulting in minimal business impact and reduced total cost of ownership (TCO). A three-year Care Pack at the appropriate level is recommended, because this is lower in cost than a one-year Care Pack followed by two years' worth of support contract.

Note

SBW can be accessed through the HP Smart Portal:

- **http://www.hp.com/eur/smartportal** (Europe, Middle East and Africa)
- http://www.hp.com/go/partnerportal (Canada and United States)
- http://www.hp.com/partners/ap (Asia Pacific)

Care Pack information can be found at: **http://www.hp.com/go/carepack**

Approaches to sizing the customer solution

There are three primary approaches to determine the correct sizing for a Helion CloudSystem solution:

1. Leverage the experience of previous customer configurations.
2. Begin with one of the reference configurations (small/medium/large) and customize as appropriate.
3. Use Capacity Advisor to gather data from legacy Matrix OE systems.

The first approach relies on experience gained from previous successful Helion CloudSystem implementations. Use caution because all customers are different, even if their applications and workloads share similar characteristics.

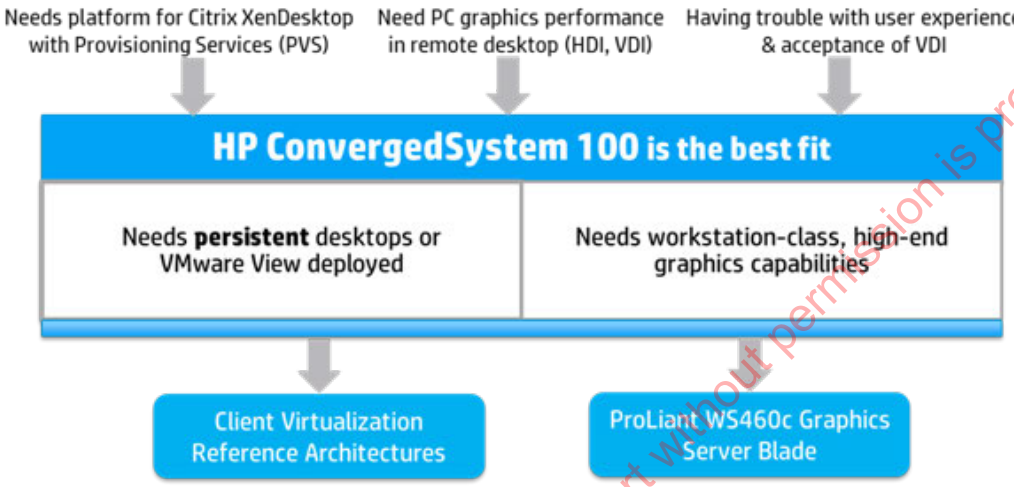
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HP ConvergedSystem decision trees

HP provides decision trees to help you select the best ConvergedSystem to meet customer requirements.

