



A large red triangle graphic is positioned on the left side of the page, pointing towards the center. Inside this triangle, the text "Integrated Cloud Applications & Platform Services" is written in a white, sans-serif font. To the right of the triangle, there is a collage of three smaller images: a man in a plaid shirt looking at a laptop screen, a person in a blue shirt looking at a computer monitor, and a group of four people (three men and one woman) looking at a document together.

Integrated Cloud Applications & Platform Services

# Oracle Cloud Infrastructure Fundamentals

Student Guide

D100804GC10

Edition 1.0 | September 2017

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# Getting Started with Oracle Cloud Infrastructure

September 2017



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## Objectives

After completing this lesson, you should be able to:

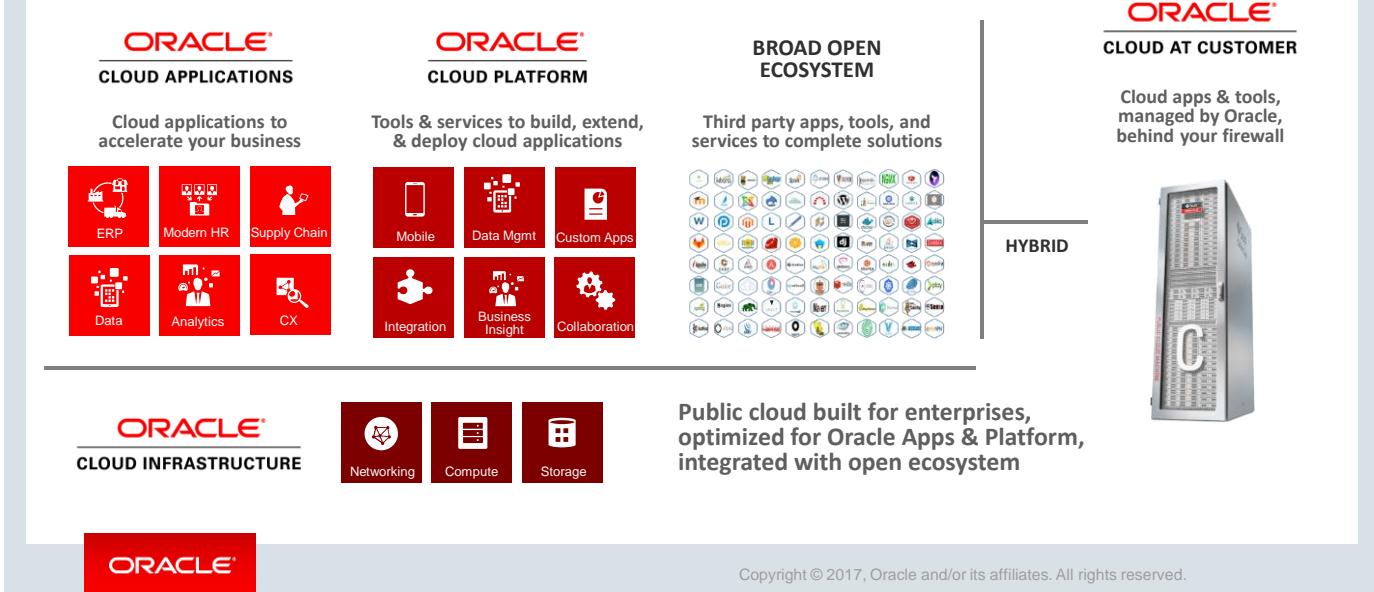
- Describe Oracle Cloud Infrastructure
- Explain typical use cases for Oracle Cloud Infrastructure



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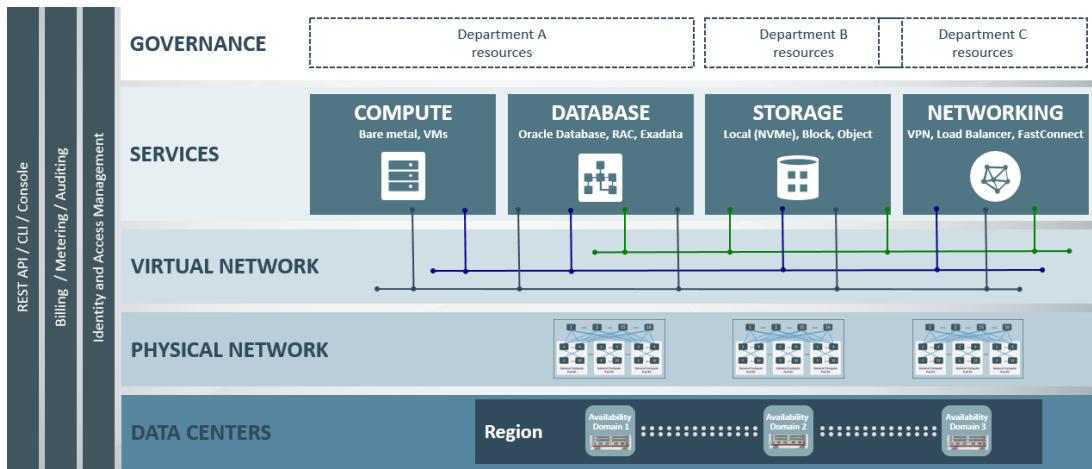
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# Oracle Cloud Infrastructure Strategy



Our strategy is to give customers the best cloud applications and platform, partner with a broad and open ecosystem, and run these technologies on the best infrastructure, either in the cloud or on-premises, or both.

