Oracle® Private Cloud at Customer

Getting Started Guide

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Oracle Legal Notices

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Preface

This document is part of the documentation library for Oracle Private Cloud at Customer.

Audience

The Oracle Private Cloud at Customer documentation is written for system administrators who monitor a private cloud environment deployed at the customer site, and manage virtual machines for users. It is assumed that readers are familiar with web and virtualization technologies and have a general understanding of operating systems such as UNIX (including Linux) and Windows.

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Conventions

The following text conventions are used in this document:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
italic	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
`monospace`	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

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Access to Oracle Support for Accessibility

Oracle customers that have purchased support have access to electronic support through My Oracle Support. For information, visit https://www.oracle.com/corporate/accessibility/learning-support.html#support-tab.

Diversity and Inclusion

Oracle is fully committed to diversity and inclusion. Oracle respects and values having a diverse workforce that increases thought leadership and innovation. As part of our initiative to build a more inclusive culture that positively impacts our employees, customers, and partners, we are working to remove insensitive terms from our products and documentation. We are also mindful of the necessity to maintain compatibility with our customers' existing technologies and the need to ensure continuity of service as Oracle's offerings and industry standards evolve. Because of these technical constraints, our effort to remove insensitive terms is ongoing and will take time and external cooperation.

Chapter 1 Introduction to Oracle Private Cloud at Customer

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This chapter provides an overview of the features and components of Oracle Private Cloud at Customer.

1.1 About Oracle Private Cloud at Customer

Oracle Private Cloud at Customer enables customers to run both Oracle and non-Oracle applications on a platform located inside their data centers, while the infrastructure is managed by Oracle cloud experts. Oracle Private Cloud at Customer systems are preconfigured according to best practices, which have been proved by many mission-critical Oracle Private Cloud Appliance installations around the world.

Oracle Private Cloud at Customer is designed for rapid and simple deployment of mission-critical applications and workloads, whether running on Linux, Oracle Solaris, or Microsoft Windows. High-performance, low-latency physical network connectivity and Oracle Software Defined Networking (SDN) technologies facilitate automated provisioning of the server and storage networks. Leveraging the software-defined network fabric, customers can dynamically configure networks without having to manually re-cable connections, saving time and reducing the risk of human error. The consolidation of network connections results in up to 70 percent fewer cables and cards.

In addition to rapid infrastructure provisioning, Oracle Private Cloud at Customer also accelerates complete application stack deployment through support for Oracle VM Virtual Appliances. These are preconfigured applications, middleware, and databases packaged as ready-to-run virtual machines (VMs). The VMs are dynamically configured at deployment time, requiring customers to provide only basic configuration parameters. The result is an unparalleled ability to go from “bare-metal” infrastructure power on to logging in to a newly deployed, running application within days or even hours, instead of weeks or months.

Service Overview

Oracle Private Cloud at Customer is available through a subscription offering that requires a minimum term of 4 years. Customers select a configuration consisting of, at a minimum, three components: a Base System, a Storage Subscription, and a Compute Node subscription. The Base System includes two management nodes and supporting network infrastructure. To this, subscriptions are added for a minimum of two compute nodes, and for an Oracle ZFS Storage Appliance ZS7-2.

As the need for compute capacity increases, customers can add more compute nodes up to a total of 20 per system (or 25 for InfiniBand-based systems), to meet their business requirements. All CPU cores, disk and flash storage, and RAM for the selected configuration are included in the subscription price. There is no charge for the network communication to the Oracle Private Cloud at Customer. As the need for storage increases, additional storage tray subscriptions, both for high capacity trays and for high performance flash storage trays, can be added.

In addition, customers can combine Oracle Private Cloud at Customer with existing Oracle Exadata Cloud at Customer machines, thus enabling higher compute, network and storage capacity for the applications interacting with the database layer.

1.2 Standard Configurations

Customers can subscribe to a number of standard Oracle Private Cloud at Customer configurations, based on the capacity and performance requirements of the services and applications to be hosted on the environment. For practical purposes, an initial distinction must be made based on the systems' internal physical network connectivity: Oracle Private Cloud at Customer may be built around a full Ethernet fabric or an InfiniBand fabric. The system delivered is based on the requirements of the customer environment and could be impacted by other factors, such as local RoHS regulations.

While the performance and capacity of Ethernet-based and InfiniBand-based systems are practically identical, the rack layout is different. Because the Ethernet-based systems have an Oracle ZFS Storage Appliance ZS7-2 built into the base rack, they are only offered as a single rack configuration. However, additional storage does need to be installed in another rack.

The InfiniBand-based systems, in contrast, have an additional storage appliance, which can technically be installed inside the base rack if the required number of compute nodes is 9 or fewer. The single-rack InfiniBand-based system is called the *compact* configuration; the version with storage and infrastructure hardware installed in a second rack is called the *scale* configuration.

Optionally, each of these versions of Oracle Private Cloud at Customer can be combined with an existing Oracle Exadata Cloud at Customer system. In this configuration, both systems may share an Oracle Advanced Support Gateway.

1.2.1 Oracle Private Cloud at Customer with Ethernet Fabric

The Ethernet-based version of Oracle Private Cloud at Customer contains all the management, compute, connectivity and storage components in a single rack. It has enough rack units available for 20 compute nodes and two disk trays, with the ability to add up to 14 additional storage trays, installed in an additional rack. With 15 kVA PDUs, the maximum number of compute nodes is reduced to 13.

In terms of virtualization capacity, the minimum subscription contains two compute nodes and two high-capacity storage trays. The subscription can be expanded by one node at a time. Extra storage can also be added to the subscription.

1.2.2 Oracle Private Cloud at Customer Compact Configuration with InfiniBand Fabric

The compact configuration contains all the necessary infrastructure, compute and storage components for your private cloud environment, packaged in a single rack. Two restrictions apply: electrical power and rack space. Assuming the rack contains 22 or 24 kVA power distribution units (PDUs), a maximum of 9 compute nodes can be installed. Racks can also be equipped with 15 kVA PDUs, which can provide power reliably to a system with up to 6 compute nodes.

In terms of virtualization capacity, the minimum subscription contains two compute nodes and two high-capacity storage trays. The subscription can be expanded by one node at a time.

1.2.3 Oracle Private Cloud at Customer Scale Configuration with InfiniBand Fabric

The scale configuration comes with storage hardware and interconnect infrastructure components installed in a second rack. As the name suggests, the scale configuration is aimed at scalability over the

installation lifetime of the subscriptions by providing space to grow both the compute and storage capacity of the system. This is accomplished through the installation of additional server nodes for expanded compute capacity in the base rack and up to 14 additional storage trays in the second rack. The two-rack configuration allows the system to scale to a maximum of 25 compute nodes. A fully loaded base rack requires 24 kVA PDUs; the maximum number of compute nodes is reduced to 23 with 22 kVA PDUs, or 13 with 15 kVA PDUs.