HP ConvergedSystem 100 decision tree



When to propose ConvergedSystem 100 for Hosted Desktops

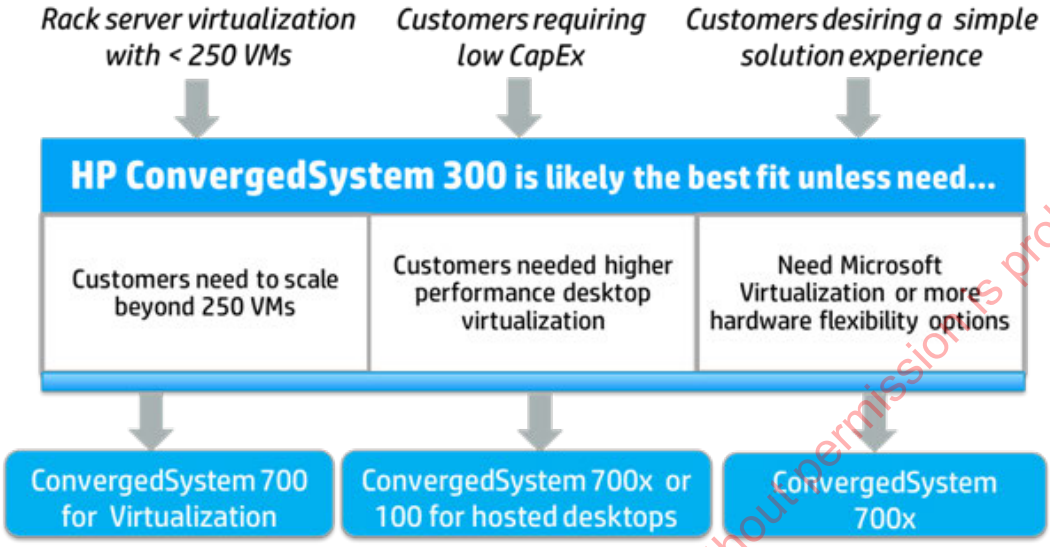
A ConvergedSystem 100 is the best fit for a customer scenario when the customer:

- Needs a platform for Citrix XenDesktop with Provisioning Services
- Needs PC graphics performance in a remote desktop
- Is having trouble with user experience and acceptance of a virtual desktop infrastructure

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HP ConvergedSystem 300 decision tree



When to propose ConvergedSystem 300

If the customer is looking to virtualize fewer than 250 virtual machines and prefers rack servers, lead with the ConvergedSystem 300.

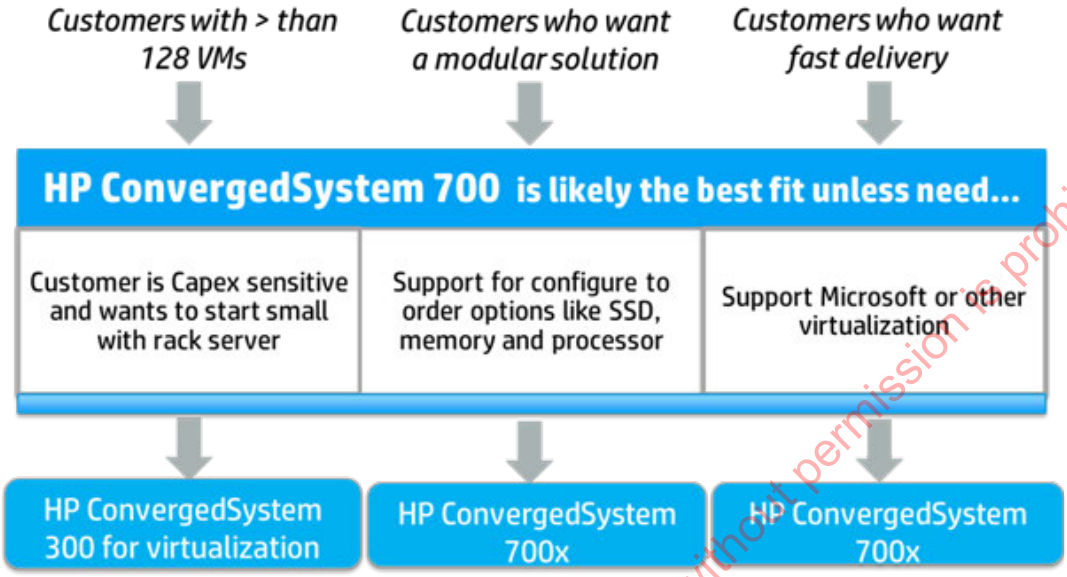
If the customer is focused on capital expense, then consider the ConvergedSystem 300 for Virtualization. It offers a low-cost platform for integrated systems that deliver virtualization in an appliance-like fashion.

If the customer wants a simple solution with a total solution experience for their virtualization needs, then consider the ConvergedSystem 300. If the customer requires high-performance client virtualization, then consider the ConvergedSystem 300 for Virtualization or the ConvergedSystem 700 for Virtualization.