# Oracle Cloud Infrastructure: Overview



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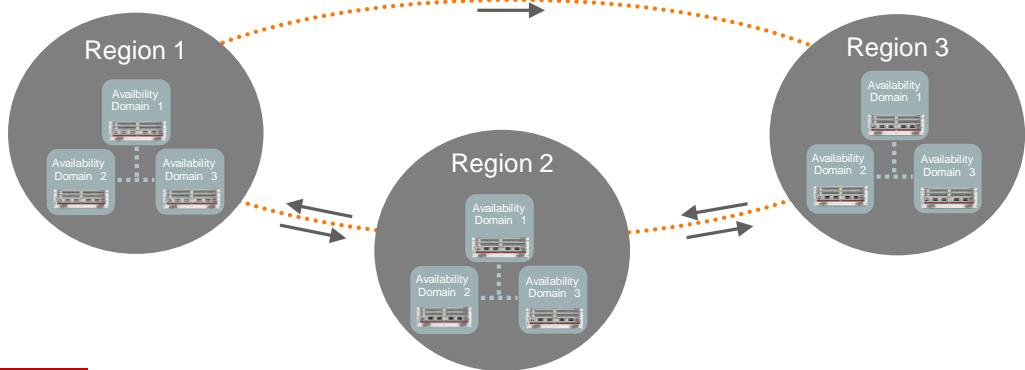
Oracle Cloud Infrastructure combines the elasticity and utility of public cloud with the granular control, security, and predictability of on-premises infrastructure to deliver high-performance and cost-effective infrastructure services.

Oracle Cloud Infrastructure is the first cloud platform to implement off-box network virtualization. The off-box network virtualization takes network and IO virtualization out of the software stack and puts it in the network. As a result, customers can provision truly elastic, self-service, pay-as-you-go physical, dedicated hosts with no hypervisor overhead, noisy neighbors or shared resources with a full software-defined layer 3 network topology.

In addition, the off-box network virtualization enables you to run bare metal hosts side-by-side with any class of systems – from Virtual Machines (VMs) to Engineered Systems such as Exadata, all using the same set of APIs. This implies that you can leverage Exadata hardware (such as InfiniBand) and software (such as smart scan, flash cache, columnar compression) features for your applications while leveraging the cloud-native security and governance capabilities of a layer 3 virtual cloud network.

## Regions and Availability Domains

- OCI is hosted in regions, which are located in different metropolitan areas
- Availability Domains (AD) are isolated from each other and are fault tolerant
- Multiple ADs can be used to ensure high availability and protect against resource failure
- Some resources are AD specific, such as an instance and the storage volume attached to it



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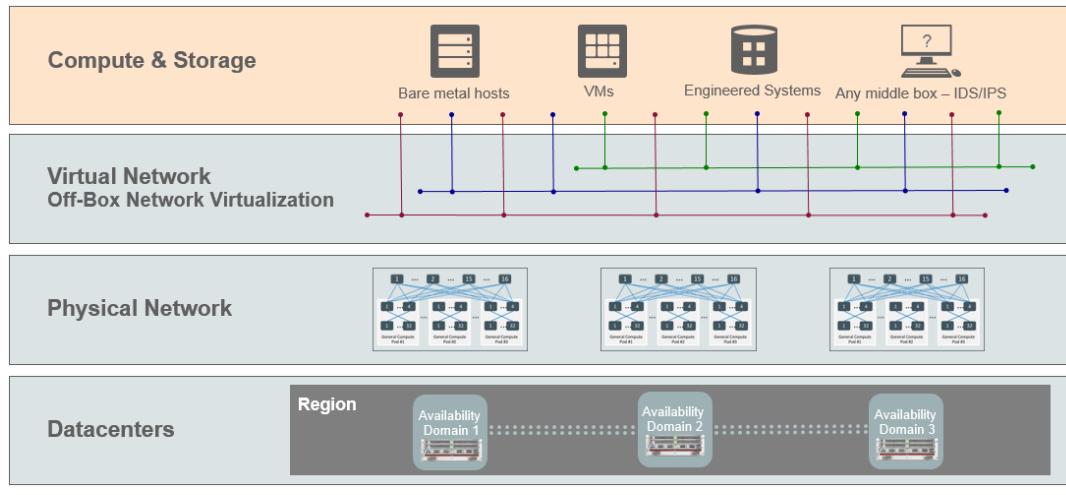
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Disaster recovery is a salient feature of cloud computing. In the case of Oracle Cloud Infrastructure, while the availability domains provide the facility for high availability, regions provide the basis for disaster recovery. Regions are completely independent of other regions and can be separated by vast distances—across countries or even continents. Generally, you would deploy an application in the region where it is most heavily used, since using nearby resources is faster than using distant resources. However, you can also deploy applications in different regions to:

- Mitigate the risk of region-wide events, such as large weather systems or earthquakes
- Meet varying requirements for legal jurisdictions, tax domains, and other business or social criteria

## Off-box Network Virtualization

Highly-configurable private overlay networks, move management and IO out of the hypervisor, and enable lower overhead and bare metal instances



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Generally the network virtualization is rendered by relying on the hypervisor [the hardware virtualization layer]. However, with Off-box Virtualization, the hypervisor layer is removed and network virtualization is run on the hardware directly. This increases network performance and more importantly gives a higher level of security by providing isolation. So that even if the hypervisor layer is breached, the attack remains localized to that single virtual network and does not permeate to other virtual networks.