In terms of virtualization capacity, the minimum subscription contains two compute nodes and two high-capacity storage trays. The subscription can be expanded by one node at a time. In the case of a scale configuration, extra storage can also be added to the subscription one high-performance or high-capacity tray at a time.

1.2.4 Integration with Oracle Exadata Cloud at Customer

All standalone configurations of Oracle Private Cloud at Customer, as described above, can be integrated with an existing Oracle Exadata Cloud at Customer system. The main benefit of this integration is that applications can be consolidated on the virtualization compute platform, with high-performance access to the database layer.

Oracle Exadata Cloud at Customer consists of two racks. The base rack contains the Database Machine with database and storage servers. Additional infrastructure components, which provide a cloud deployment management interface for the Oracle Exadata Cloud at Customer system, are installed in a second rack named the Oracle Cloud Control Plane. This configuration results in a total of 3 racks. However, additional disk trays for storage capacity may still require extra rack space.

When an Oracle Private Cloud at Customer is added to the configuration, the management networks of both systems are joined together for easy maintenance access. A single instance of Oracle Advanced Support Gateway is used for monitoring and administration of both integrated systems.

Most importantly, for optimum connectivity between the application layer and the database layer hosted by the two respective systems, the data network traffic must be optimized. Using their 10GbE infrastructure, both Oracle systems connect externally to the customer data center network. Because the data traffic passes through the data center switches, it is critical that the data center network hardware and topology are configured to enable the best possible connection.

1.3 Feature Description

Oracle Private Cloud at Customer includes the following features:

- **Easily extensible platform, managed by Oracle:** Customers select the initial configuration that suits their requirements. Oracle installs, configures and manages the private cloud infrastructure, allowing the customer to focus on deploying their business-critical applications and services. When the platform reaches its limits, capacity can be easily extended.
- **Rapid application stack deployment, not just infrastructure:** Support for ready-to-run Oracle VM Assemblies enables users to rapidly deploy not only the infrastructure, but also the applications that are hosted on the infrastructure.
- **Support for a wide variety of guest operating systems:** Support for Linux, Oracle Solaris, and Windows operating systems and applications.
- **Converged infrastructure orchestration software:** The Controller Software orchestrates automated discovery, configuration, and management of included server, network, and storage resources. It allows Oracle to provision the infrastructure in the customer data center in a short amount of time.

- **Unified, software-defined network fabric:** Incorporated Oracle Software Defined Networking hardware provides a single, consolidated fabric allowing new networks to be dynamically added and existing networks to be modified without the need to manually modify cabling. Oracle manages these configuration tasks for you remotely.
- **Unified management:** Browser-based management software, Oracle Enterprise Manager, centralizes administrative operations and provides at-a-glance status for all monitoring targets. Role-based access control permits secure private cloud platform administration and usage across users and groups with different rights. Oracle manages all infrastructure through the Oracle Advanced Support Gateway; the customer manages VM provisioning through the Oracle Enterprise Manager IaaS self-service portal.

1.4 System Components

Oracle Private Cloud at Customer systems consist of virtualization compute nodes, storage appliances, as well as required Ethernet or InfiniBand networking components. Table 1.1 lists the quantity and description of each component in an Oracle Private Cloud at Customer system.

Table 1.1 Oracle Private Cloud at Customer Rack Components

Component Type	Oracle Private Cloud at Customer with Ethernet Fabric	Oracle Private Cloud at Customer with InfiniBand Fabric
Management node	(2) Oracle Server X8-2	(2) Oracle Server X5-2
Virtualization compute node	(2-20) Oracle Server X8-2 with 2 Intel 24-core CPUs and 768GB RAM	(2-25) Oracle Server X7-2 with 2 Intel 24-core CPUs and 768GB RAM
Storage appliance	(1) Oracle ZFS Storage Appliance ZS7-2 with up to a total of 16 disk trays in secondary cabinets	(1) internal Oracle ZFS Storage Appliance ZS5-ES used as appliance system disk (1) Oracle ZFS Storage Appliance ZS7-2 with up to a total of 16 disk trays in secondary cabinets
Rack	(1) Oracle Rack Cabinet 1242 base	(1-2) Oracle Rack Cabinet 1242 base
Administration network hardware	(1) Cisco Nexus 9348GC-FXP Switch	(2) Oracle Switch ES1-24
Internal network hardware	(2) leaf Cisco Nexus 9336C-FX2 Switch	(2) NM2-36P Sun Datacenter InfiniBand Expansion Switch
External network hardware	(2) spine Cisco Nexus 9336C-FX2 Switch	(2) Oracle Fabric Interconnect F1-15

Note

The maximum number of compute nodes in a single Oracle Private Cloud at Customer base rack is determined by the capacity of the power distribution units (PDUs) installed in the rack:

- 15 kVA PDUs can provide power to a base system with 13 compute nodes
- 22 kVA PDUs can provide power to a base system with 23 compute nodes, or 20 compute nodes in systems with Ethernet fabric
- 24 kVA PDUs can provide power to a base system with 25 compute nodes, or 20 compute nodes in systems with Ethernet fabric

Storage

Oracle Private Cloud at Customer is deployed with an Oracle ZFS Storage Appliance ZS7-2, which provides approximately 200TB of storage space per capacity-type disk shelf, for use by the guest VMs hosted in your private cloud environment. For detailed information about the Oracle ZFS Storage Appliance ZS7-2, refer to the product data sheet.

A typical Ethernet-based deployment consists of a single rack with the storage appliance and two disk shelves installed inside the base rack. A portion of the available disk space is reserved for internal use by the management nodes and the controller software. Additional disk shelves must be installed in another rack, and are connected directly to the storage controller servers.

In a typical InfiniBand-based deployment the internal storage appliance serves as the internal 'system disk'. The external storage appliance is installed in a separate rack and connected to the necessary InfiniBand and Ethernet networks. Additional disk shelves are installed in the storage rack. There are always two switches installed for 10GbE interconnectivity, and when deployed together with Oracle Exadata Cloud at Customer, a single Oracle Advanced Support Gateway is configured to manage both systems. Optionally, the storage appliance and other components can be installed into the Oracle Private Cloud at Customer base rack, on condition that the virtualization platform consists of no more than 9 compute nodes and requires no extra disk shelves.