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HP ConvergedSystem 700 decision tree



When to propose ConvergedSystem 700

If the customer needs to virtualize more than 128 VMs or prefers server blades, then consider the ConvergedSystem 700 for Virtualization, which can scale from 128 to 512 virtual machines.

If the customer wants to configure the solution with different options for memory, storage, and networking, they should consider a Helion CloudSystem 700x.

If the customer wants fast delivery with optimized management, consider a ConvergedSystem 700x.

If the customer needs Microsoft Hyper-V virtualization, then consider the ConvergedSystem 700x, which provides capabilities for configure-to-order (CTO) hardware and software, including the Microsoft virtualization layer and management stack.

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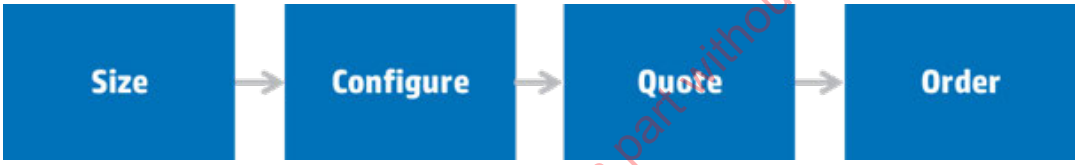
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HP sizing and configuration tools

HP offers additional tools to size and configure solutions. These include:

- **ActiveAnswers**—This tool is the online solutions authority in which HP shares its experience and best practices for planning, deploying, and operating enterprise solutions. Registration gives you complete access to the ActiveAnswers portfolio of tools, information, and technical papers for sizing and analyzing HP solutions.
- **Solution sizers**—These automated tools assist you in managing the size and scope of a particular solution environment. The sizing information and algorithms have been developed using testing and performance data on a wide range of HP servers running solutions from HP partners such as Citrix, Lotus, SAP, and Microsoft. These tools provide a consistent methodology to help you determine the optimal server for any environment.

Configurators compared with sizers



Although they are complementary tool sets, there are some important differences between sizing tools and configurators:

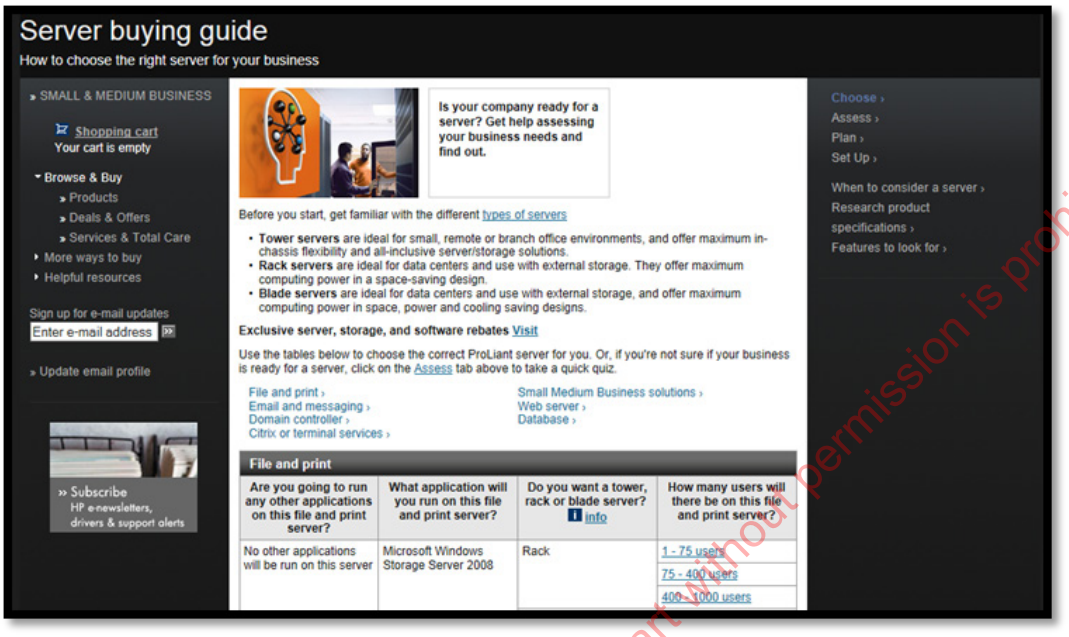
- Configurators are product-specific. They deliver individual product-level configurations, and ensure that the configuration rules are validated and that the required piece parts are incorporated.
- Sizers focus on capacity, performance, and operational or business requirements. They enable what-if scenarios and price-to-performance tradeoffs. They provide valid, supported configurations based on currently available technology. The output from a sizer can be saved and uploaded to the SBW Quoter Module.