## Key Differentiators

### Enterprise IaaS Architecture

- Industry's first Bare Metal Cloud Services w/ support for key enterprise apps
- Off-Box Network Virtualization (w/ support for plugging Exadata appliances)
- Robust Security and Governance capabilities
- Flexibility and control (Bare Metal and VMs share the same set of APIs)

### Industry Leading Price Performance

- Lower compute costs than AWS EC2 compute
- Fast, predictable block storage with no additional cost for IOPS; multiple X cheaper than AWS
- Bandwidth costs cheaper than AWS bandwidth by 85%
- Non-oversubscribed network, predictable performance with low latency and high throughput
- Industry leading 25 Gb/s network fabric (to be launched at OOW17)



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## Summary

In this lesson, you should have learned how to:

- Describe Oracle Cloud Infrastructure
- Explain typical use cases for Oracle Cloud Infrastructure



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# Identity and Access Management Service

September 2017



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## Objectives

After completing this lesson, you should be able to:

- Describe the concepts and terms used in IAM service
- Log in and navigate through the web console
- Configure users and groups
- Create compartments and Policies



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## Identity and Access Management Service

- Identity and Access Management Service (IAM) lets you control who has access to your cloud resources
- A Resource is a cloud object that you create and use in Oracle Cloud Infrastructure Service
  - Example: Compute instances, block storage volumes, Virtual Cloud Networks (VCNs), subnets, route tables, and so on are resources
- IAM concepts – Tenancy, Compartments, Users, Groups, Policies



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## IAM Service Resources - Tenants, Compartments

### Tenancy

- Equivalent of an account; tenancy contains all of your Bare Metal Cloud Services resources
- Provisioned with a single, top-level compartment called the *root compartment*; you can create other compartments

### Compartment

- Logical container used to organize and isolate cloud resources; each resource is in exactly one compartment
- Compartments are hierarchical; permissions in a parent compartment are inherited by child compartments (\*currently compartments are only one level deep)
- Compartments are global and logical; distinct from *physical containers* like Regions and Availability Domains
- Resources can be connected/shared across compartments



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# IAM Service Resources - Users, Groups

## Users

- Users can be created and given console passwords to use the web console and/or API signing keys to use the REST API and SDKs
- User must be placed in groups to be given access to cloud resources
  - A new user has no permissions until you place the user in one or more groups and there's at least one policy that gives that group permission to either the tenancy or a compartment
- Users can be members of multiple groups

## Groups

- Used to grant privileges to cloud resources
- A group has no permissions until you write at least one policy that gives that group permission to either the tenancy or a compartment

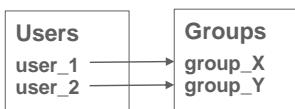


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# IAM Service

Service Limits

Tenancy



Compartment A



Object Storage      VCloud Network

Compartment B



BM      Block Storage      Load Balance

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## Policies

- Supports security principle of least privilege; by default, users are not allowed to perform any actions
- Policies are comprised of one or more statements which specify what groups can access what resources and what level of access users in that group have
- Policies are written in human-readable format:
  - Allow group <group\_name> to <verb> <resource-type> in tenancy <tenancy\_name>
  - Allow group <group\_name> to <verb> <resource-type> in compartment <compartment\_name> [where <conditions>]
  - Example: *Allow group ProjectA\_Admins to manage all-resources in compartment ProjectA\_compartment*

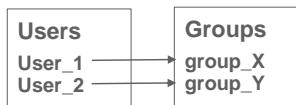


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## IAM Service

Service Limits

### Tenancy



### Policies

PolicyA: Allow group\_X to manage all-resources in compartmentA  
PolicyB: Allow group\_Y to manage all-resources in compartmentB

### CompartmentA



PolicyA

### CompartmentB



PolicyB

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## Policies

Allow group *<group\_name>* to *<verb> <resource-type>* in tenancy *<tenancy\_name>*



verb	Type of access	Aggregate resource-type	Individual resource type
inspect	Read only access without access to any user-specified metadata	all-resources	
read	Read only access, plus the ability to get user-specified metadata	database-family	db-systems, db-nodes, db-homes, databases
use	Update existing resources, but not create or delete	instance-family	instances, instance-images, volume-attachments, console-histories
manage	Includes all permissions for the resource	object-family	buckets, objects
		virtual-network-family	vcn, subnet, route-table, more
		volume-family	Volumes, volume-attachments, volume-backups

The IAM Service has no family resource-type, only individual ones; Audit and Load Balancer have individual resources (load-balancer, audit-events)



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## Policy Examples

### Aggregate Resource Types

allow group **Admins** to manage all-resources in tenancy

allow group **HRAadmins** to use all-resources in compartment **HR**

allow group **NetAuditors** to read virtual-network-family in tenancy

allow group **ServerAdmins** to inspect instance-family in tenancy

### Individual Resource Types

allow group **NetAuditors** to manage subnet in compartment **IT**

allow group **CompSec** to use console-histories in tenancy

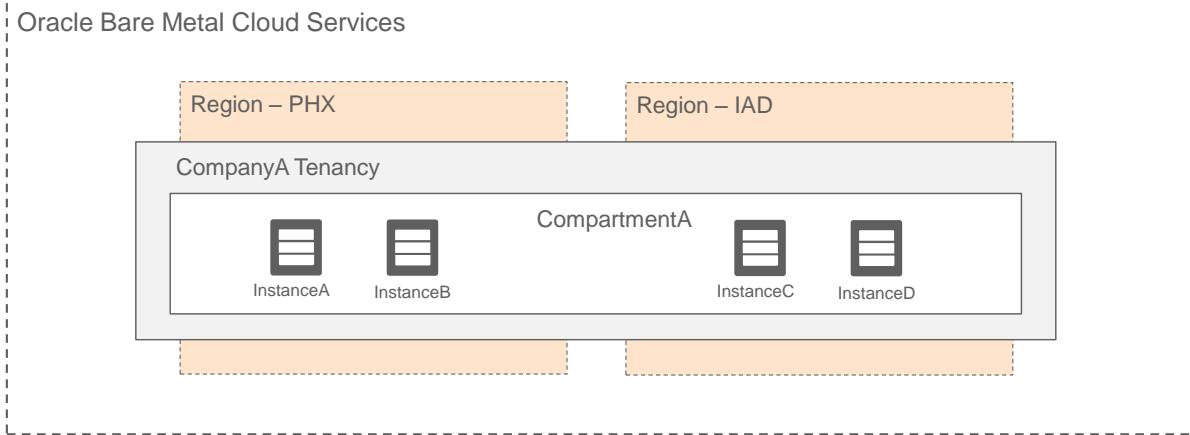
allow group **ServerAdmins** to read instances in compartment **IT**

allow group **VolumeBackupAdmins** to inspect volumes in tenancy



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## IAM Service resources are global