1.5 Software Components

The initialization of the Oracle Private Cloud at Customer platform is managed through the Oracle Private Cloud Appliance Controller Software, which uses a high degree of provisioning automation. This stage of the platform deployment is performed entirely by Oracle, as are the updating and patching of the Controller Software and operating systems.

The virtualization layer is built around the Oracle VM hypervisor. Administrative operations on virtual machines and their networking and storage resources are handled by Oracle VM Manager, which runs as an Oracle WebLogic Server domain on both management nodes. All configuration details and operational data related to the virtualized environment under Oracle VM Manager control, are stored inside the management repository. This is an Oracle MySQL Enterprise Edition database that resides on the shared storage provided by the internal storage appliance. The two management nodes are configured as an active/standby cluster for high availability (HA): when the active management node goes offline, the other management node assumes the active role, takes control of the database, and continues to provide the Oracle VM Manager service.

None of the management applications and interfaces above are available for customer use in an Oracle Private Cloud at Customer deployment. As a customer, and administrator of the virtual machines running on your private cloud platform, you perform all monitoring and management tasks through Oracle Enterprise Manager 13c. For detailed information and instructions, refer to *Managing the Virtualized Environment* in Chapter 2, *Learn About Deploying, Managing and Using Oracle Private Cloud at Customer*.

Chapter 2 Learn About Deploying, Managing and Using Oracle Private Cloud at Customer

This chapter centralizes the essential information topics you need in order to explore the installation and configuration aspects and the functionality of Oracle Private Cloud at Customer. This is a convenient starting point to learn the basics and get started with your private cloud deployment plans.

Configuration Models

Customers can subscribe to different configuration models. The Ethernet-based system is available as a single rack only; the InfiniBand-based system is available as a compact single-rack configuration or a two-rack scale configuration. All configurations can be combined with Oracle Exadata Cloud at Customer.

See Standard Configurations.

Platform Architecture and Deployment

Oracle deploys the private cloud infrastructure inside your data center. It is your responsibility to prepare your data center for deployment and ensure that all requirements are met.

- Prepare for installation

  Learn about required preparation tasks in anticipation of Oracle Private Cloud at Customer deployment at your site.

- Site requirements

  Learn about the site requirements that must be met before Oracle Private Cloud at Customer can be deployed at your site. Checklists are provided to help you track any tasks that need to be completed to ensure that all requirements are met.

- Network requirements

  Learn about the network requirements for Oracle Private Cloud at Customer. Your data center network must accommodate for the integration of Oracle Private Cloud at Customer. A worksheet is provided to help you collect important configuration parameters.

- Concept and architecture

  Learn about the concept and basic architecture of Oracle Private Cloud at Customer.

Managing Cloud Accounts, Access Rights and User Roles

User accounts within Oracle Private Cloud at Customer are assigned in three tiers, based on the Oracle Enterprise Manager IaaS roles and privileges required to perform specific tasks. For a detailed description, refer to Role-Based Administration. For a list of tasks per user category, and step-by-step instructions, refer to Chapter 5, *Configure and Use the Virtualized Environment*.

Managing the Virtualized Environment

The virtualized environment hosted on Oracle Private Cloud at Customer is managed through an instance of Oracle Enterprise Manager. It runs in a virtual machine hosted on one of the two initial compute nodes. It is configured with a minimal footprint and priority level to allow customer created VMs to take priority.

For detailed information and step-by-step VM configuration, management and usage instructions, refer to these pages:

- Section 5.2, “Cloud Administrator Tasks”

  Learn about the various tasks for which the cloud administrator is responsible.

- Section 5.3, “Customer Administrator Tasks”

  Learn about the details of the various tasks you can perform as a customer administrator.

- Section 5.4, “Customer User Tasks”

  Learn about the details of the various tasks you can perform as a customer user.

Oracle offers several preconfigured Oracle VM Virtual Appliances for download. These allow customers to rapidly set up a typical Oracle product stack within their virtualized environment on Oracle Private Cloud at Customer, without having to perform the full installation and configuration process.

Refer to this page: Virtual Appliances Download - Oracle VM and Private Cloud Appliance . It provides a list of virtual appliances, download links, installation instructions, and references to technical papers and detailed product documentation.

Monitoring Health and Performance

All monitoring functionality is centralized within Oracle Enterprise Manager. For detailed information and instructions, refer to these pages:

- Oracle Enterprise Manager plug-in for Oracle Private Cloud Appliance
- Monitoring and managing targets

Training Resources

All Oracle Private Cloud at Customer training videos can be found on Oracle Learning Library.

Related Documentation

For detailed information about components of Oracle Private Cloud at Customer, as well as other related documentation, refer to these resources:

- Oracle Private Cloud at Customer home page
- Oracle Private Cloud Appliance documentation library
- Oracle ZFS Storage Appliance ZS7-2 documentation library
- Oracle Advanced Support Gateway documentation library
- Oracle Enterprise Manager Cloud Control 13.4 documentation library

Chapter 3 Concept and Architecture of Oracle Private Cloud at Customer

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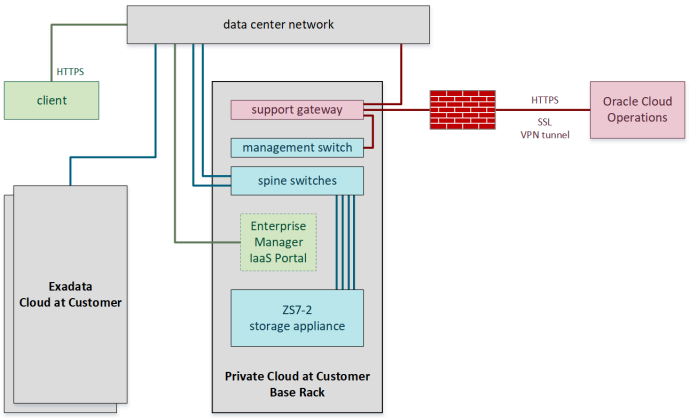
This chapter describes conceptual principles of the Oracle Private Cloud at Customer offering, and the architecture around which the system is built. The core system is an Oracle Private Cloud Appliance, which exists in two versions with significantly different physical network architecture. The system with Ethernet fabric is described here. For an equivalent description of the InfiniBand-based system, refer to Section 3.6, “Architecture of Oracle Private Cloud at Customer with InfiniBand Fabric”.

For years, Oracle Private Cloud Appliance has been combining cloud simplicity, agility and elasticity with deployment inside customer data centers, in order to run Oracle and non-Oracle workloads. Oracle Private Cloud at Customer extends the capabilities of the Oracle Private Cloud Appliance, by adding Oracle ZFS Storage Appliance ZS7-2 with up to 16 disk shelves, and Oracle Advanced Support Gateway. The gateway enables the most important factor in your subscription: complete management by Oracle of the entire infrastructure, deployed inside your own data center.