If you know exactly what you want, go directly to SBW. When you are not sure which combination of HP storage products you want to propose to your customer, use the HP Storage Sizer.

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Online server selection guides



Servers can be customized online during the purchasing process by using how-to guides. One of the best places to find online information about HP ProLiant and Integrity servers is the HP website. There you can use the HP how-to guides for servers to research and choose from a variety of servers and options. These guides will help you understand how to size a server to suit specific business needs. These guides enable you to customize the server with:

- Memory
- Secondary or tertiary drive controllers
- Hard drives and removable media bay devices
- Cables
- Hot-plug devices and additional network interface controllers (NICs)
- Operating system and management software
- Care Pack services
- Rack deployment options

Note
The degree to which a server can be customized depends on the line and series. Not all options are available for every server or in every geographic region.

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Planning and sizing HP Converged Infrastructure and cloud solutions case study

Your customer is an IT solutions provider that offers software, infrastructure, and a wide range of related services. With offices in the Netherlands and four other countries, they are active in the public and private sectors and have customers across many different industries.

Over the last few years, this provider has seen a trend in the market toward providing services rather than selling products. There has been a corresponding shift towards private cloud solutions as a way to deliver IT solutions.

In response to these changes, they started to look for cloud solutions they could provide to their clients. Then one of their existing customers asked them for help, so they decided to accelerate the process.

The primary objectives and requirements of this IT service provider include:

- Delivering a comprehensive cloud solution, meeting the requirements of their customers and boosting market competitiveness
- Adding new capacity by 90% so IT can keep up with the pace of business
- Responding to customer demand for cloud-based solutions
- Achieving increased flexibility, with storage capacity that can be temporarily boosted as required
- Accelerating deployment by using virtualized resources
- Simplifying IT management and administration, accelerating ROI
- Reducing up-front capital expenditure, with hope of shifting costs to operating expenditure
- Lowering costs of managing IT by 25%

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Case study activity

After reading the case study, answer the following questions. Be prepared to discuss your answers with the group.

- Which type of cloud-based solution would you propose for this customer?

- What IT improvements (hardware, software, and services) would you recommend?

- How will these solutions meet the customer's need for continued additional capacity?

- What are the business benefits of your proposed solution?

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Learning check

Your facilitator will lead a class discussion to capture key insights and challenges from the module. To prepare for the discussion, answer each of the following questions. Write your answers here and be prepared to share them with the group:

1. What is the difference between configurators and sizers?

   _____

   _____

   _____

   _____

   _____

2. How many server blades does HP Helion CloudSystem support in these configurations?

   Small: _____

   Medium: _____

   Large: _____

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Summary

Designing an appropriate Converged Infrastructure solution to meet customer requirements requires a systematic approach. Before you can plan the solution, you must determine that a Converged Infrastructure solution is right for the customer. This process includes verifying whether the customer's current IT environment can support the solution. The two major components of the review are a technical analysis and an application analysis. There are also some nontechnical considerations to take into account. This is also the stage where competitors' solutions might still be appealing to the customer, and you will have to formulate the value proposition for the HP solution.