IAM Service resources (compartments, users, groups, and policies) are global, so you can access them across all regions



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## Resource Locations

Service	Resource	Location	
IAM	Users, Groups, Policies, Compartments, API Signing Keys	Global	
Compute	Images	Regional	
	Instances	Availability Domain	Instances can be attached only to volumes in the same AD
	Volumes	Availability Domain	
	Volume backup	Region	Backups can be restored as new volumes to any AD within the same region
Database	DB Systems	Availability Domain	
Network	Virtual Cloud Network (VCN)	Region	
	Subnet	Availability Domain	
	Security Lists, Route Table	Region	
	Dynamic Routing Gateway (DRG)	Region	
	Customer Premises Equipment (CPE), Internet Gateway	Region	



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## Resource Locations

Service	Resource	Location	
Load Balancer	Load Balancer	Region	
Storage	Buckets	Region	Bucket is a regional resource but it can be accessed from any location as long as correct region-specific URL is used



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## Signing Up for Oracle Cloud Infrastructure Services

You can sign up for Oracle Cloud Infrastructure Services in the following ways:

- Contact your Oracle sales representative
- Visit Oracle Store, <https://shop.oracle.com> and sign up for the Oracle Cloud Infrastructure Services
- Sign up for a free trial at <http://cloud.oracle.com/tryit>



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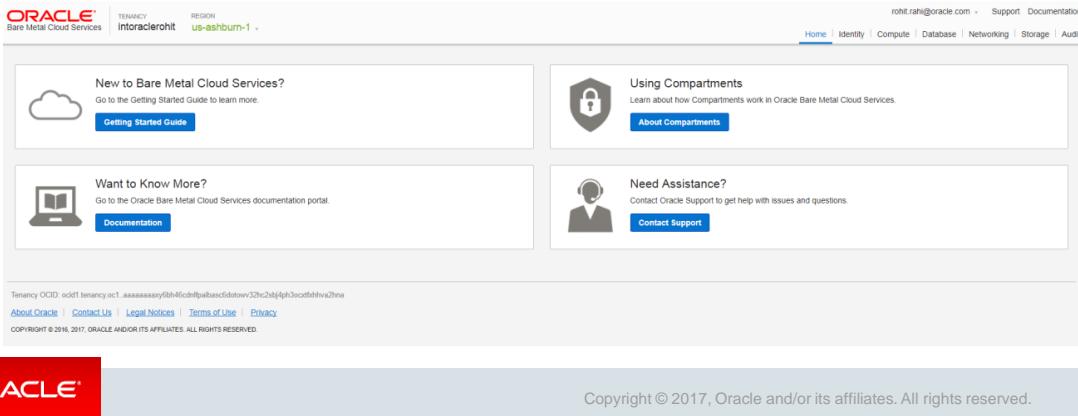
You can sign up for Oracle Cloud Infrastructure Services in the following ways:

- Contact your Oracle sales representative: Your Oracle sales representative can provide you information about the pricing options available to your company. Your sales representative will collect some information from you and initiate the registration process.
- Go to the Oracle Store: Visit <https://shop.oracle.com/> and sign up for the Oracle Cloud Infrastructure Services.
- Sign up for a free trial at <http://cloud.oracle.com/tryit>

When your registration process is completed, you will be provisioned a “Tenancy” in Oracle Cloud Infrastructure Services. Oracle will send you a notification email with instructions to sign in to the web console for the first time. There is no charge until you start using the service.

## Signing In to the Console

- Region based URL for the web-based console (for example: Ashburn region):  
<https://console.us-ashburn-1.oraclecloud.com>
- Use the console to access and manage your Oracle Cloud Infrastructure services
- The services you can use depend on: Service Limits set for your tenancy, permissions granted by administrator



Console is the web-based user interface that you use to access and manage Oracle Cloud Infrastructure Services.

- The supported browsers include the latest versions of Google Chrome, Firefox, Microsoft Edge, and Internet Explorer 11.
- When you sign in to the web console, you'll see the home page.
- Use the service tabs in the upper right to create, manage, and view your cloud resources.
- Links to the documentation and to Oracle Support give you quick access to help and detailed information for using the services.