A web-based self-service management interface, Oracle Enterprise Manager 13c, gives the customer interactive access to service administration functions. Because the Oracle Private Cloud at Customer environment is hosted inside your data center, no firewall is implemented to govern client access. However, you are free to implement additional firewalls within your network if desired.

Figure 3.1 shows a high-level view of the Oracle Private Cloud at Customer architecture in a single diagram. From a technical perspective, the architecture is identical to Oracle Private Cloud Appliance X8-2, but it offers a lower maximum number of compute nodes, and adds optional storage capacity extension for the built-in Oracle ZFS Storage Appliance ZS7-2.

Figure 3.1 Oracle Private Cloud at Customer Architecture at a Glance



Oracle monitors and manages the Oracle Private Cloud at Customer infrastructure components, including the physical compute node hardware, network switches, power distribution units (PDUs), Oracle Integrated Lights Out Manager interfaces (ILOMs), and the storage. These operations are performed remotely by Oracle using the Oracle Advanced Support Gateway, which may be located inside your network DMZ.

3.1 Modular Compute Platform

Note

This section applies to systems based on Ethernet network architecture.

If your system is built around an InfiniBand fabric, refer to the equivalent section in *Section 3.6, "Architecture of Oracle Private Cloud at Customer with InfiniBand Fabric"*.

Compute capacity is provided by an Oracle Private Cloud Appliance base rack, with a number of compute nodes selected to meet the requirements of the workloads it must host. A single system contains at least 2 and up to 20 compute nodes. As the customer requirements change over time, the subscription is adjusted and the configuration can be extended by one compute node at a time. All rack units, whether populated or not, are pre-cabled and pre-configured at the factory in order to facilitate the installation of expansion compute nodes on-site at a later time.

At the heart of the system is a pair of management nodes, configured as an active/standby cluster for high availability. The active management node takes the shared virtual IP address and runs the Oracle VM Manager and related services, which are required for the configuration and management of the virtualization platform. The active management node also runs the Oracle Private Cloud Appliance Controller Software, which is the system level management service. The Controller Software orchestrates compute node provisioning tasks from initial power-on to deployment readiness, and ensures the synchronization of essential configuration parameters between server nodes and across infrastructure components.

The core network infrastructure is a physical 100Gbit Ethernet fabric with built-in redundancy, designed around a leaf/spine topology. In this two-layer design, the leaf switches interconnect the rack hardware components, while the spine switches form the backbone of the network and perform routing tasks. Software defined networking (SDN) is implemented on top of the Ethernet fabric, providing dynamically allocated high-performance connectivity to physical components and virtual machines, while maintaining the traffic separation of hard-wired connections. Using VxLAN encapsulation and VLAN tagging, thousands of virtual networks can be deployed, providing segregated data exchange. Traffic can be internal between resources within the appliance environment, or external to network storage, applications, or other resources in the data center or on the internet. External connectivity is provided by redundant 10Gbit Ethernet uplinks to the next-level data center switches or top-of-rack (ToR) switches.

The Oracle ZFS Storage Appliance ZS7-2 is installed inside the base rack. A small portion of the available disk space is reserved for use as a 'system disk' for the entire appliance, providing storage space for the Controller Software, Oracle VM Manager and system databases, software and firmware upgrade files, local package repositories, backups, and so on. The rest of the approximately 200TB can be configured as underlying storage for Oracle VM repositories, virtual appliances (assemblies/templates), virtual machine disks and application data. The storage resources are accessed through the dedicated internal storage network.

3.2 Storage Provisioning

Note

This section applies to systems based on Ethernet network architecture.

> If your system is built around an InfiniBand fabric, refer to the equivalent section in *Section 3.6, "Architecture of Oracle Private Cloud at Customer with InfiniBand Fabric"*.

Storage for the virtualized environment – presented as file or block based resources, accessed through storage repositories or directly attached to virtual machines – must be configured on the Oracle ZFS Storage Appliance ZS7-2, which is installed inside the appliance base rack. Co-engineered with Oracle Private Cloud Appliance, the ZFS storage appliance adds the extreme performance and efficiency required by demanding enterprise applications and unpredictable cloud workloads. It adds a usable capacity of 200TB to the system and leverages the high bandwidth and low latency of the appliance Ethernet fabric.

The storage resources are accessed through the dedicated internal storage network, which is a redundant 40Gbit Ethernet connection between the spine switches and the storage appliance. All four storage controller interfaces are bonded into one datalink.

The Oracle ZFS Storage Appliance ZS7-2 is physically connected to the spine switches through a redundant 40Gbit Ethernet connection. All four storage controller interfaces are bonded using LACP into one datalink. This way of connecting compute and storage hardware provides excellent performance and flexibility. Flexible storage provisioning is critical to support the diverse workloads of a private cloud environment. Virtual disks in an Oracle VM repository are a convenient way to provide disk space to a virtual machine. However, many configurations also require shared storage in the form of mounted NFS volumes, and in some cases a directly attached iSCSI physical disk is preferable. The storage architecture of Oracle Private Cloud at Customer enables any desired combination.

The default storage configuration consists of a 100TB LUN-based storage repository presented to the hypervisor, and a 50TB NFS share accessible to virtual machines through a custom network. The remaining space of the 200TB capacity is held in reserve for the provisioning of iSCSI LUNs or additional repositories. Further allocation of storage resources is managed within Oracle Enterprise Manager. Note that the customer may select a different storage configuration prior to system initialization.

The Oracle Private Cloud at Customer subscription can be expanded to include additional storage. Customers who need more disk space for their workloads can add high-capacity and/or high-performance storage to their subscription. The extra disk shelves – up to 14 outside of the base rack – are installed in a separate rack, and are connected to, and managed by the pair of controllers already present inside the base rack.

3.3 Support Gateway

Oracle monitors and manages the Oracle Private Cloud at Customer infrastructure components, including the physical compute node hardware, network switches, power distribution units (PDUs), Oracle Integrated Lights Out Manager interfaces (ILOMs), and the storage. For this purpose, Oracle uses the Oracle Advanced Support Gateway, a physical machine installed inside the base rack. (In a scale configuration with InfiniBand fabric, the gateway is installed in the external storage rack.)

The support gateway requires connections to three networks: the appliance internal maintenance network, the customer data center network, and the external administration network. The support gateway hosts a separate custom instance of Oracle Enterprise Manager, which is accessed remotely by Oracle Cloud Operations only. It allows Oracle to perform administration and support tasks remotely, which would otherwise require on-site intervention.