With the Helion CloudSystem licensing model, customers can choose between per OSI or per-server licensing models. Because these two models cannot be mixed within the same cloud, you should determine which model is most appropriate for the customer.

The Helion CloudSystem sizing and configuration process comprises three main phases: Discover, Design, and Build.

The first stage of the Discover phase focuses on determining the number and type of user instances, the number of virtual machines and physical nodes, how much memory the VMs should have, and how much storage is needed per instance.

The second stage focuses on defining the performance of the VMs. This involves mapping the VM to a physical machine—which might be a fraction of a standard server. Amazon has defined what they call a *standard compute unit* based on a particular Xeon processor/clock speed, and this definition can be used as a standard reference point for a VM.

In the Design phase, server blades and CPUs are recommended because they have been used repeatedly, and experience suggests that their power and performance characteristics will translate into a good solution.

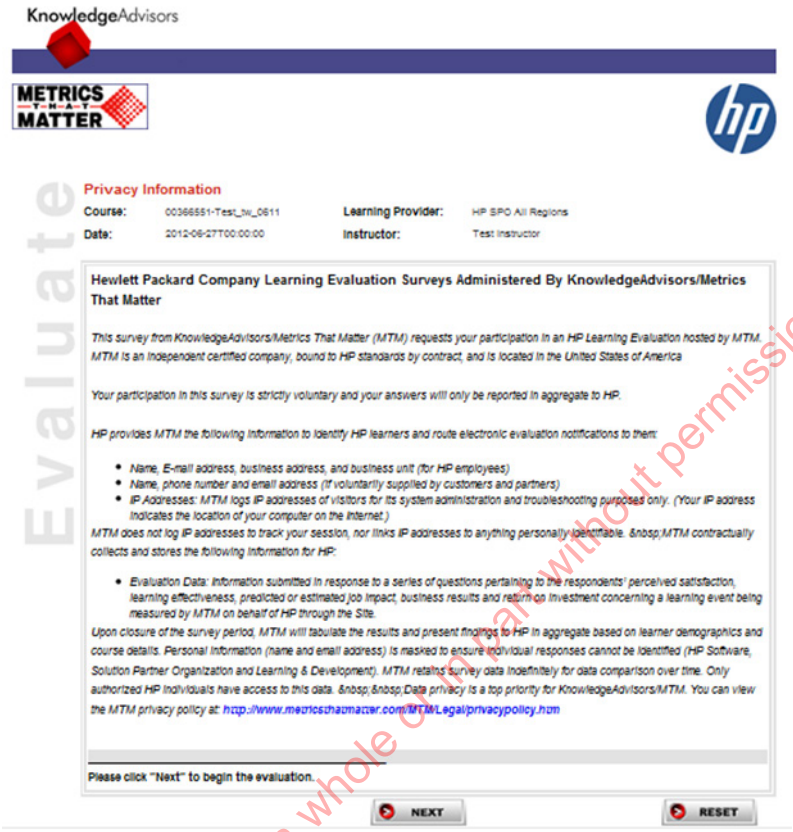
In the Build phase, the BOM can be created either manually or, for HP employees and registered HP partners, with a tool such as HP SalesBuilder for Windows (SBW). After the BOM has been completed, the cost of ownership should be checked and a decision made whether to go back and change some of the numbers to bring the cost down. For example, the mix between physical and virtual servers could be adjusted. The customer might not have specified the mix, and this is the time to fine-tune it to optimize the cost.

After you have assembled the business and technical information you need from the customer, you can begin to propose a solution. The creation of timely, accurate, and high-quality proposal-ready content requires the application of a rigorous development and maintenance process.

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Learner survey and course feedback



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Contact us at:

EMAIL mailto:certification.development@hp.com

Be sure to include the course title and the revision in your message.

Thank you for taking the time to help us improve your experience!

The HP ExpertOne team

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