## Resource Identifier

- Oracle Cloud Identifier (OCID) - Oracle-assigned unique ID to every resource
- `ocid1.<RESOURCE TYPE>.<REALM>.[REGION][.FUTURE USE].<UNIQUE ID>`
  - `ocid1`: literal string indicating the version of the OCID
  - Resource type: type of the resource (vcn, instance...)
  - Realm: currently `oc1`, realm is the set of regions that share entities
  - Future use: reserved for future use
  - Unique ID: unique portion of the ID
- Examples
  - tenancy:  
`ocid1.tenancy.oc1..aaaaaaaaaxy6bh46cdnlfpaibasc6dotowv32hc2sbj4ph3ocxtfxhhva2hna`
  - instance:  
`ocid1.instance.oc1.iad.abuwcljtwfk7f5e2o3q6ircgpdt6rg52itdyg72tgdtbiwqlujt7vm5h3da`



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## Resource Identifier – tenancy OCID

The screenshot shows the Oracle Bare Metal Cloud Services homepage. At the top, it displays the Oracle logo, tenant information ('TENANT: intoracelerohit'), and region ('REGION: us-ashburn-1'). The navigation bar includes links for Home, Identity, Compute, Database, Networking, Storage, and Audit, with 'rohit.rahi@oracle.com' and 'Support Documentation' also present. The main content area is divided into four sections: 'New to Bare Metal Cloud Services?' (with a 'Getting Started Guide' button), 'Using Compartments' (with an 'About Compartments' button), 'Want to Know More?' (with a 'Documentation' button), and 'Need Assistance?' (with a 'Contact Support' button). A callout arrow points from the bottom-left corner of the 'Want to Know More?' section to the URL in the browser's address bar, which is highlighted with a red box and labeled 'Tenancy OCID'. The URL is: `Tenancy OCID: oc1:tenancy:oc1:aaaaaaaaaxy9bh46cohlfjpalbascl6dat0nv32hc2u8j4pA3soctffhva2lna`. The footer contains links for About Oracle, Contact Us, Legal Notices, Terms of Use, and Privacy, along with a copyright notice: 'COPYRIGHT © 2016, 2017, ORACLE AND/OR ITS AFFILIATES. ALL RIGHTS RESERVED.'



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## Resource Identifier – instance OCID

The screenshot shows the Oracle Cloud Infrastructure Compute Instances page. At the top, there is a navigation bar with back, forward, and search icons, followed by a secure connection indicator and the URL <https://console.us-phoenix-1.oraclecloud.com/#/a/compute/instances/ocid1.instance.oc1.iad.abuwcljtwfk7f5e2o3q6ircgpdt6rg52itdyg72gdtbiwqluj7vm5h3da>. Below the URL, the Oracle Bare Metal Cloud Services logo is displayed, along with the tenant name "intoraclerohit" and the region "us-ashburn-1". A "Home" link is also present.

The main content area shows a green thumbnail image of the instance, labeled "BM" and "RUNNING". To the right of the thumbnail are several action buttons: "Create Custom Image", "Start", "Stop", "Reboot", and "Terminate".

**Instance Information** section:

- Availability Domain: dKYS:US-ASHBURN-AD-1
- OCID:** `ocid1.instance.oc1.iad.abuwcljtwfk7f5e2o3q6ircgpdt6rg52itdyg72gdtbiwqluj7vm5h3da` (highlighted with a red border)
- Launched: Fri, 07 Jul 2017 21:12:16 GMT
- Compartment: intoraclerohit

**Primary VNIC Information** section:

- Image: [Oracle-Linux-7.3-2017.05.23.0](#)
- Region: iad
- Shape: BM.Standard1.36
- Virtual Cloud Network: [VCN-Ashburn](#)

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# Security Credentials

Access to different interfaces requires appropriate credentials

- Console Password
  - You use the password to sign in to the web console.
  - An administrator will provide you with a one-time password when setting up your account.
  - At your first log in, you are prompted to reset the password.
- API Signing Key
  - The API Signing Key is required when using the API in conjunction with the SDK.
  - The key is an RSA key pair in the PEM format (minimum 2048 bits required).
  - In the interfaces, you can copy and paste the PEM public key.

Add Public Key [help](#) [cancel](#)

Note: Public Keys must be in the PEM format.

PUBLIC KEY

```
-----BEGIN RSA PUBLIC KEY-----
MIIBCAgKCAQEAxTvsd/1rZiz:/w0z7flm3g+xnvdxDTvG6oPw4f4D60d4q8YVlQy
K/nmmFL63tXk7n5Jqvz96rL4jra11Tm8DvxBuyJr+c5z4Kic6o/ridHMYLuza
zsHxXpgjxVBQcC/ahsVPj1dvAqvbkeLXDp9AeJHcg+AK51Cm1v5Hlg/6Phbj1H
Z9IKpxTd6Qk0n2HFrhT8cozqu95KkTvGh16E19ADCoYz95SXv8enkVs6Sknhj
Kmda1mo3xy5GccjpAjBjgJASx+nLjG0vNmDjTHfoAgw560lhtAXLJ9Ud670ff
jEvn/JEqQcinf0dsFU6aeNR119G4E5uQIDAOQAB
-----END RSA PUBLIC KEY-----
```

**Add**



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## Console Password:

- Sign in to the web console the first time with the one-time password, and change the password, when prompted. Password requirements are shown in the console.
- The one-time password expires in 7 days. You can change the password later.
- Also, you or an administrator can reset the password using the console or the API. Resetting the password creates a new one-time password that you'll be prompted to change the next time you sign in to the console. If you're blocked from signing in to the console because you've tried 10 times in a row unsuccessfully, contact your administrator.

## API Signing Key:

- After you've uploaded your first API key in the console, you can use the API to upload any additional ones you want to use. If you provide the wrong kind of key (for example, your instance SSH key, or a key that isn't at least 2048 bits), you'll get an InvalidKey error.

You can upload your PEM public key in the Console:

- Open the Console, and sign in.
- Click your username in the top-right corner of the Console, and then click User Settings.
  - If you're an administrator doing this for another user, instead click Identity, click Users, and then select the user from the list.
- Click Add Public Key. Paste the contents of the PEM public key in the dialog box and click Add.