Through its internal connections the Oracle Advanced Support Gateway can detect hardware and configuration issues, which it forwards to Oracle in the form of alerts. The entire system is integrated with Oracle Auto Service Request, allowing the support gateway to automatically raise a priority service request that includes all the relevant diagnostic data. This process considerably speeds up system serviceability.

If Oracle Private Cloud at Customer is combined with an Oracle Exadata Cloud at Customer system, a single support gateway is used to monitor and manage both systems. The support gateway works with multiple Oracle Exadata Cloud at Customer systems, if required, but supports only one Oracle Private Cloud at Customer environment.

The Oracle Advanced Support Gateway documentation can be found at https://docs.oracle.com/cd/E41177_01/index.html.

3.4 Role-Based Administration

Management, configuration and self-service user tasks within Oracle Private Cloud at Customer are performed through Oracle Enterprise Manager. It contains many features and options for role based access control, enabling privileges and functions associated with predefined roles. Oracle Private Cloud at Customer uses the Infrastructure as a Service (IaaS) functionality, which provides these default roles: `EM_CLOUD_ADMINISTRATOR`, `EM_SSA_ADMINSTRATOR`, `EM_SSA_USER`.

In a typical Oracle Private Cloud at Customer environment, a simplified approach is taken. There are three logical categories of users; each of them using the built-in IaaS roles and privileges differently.

- **Cloud Administrator**

  The Cloud Administrator user account is owned by Oracle. The account has all the access rights and privileges to perform the Oracle Enterprise Manager setup for all the infrastructure components under its control, to configure the building blocks available to the virtualized environment, and to generate other roles and user accounts.

- **Customer Administrator**

  The Customer Administrator account is the customer-owned account with the highest privileges. This account has no control over the infrastructure, but configures the Self Service Portal for users, manages the virtualized resources and sets quota on those resources for the end users. The Customer Administrator can submit a service request to have configuration changes applied that require Cloud Administrator privileges.

- **Customer User**

  A Customer User account is provided to all consumers of virtualized resources. All users manage the life cycle of their deployed virtual machines, as well as the storage space and networking resources made available to them. They can do so within the limitations of the quota assigned to them by the Customer Administrator, and consult chargeback information about their usage at any time.

Oracle Enterprise Manager has two different management interfaces:

- The *Cloud Control Console* is used by Customer Administrators to set up, monitor and manage your Infrastructure as a Service (IaaS) environment.
- The *Self Service Portal* is the home page of the Customer Users. It enables Customer Users to provision and access virtual machines and applications, and allows tracking of resource consumption and data collection for chargeback and capacity planning.

3.5 Integration with Oracle Exadata Cloud at Customer

Oracle Private Cloud at Customer can be deployed as an extension of the compute capacity for an existing Oracle Exadata Cloud at Customer system. For this configuration, the networking and monitoring of both systems must be integrated to operate as a single entity.

The key element in the integration of the two systems is high speed Ethernet. Both Oracle systems are equipped with redundant 10GbE connections to the customer data center network. Network performance between the two systems depends on the bandwidth and latency of the data center network. It is possible to optimize the data path by assigning a dedicated custom network from Oracle Private Cloud at Customer to the next-level data center switches, and then configuring the data center network to direct the traffic through a separate high-performance network segment or VLAN routed to the Oracle Exadata Cloud at Customer.

The system administration networks are also joined together to form a single gigabit Ethernet network. It connects the management interfaces of the servers and interface components, and allows the Oracle Advanced Support Gateway to monitor the entire integrated system. Since only a single support gateway is required, the monitoring services for Oracle Private Cloud at Customer are added to the existing gateway of the Exadata system.

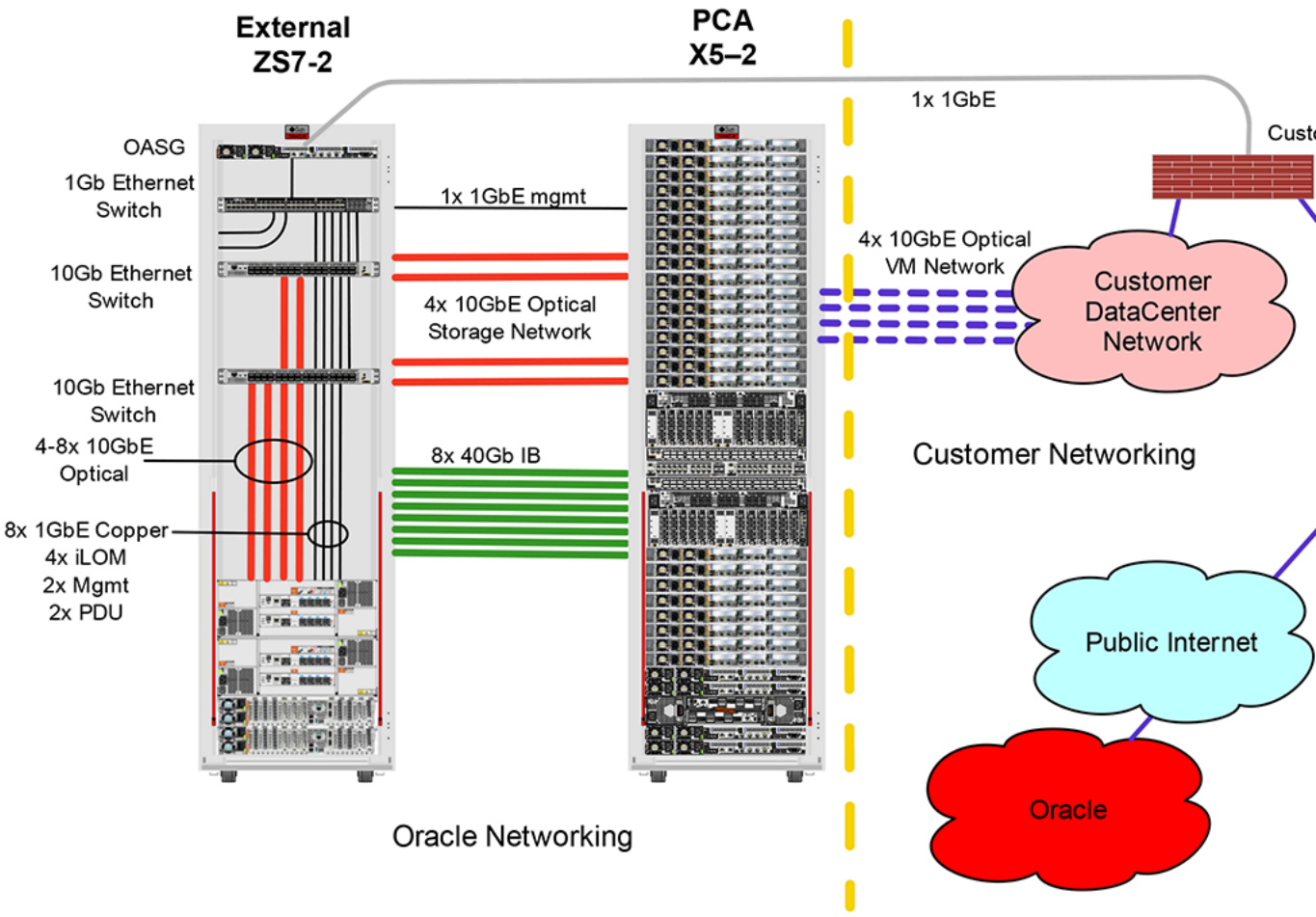
From an administrative user perspective, the two systems are accessed separately. The Oracle Cloud Control Plane provides the cloud management interface to Oracle Exadata Cloud at Customer, while a customer-accessible instance of Oracle Enterprise Manager is used to manage the virtual machines and their underlying resources within the Oracle Private Cloud at Customer environment.

3.6 Architecture of Oracle Private Cloud at Customer with InfiniBand Fabric

The Oracle Private Cloud at Customer offering is based on Oracle Private Cloud Appliance, which exists in two versions with significantly different physical network architecture: Ethernet and InfiniBand, respectively. The two architectures are built for the same purpose: to provide the best possible infrastructure for a broad range of virtualized workloads in a private cloud environment. Software Defined Networking is used in both cases to dynamically provision connectivity between physical and virtual components.

The technical architecture for Oracle Private Cloud at Customer based on a physical InfiniBand fabric, is the same as for an on-premises implementation of Oracle Private Cloud Appliance X5-2 combined with an external Oracle ZFS Storage Appliance ZS7-2.

Figure 3.2 On-Premises Implementation of Oracle Private Cloud Appliance X5-2 with Oracle ZFS Storage Appliance ZS7-2



The sections below explain specific aspects of the architecture of InfiniBand-based systems, which differ significantly from the Ethernet-based architecture. A note in the description of the Ethernet-based architecture points to the equivalent InfiniBand-based section below. The information regarding the Oracle Advanced Support Gateway and the integration with Oracle Exadata Cloud at Customer is applicable to both architectures.

3.6.1 Modular Compute Platform

Compute capacity is provided by an Oracle Private Cloud Appliance X5-2 base rack, with a number of compute nodes selected to meet the requirements of the workloads it must host. A single system contains at least 2 and up to 25 compute nodes. In function of the customer subscription, the configuration can be extended by one compute node at a time. All rack units, whether populated or not, are pre-cabled and pre-configured at the factory in order to facilitate the installation of expansion compute nodes on-site at a later time.

At the heart of the system is a pair of management nodes, configured as an active/standby cluster for high availability. The active management node takes the shared virtual IP address and runs the Oracle VM Manager and related services, which are required for the configuration and management of the

virtualization platform. The active management node also runs the Oracle Private Cloud Appliance Controller Software, which is the system level management service. The Controller Software orchestrates compute node provisioning tasks from initial power-on to deployment readiness, and ensures the synchronization of essential configuration parameters between server nodes and across infrastructure components.

The core network infrastructure is a physical 40Gbit (Quad Data Rate) InfiniBand fabric with built-in redundancy. Software defined networking (SDN) is implemented on top of the InfiniBand fabric, providing dynamically allocated high-performance connectivity to physical components and virtual machines, while maintaining the traffic separation of hard-wired connections. External connectivity for the virtualization platform is provided by redundant 10Gbit Ethernet uplinks to the next-level data center switches.

A storage appliance is installed in the bottom four rack units of the base rack. This should be considered as a 'system disk' for the entire appliance, as its main purpose is to provide storage space for the Controller Software, Oracle VM Manager and system databases, software and firmware upgrade files, local package repositories, backups, and so on. Storage resources for Oracle VM repositories, virtual appliances (assemblies/templates), virtual machine disks and application data are configured on the Oracle ZFS Storage Appliance ZS7-2, which is accessed through the 10GbE public network infrastructure as well as the InfiniBand storage network.

3.6.2 Storage Provisioning

Storage for the virtualized environment – presented as file or block based resources, accessed through storage repositories or directly attached to virtual machines – must be configured on external storage hardware. For this purpose, every Oracle Private Cloud at Customer installation includes an Oracle ZFS Storage Appliance ZS7-2, which is typically installed in a separate storage rack, but can also be installed in the compute base rack if a compact configuration is required.

Storage functionality and performance are identical for compact single-rack and scalable two-rack configurations. Co-engineered with Oracle Private Cloud Appliance, the ZFS storage appliance adds the extreme performance and efficiency required by demanding enterprise applications and unpredictable cloud workloads. It adds a usable capacity of 200TB to the system and leverages the high bandwidth and low latency of the appliance InfiniBand fabric.

The Oracle ZFS Storage Appliance ZS7-2 is physically connected to the compute base rack in two ways: through 10GbE interconnect switches inside the storage rack, and with InfiniBand cabling directly to the Fabric Interconnects. This way of connecting compute and storage hardware provides excellent redundancy and performance, as well as maximum flexibility. Flexible storage provisioning is critical to support the diverse workloads of a private cloud environment. Virtual disks in an Oracle VM repository are a convenient way to provide disk space to a virtual machine. However, many configurations also require shared storage in the form of mounted NFS volumes, and in some cases a directly attached iSCSI physical disk is preferable. The storage architecture of Oracle Private Cloud at Customer enables any desired combination.

The default storage configuration consists of a 100TB LUN-based storage repository presented to the hypervisor, and a 50TB NFS share accessible to virtual machines through a custom network. The remaining space of the 200TB capacity is held in reserve for the provisioning of iSCSI LUNs or additional repositories. Further allocation of storage resources is managed within Oracle Enterprise Manager.

The Oracle Private Cloud at Customer subscription can be expanded to include additional storage. In the case of a scale configuration, with the Oracle ZFS Storage Appliance ZS7-2 installed in a second rack, customers who need more disk space for their workloads can add high-capacity and/or high-performance storage to their subscription. The extra disk shelves are installed in the storage rack and are managed by the pair of controllers already present.

Chapter 4 Oracle Private Cloud at Customer Responsibilities

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When you subscribe to Oracle Private Cloud at Customer, you should understand the responsibilities of the Oracle Operations and Support personnel, as well as your responsibilities as a customer.