## Summary

In this lesson, you should have learned how to:

- Describe the concepts and terms used in IAM service
- Log in and navigate through the web console
- Configure users and groups
- Create compartments and Policies



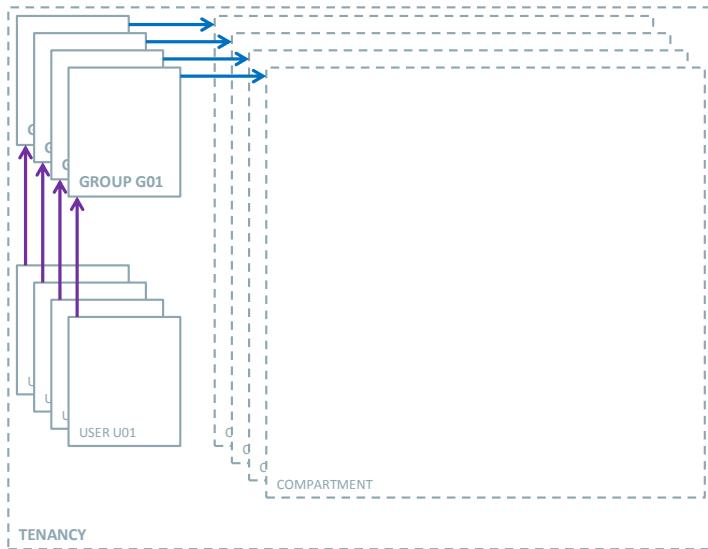
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## Practice 2: User, Group, and Policy Management

In this practice, each participant:

- Explores the Oracle Cloud Infrastructure environment
- Sets up users and groups
- Sets up security policy and rules



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This is the first practice session. In this session, you explore the Oracle Cloud Infrastructure environment that you have been provided. You will also set up users, group, and security policy rules that you will use to build your highly available WordPress environment.

All participants share one tenancy. Each participant will work in their own compartment to create and configure resources to set up the application in a highly available configuration.



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# Virtual Cloud Network Service

September 2017



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## Objectives

After completing this lesson, you should be able to:

- Describe key Virtual Cloud Network (VCN) concepts
- Manage your cloud network components, such as:
  - Route Table
  - Security List
  - Internet Gateway
  - Dynamic Routing Gateway
- Evaluate the different options of connecting to the Internet



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## Virtual Cloud Network (VCN)

- A Virtual Cloud Network is a virtual version of a traditional network—including subnets, route tables, and gateways—on which your instances run. A cloud network resides within a single region but can cross multiple Availability Domains.
- A VCN covers a single, contiguous IPv4 CIDR block of your choice.
- Recommend using one of the private IP address ranges in [RFC 1918](#) (10.0.0.0/8, 172.16/12, and 192.168/16). However, you can use a publicly-routable range.
- Allowable VCN size range: /16 to /30.
- VCN reserves the first two IP addresses and the last one in each subnet's CIDR



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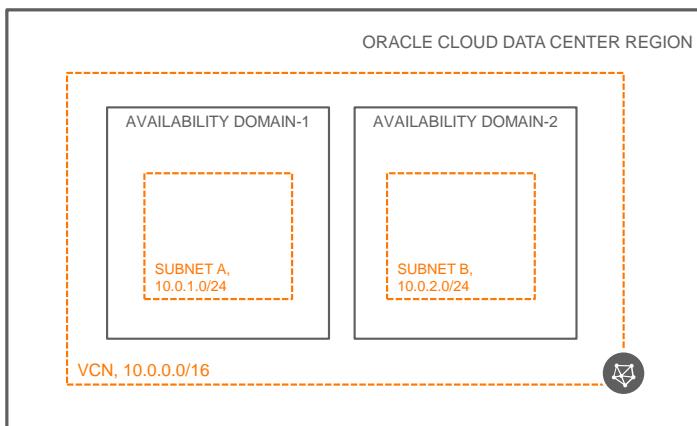
## Basic Networking

- CIDR notation: an IP address and its associated routing prefix
- 0.0.0.0/0 = entire IPv4 range (whole Internet)
- x.x.0.0/16 = class B network (65,536 IP addresses)
- 10.0.0.0/16 = 65,536 IP addresses (10.0.1.0 – 10.1.255.255)
- IP address 192.168.0.15 w/ netmask 255.255.255.0 in CIDR notation = 192.168.0.15/24 (the first 24 bits of the IP address given are considered significant for the network routing)
- RFC 1918 IP Blocks – Private IP address blocks
  - 10.0.0.0 - 10.255.255.255
  - 172.16.0.0 - 172.31.255.255
  - 192.168.0.0 - 192.168.255.255



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## Subnet



A VCN resides within a single region, but can cross multiple Availability Domains (AD).

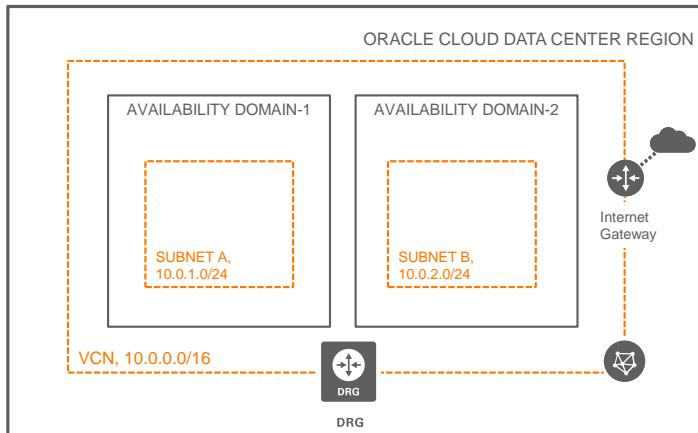
**Subnet:** each VCN network is subdivided into subnets, and each subnet is contained within a single Availability Domain.