4.1 Preparing for Delivery

One of your key responsibilities with a subscription to Oracle Private Cloud at Customer is to work with your assigned Oracle Cloud Delivery team to ensure your data center meets all the requirements. This process includes your participation in an audit of your data center, making sure there are no issues that will delay or prevent the Oracle Private Cloud at Customer from being installed and configured quickly, efficiently, and securely in your data center.

The Oracle Private Cloud at Customer Deployment Guide guides you through the preparation process.

4.2 Initial Configuration and Setup

Caution

Make sure that all preparations for the installation of Oracle Private Cloud at Customer have been completed before the installation team arrives. This includes physical preparation, such as power and network, as well as logical preparation, such as IP address assignment, DNS entries, and firewall modifications to allow Oracle to reach the Oracle Advanced Support Gateway. Failure to complete all preparation tasks may result in long delays in implementation and multiple on-site visits by the installation team.

When your Oracle Private Cloud at Customer hardware arrives, a team of Oracle customer support engineers will set up the hardware, and install and configure the Oracle Advanced Support Gateway. More specifically:

- An Oracle Field Service engineer will set up and configure the hardware.
- An Oracle Advanced Customer Support (ACS) engineer will install and configure the software.
- A member of the Oracle Gateway Team will set up and configure the Oracle Advanced Support Gateway.

When the system is up and running, the ACS engineer validates the installation and completes your Oracle Private Cloud at Customer order. The designated Oracle Cloud Account administrator on your team receives a welcome email message. The email contains the links and credentials required to log in to your new Oracle Cloud Account for the first time.

4.3 Day-to-Day Systems Management

Day-to-day management of your Oracle Private Cloud at Customer system infrastructure, including the Oracle hardware and software, is handled by Oracle Operations, via the Advanced Support Gateway.

The Oracle Advanced Support Gateway is also managed by Oracle Operations. It provides efficient, secure connections between your Oracle Private Cloud at Customer hardware and software and the Oracle Operations team. Using the gateway, the Oracle Cloud Operations team monitors your system and responds to your service requests securely and promptly.

The goal is to free up your IT engineers so they can support the real work that your company needs to perform, including developing and deploying applications, managing the Oracle Cloud services, and running your business.

4.4 About Managing Your Oracle Private Cloud Accounts

Oracle Private Cloud account management is the responsibility of you, the customer, and you can assign administrators to manage your deployed services and applications.

Typically, you assign two or more administrators on your team to manage the Oracle Private Cloud accounts. They monitor your Oracle Private Cloud usage and create and manage Cloud Service instances. They also can create additional Private Customer Users, who can be assigned specific tasks or roles.

Chapter 5 Configure and Use the Virtualized Environment

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Once the Oracle Private Cloud at Customer infrastructure has been deployed in your data center, the Self Service Portal has been configured, and the initial virtualized resources have been provisioned, your private cloud is made available to customer administrators and end users. Their permitted activities are tied to their user accounts and the roles and privileges assigned to them.

5.1 Role Based Access Control

Management, configuration and self-service user tasks within Oracle Private Cloud at Customer are performed through Oracle Enterprise Manager, which offers fine-grained options for role based access control. In a typical Oracle Private Cloud at Customer environment, a simplified approach is taken. There are three logical categories of users; each of them using the built-in IaaS roles and privileges differently. See Section 3.4, “Role-Based Administration” for more information.

The instructions in the sections that follow, are based on typical private cloud use cases. They provide step-by-step guidance to perform a number of tasks and complete a workflow from start to finish. The tasks are grouped by user category.

5.2 Cloud Administrator Tasks

Cloud Administrator tasks are the responsibility of Oracle. They include infrastructure monitoring, the creation of user roles and accounts, and fundamental setup operations to make the Self Service Portal and virtualized storage, network and compute resources available for further configuration and usage.

Customer Administrators interact with the Oracle Cloud Administration team through the opening of Service Requests in the Oracle Support portal. Service requests may be opened for the following functions:

- create, modify or delete networks and VLAN interfaces
- create, modify or delete repositories, LUNs and NFS shares
- create, modify or delete VM zone groups or move compute nodes between zone groups

5.3 Customer Administrator Tasks

The following table lists the tasks that a Customer Administrator is allowed to perform. Detailed instructions are provided in a demonstration video of each task.

Table 5.1 Overview of Customer Administrator Tasks

Task Description	Links
Initial log in Review the initial login sequence to Oracle Enterprise Manager, where you change the initial password and set accessibility preferences.	video: Initial log in

Task Description	Links
Change a password Learn how to change the Customer Administrator password when you are logged in as the Customer Administrator.	video: Changing the customer administrator password
Prepare the Software Library Learn how to create a referenced location, from which you can gather resources, and how to create a folder in the software library, as a way to control access for users and resources.  **Note** It is not supported to rename or edit a Virtualization Template that was previously saved as a different name within the Enterprise Manager Software Library. If this type of Virtualization Template requires renaming it should be saved as a new component.	video: Prepare the software library related documentation: • Organize entities
Create a template component Learn about creating a template component by adding a referenced template file to a folder in the software library. Once in the software library, the template can be deployed to users.	video: Create a template component related documentation: related documentation
Create an assembly component Learn about creating an assembly component by adding a referenced assembly file to a folder in the software library. Once in the software library, the assembly can be deployed to users.	video: Create an assembly component related documentation: related documentation
Create an ISO component Learn about creating an .iso component by adding a referenced .iso file to a folder in the software library. .iso files must be converted to templates before they can be deployed to users.	video: Create a ISO component related documentation: Creating a Template Component
Create a template from an ISO file Learn how to create a VM from an .iso component, save that component as a template, and then share the template with specific users or roles.	video: Create a template from an ISO file related documentation: • Provision guest VM from ISO • Edit guest VM • Start guest VM

Task Description	Links
	• Save guest VM as template
Publish and import virtualization components Learn how to publish Software Library component to the Self Service portal, and how to import components into zones.	video:Publish and import virtualization component
Define a machine size Learn how to define a machine size for Customer Users by choosing a preconfigured size of CPUs, memory, and storage, or creating a custom size.	video:Define a machine size related documentation: related documentation
Configure request settings Learn how to configure the default settings for self-service portal users, including limiting request durations, and network restrictions.	video:Configure request settings related documentation: Setting Up the Self Service Portal (step 2)
Assign quota to a role Learn how to assign resource quota, zones, and networks to specific roles.	video:Assign a quota to a role related documentation: Setting Up the Self Service Portal (steps 3 and 4)
Assess failed jobs Learn how to find a failed job by user, and view the errors related to the failure.	video:Assess failed user jobs
Create a chargeback plan Learn how to set up chargeback plans, assign users to cost centers, and associate cost centers with chargeback plans so that charges for IaaS resources can be collected from consumers.	video:Configuring chargeback related documentation: • Global chargeback settings • Universal charge plan • Extended charge plan • Cost centers • Add entities to chargeback • View chargeback information
Follow best practices for virtual machine configuration Learn how to change memory, CPU, network, or storage settings for a VM, and in what cases you need to shut down the VM for changes.	video:Best practices for VM configuration related documentation: Editing a Guest Virtual Machine
Monitor resources Learn how to monitor targets such as zones, virtual servers, and server pools, and view inventory and consumption information.	video:Monitoring Oracle Private Cloud Appliance resources related documentation: Viewing the Infrastructure Cloud Home page