- You can have more than one subnet in an AD for a given VCN.
- Each subnet has a contiguous range of IPs, described in CIDR notation. Subnet IP ranges may not overlap.
- Subnets can be designated as either Public or Private.
- Instances draw their internal IP address and network configuration from their subnet.



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## IGW, DRG

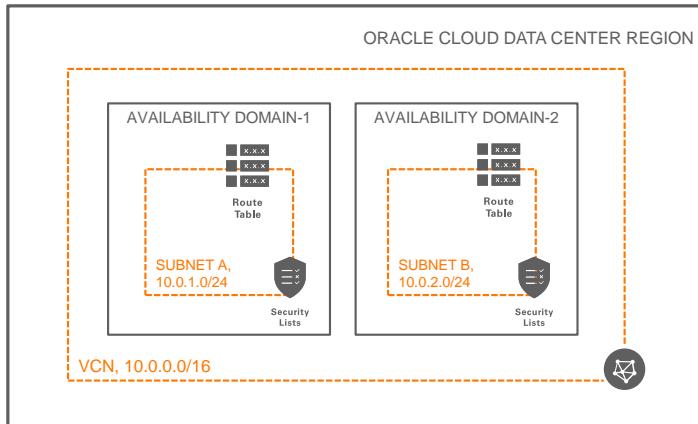


**Internet Gateway:** Internet Gateway provides a path for network traffic between your VCN and the internet.

**Dynamic Routing Gateway (DRG):** A virtual router that provides a single point of entry for remote network paths coming into your VCN. You can use it to establish a connection with your on-premises network through IPSec VPN or FastConnect.

After creating an IGW or attaching a DRG, you must add a route for the IGW/DRG in the VCN's route table to enable traffic flow.

## Security Lists, Route Table

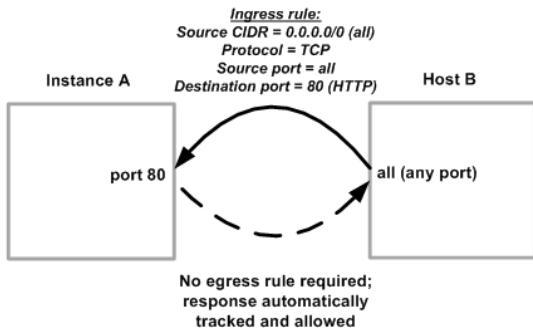


**Security List:** A common set of firewall rules associated with a subnet and applied to all instances launched inside the subnet.

- Security lists provide ingress and egress rules that specify the types of traffic allowed in and out of the instances.
- You can choose whether a given rule is stateful or stateless.

**Route Table:** A set of route rules that provide mapping for the traffic from subnets through gateways to destinations outside the VCN.

## Stateful Security Lists

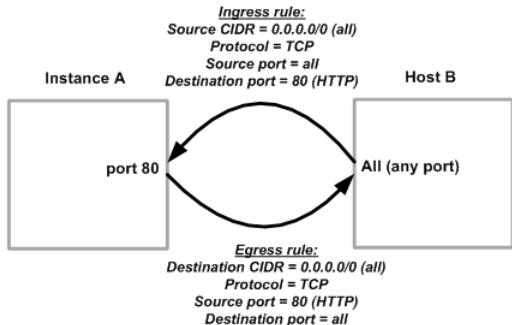


- Connection Tracking: when an instance receives traffic matching the stateful ingress rule, the response is tracked and automatically allowed regardless of any egress rules.
- Similarly for sending traffic from the host.
- Default Security Lists are stateful.

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## Stateless Security Lists



- With stateless rules, response traffic is not automatically allowed.
- To allow the response traffic for a stateless ingress rule, you must create a corresponding stateless egress rule.
- If you add a stateless rule to a security list, that indicates that you do NOT want to use connection tracking for any traffic that matches that rule.
- Stateless rules are better for scenarios with large numbers of connections.

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## Default Security List

- Allows TCP traffic on destination port 22
- Allows ICMP traffic type 3 code 4 from source 0.0.0.0/0 and any source port
- Allows ICMP traffic type 3 (all codes) from your VCN's CIDR
- Makes it possible to do Path MTU Discovery if you're using jumbo frames
- Allows all outgoing traffic
- Rule Modification:
  - An addition of security rule in the default security list
  - The new rule allows HTTP traffic on port 80.

The screenshot shows the Oracle Cloud Network Details > Security Lists > Security List Details page for a security list named "Default Security List for FunVCN".  
In the "Ingress Rules" section, there are no rules listed.  
In the "Stateless Rules" section, there are no rules listed.  
In the "Stateful Rules" section, there are four rules listed:

- Source: 0.0.0.0 IP Protocol: TCP Source Port Range: All Destination Port Range: 22 Allows: TCP traffic for ports: 22 SSH Remote Login Protocol
- Source: 0.0.0.0 IP Protocol: ICMP Type and Code: 3, 4 Allows: ICMP traffic for: 3, 4 Destination Unreachable: Fragmentation Needed and Don't Fragment was Set
- Source: 10.0.0.0/16 IP Protocol: ICMP Type and Code: 3 Allows: ICMP traffic for: 3 Destination Unreachable
- Source: 0.0.0.0 IP Protocol: TCP Source Port Range: All Destination Port Range: 80 Allows: TCP traffic for ports: 80 HTTP

The last rule (TCP port 80) is highlighted with a red border.