Task Description	Links
Monitor server memory utilization Learn how to view memory utilization and allocation.	video:Monitoring Server Memory Utilization for Oracle Private Cloud at Customer
Stage files for the uploader user Learn how to upload a file to the on-board HTTP server, using SFTP as the uploader user. Oracle Private Cloud at Customer users can request configuration of an HTTP server on the Oracle Enterprise Manager host. This HTTP server is configured as a referenced file location in Oracle Enterprise Manager. Included in this configuration are the uploader user and an SFTP server.	video:Staging files for Oracle Enterprise Manager as the uploader user
Learn about the Kubernetes as a Service feature Learn key background information about using the Oracle Enterprise Manager features that support Kubernetes as a Service.	video: About Kubernetes as a Service

5.4 Customer User Tasks

The following table lists the tasks that a customer user is allowed to perform. Detailed instructions are provided in a demonstration video of each task.

Table 5.2 Overview of Customer User Tasks

Task Description	Links
Initial log in Review the initial login sequence to Oracle Enterprise Manager, where you change the initial password and set accessibility preferences.	video:Initial log in
Change a password Learn how to change the customer user password when you are logged in as the customer user.	video:Changing the Customer User password
Deploy a template Learn about how a Customer User can deploy a template to create a virtual server. Starting with a template provided by a Cloud Administrator, you can configure server features such as storage, memory, network, and HA. You can also choose to save your server as a template or a deployment plan for future use.	video:Deploy a template related documentation: Provisioning a Guest Virtual Machine Using Oracle VM Templates
Deploy an assembly Learn how to deploy an assembly with custom network and storage settings, after your	video:Deploy an assembly related documentation: Provisioning Guest Virtual Machines Using Oracle Virtual Assemblies (OVA)

Task Description	Links
Administrator publishes assemblies to your Self Service portal.	
Add dedicated storage to a server Learn how to add a dedicated virtual disk to a server, confirm the disk has been added, and how to release the storage when it is no longer needed.	video:Add dedicated storage to a server
Add shared storage to a server Learn how to add a virtual disk to a server and share that storage with an additional server, confirm the disk is shared, then releasing that storage when it is no longer needed.	video:Add shared storage to a server related documentation: Requesting Servers
Deploy a server using iSCSI storage LUNs Learn how to request and configure a server or virtual machine that use iSCSI storage LUNs.	video:Deploy server using iSCSI LUNs
Upload and share a component Learn about uploading a template or assembly file to the Self Service Portal Software Library, and then sharing that component with specific users or roles.	video:Upload and share a component related documentation: • Self Service Portal setup (step 6) • Upload large files to Portal
VM lifecycle management: start, stop, restart, ... Learn about stopping and starting a virtual server individually, and how to manage virtual server lifecycles as part of an assembly.	video:Server lifecycle management related documentation: Starting and Stopping a Virtual Server
Modify the configuration of a server Learn how to change memory, CPU, network, or storage settings for a VM, and in what cases you need to shut down the VM for changes.	video:Modifying server configuration related documentation: Modifying the Server Configuration
Clone a server Learn how to clone an existing server. When a server is cloned, you create a copy which includes the installed software and guest OS. You can alter CPU, memory, and storage as needed, but you must change the host name and IP address of the clone.	video:Cloning a server
Create an IaaS server schedule policy Learn about creating a schedule policy for a target, and then associating that policy with one or more targets.	video:Create an IaaS server schedule policy related documentation: Defining a Schedule-Based Policy
Create an IaaS policy group	video:Create an IaaS policy group video related documentation: Creating a Policy Group

Task Description	Links
Learn about creating a policy group by combining multiple policies, and then associating that policy group with one or more targets.	
View chargeback information Learn how to view the resources used by a specific user, view charge rates for VMs, and see your chargeplan details.	video:View chargeback information related documentation: Viewing Chargeback Details
Learn about network profiles Discover the role of network profiles and how they are used to facilitate assembly deployments.	related documentation: Creating a Network Profile
Set Self Service Portal user preferences Learn how to customize your user preferences, such as configuring notifications, setting your default portal home page, and defining default values for server deployment.	video:Set self service portal user preferences
Stage files for the uploader user Learn how to upload a file to the on-board HTTP server, using SFTP as the uploader user. Oracle Private Cloud at Customer users can request configuration of an HTTP server on the Oracle Enterprise Manager host. This HTTP server is configured as a referenced file location in Oracle Enterprise Manager. Included in this configuration are the uploader user and an SFTP server.	video:Staging files for Oracle Enterprise Manager as the uploader user
Learn about the Kubernetes as a Service feature Learn background information about the Oracle Enterprise Manager features that support Kubernetes as a Service.	video: About Kubernetes as a Service
Create a Kubernetes cluster with one of the following network configurations: • **DHCP networked nodes** • **Static IP nodes** Learn how to create a Kubernetes cluster based on the network configuration of your environment.	videos: • Create a Kubernetes cluster with DHCP networked nodes • Create a Kubernetes cluster with static IP nodes
Start and stop a Kubernetes cluster Learn how to start and stop a Kubernetes cluster. **Caution!** – Stopping a Kubernetes cluster causes the cluster resources such as virtual machines,	video: Start and stop a Kubernetes cluster

Task Description	Links
virtual disks, and applications to be permanently deleted from the configuration.	
Create a node pool and scale up a Kubernetes cluster Learn how to create a node pool and scale up a Kubernetes cluster.	video:Create a Node Pool and Scale Up a Kubernetes Cluster for Oracle Private Cloud at Customer
Scale down a Kubernetes cluster and delete a node pool Learn how to scale down a Kubernetes cluster and delete a node pool.	video:Scale Down a Kubernetes Cluster and Delete a Node Pool for Oracle Private Cloud at Customer
Delete a Kubernetes cluster Learn how to delete a kubernetes cluster.	video: Delete a Kubernetes cluster