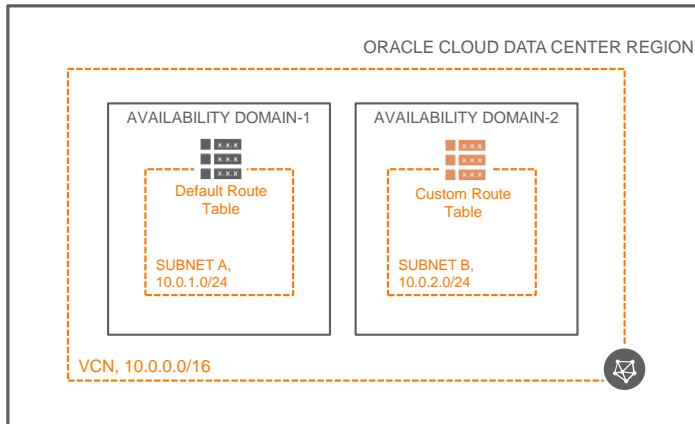
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Here are some characteristics of the default security list:

- **Stateful ingress:** Allow TCP traffic on destination port 22 (SSH) from source 0.0.0.0/0 and any source port. This rule makes it easy for you to create a new cloud network and public subnet, launch a Linux instance, and then immediately connect through SSH to that instance without needing to write any security list rules yourself.
  - The default security list does not include a rule to allow Remote Desktop Protocol (RDP) access. If you're using Windows images, make sure to add a stateful ingress rule for TCP traffic on destination port 3389 from source 0.0.0.0/0 and any source port.
- **Stateful ingress:** Allow ICMP traffic type 3 code 4 from source 0.0.0.0/0 and any source port. This rule makes it easy to receive Path MTU Discovery fragmentation messages if you're using jumbo frames.
- **Stateful ingress:** Allow ICMP traffic type 3 (all codes) from your VCN's CIDR [Classless Inter-Domain Routing] IPs and any source port. This rule makes it easy for your instances to receive connectivity error messages from other instances within the VCN.
- **Stateful egress:** No rules defined to allow all traffic. This allows instances to initiate traffic of any kind to any destination. Notice that this means the instances can talk to any Internet IP address if the cloud network has an Internet Gateway. And because stateful security rules use connection tracking, the response traffic is automatically allowed regardless of any ingress rules.

## Default VCN components

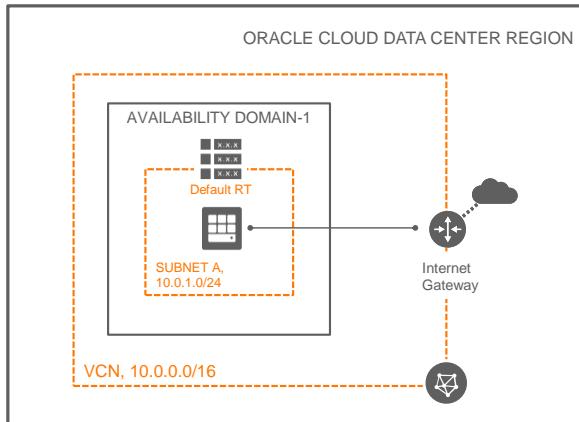


Your VCN automatically comes with some default components

- Default route table
- Default security list
- Default set of DHCP options

You can't delete these default components; however, you can change their contents (for example: individual route rules). And you can create more of each kind of component in your cloud network (for example: additional route tables).

## Public Subnet

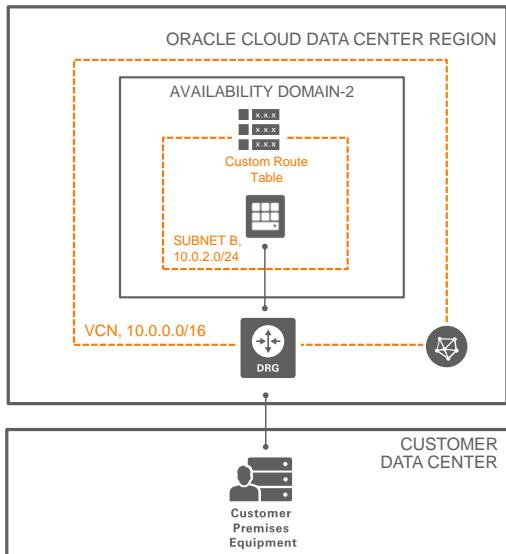


- Create a VCN, provide a CIDR range
- Create an Internet Gateway
- Create a Route Rule with traffic to Internet Gateway (for all IP addresses, 0.0.0.0/0)
- Create Security List rules that allow the traffic (and each instance's firewall must allow the traffic)
- Create a Public Subnet within a specific AD with the Route Table and Security List
- Create an instance with a public IP address within the Subnet

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## Private Subnet with a VPN

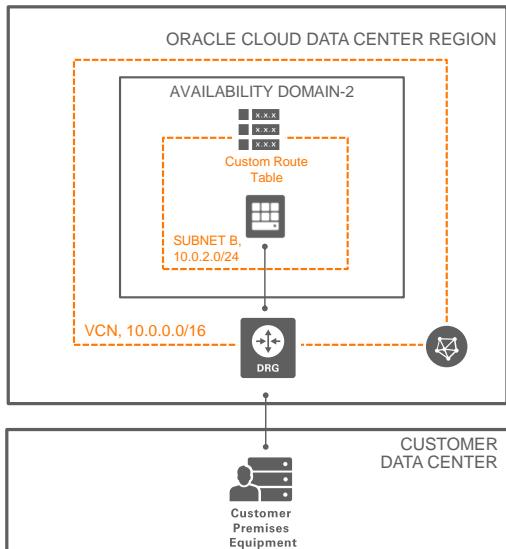


- Create a VCN, provide a CIDR range
- Create a Dynamic Routing Gateway (DRG); attach it to the VCN
- Create a new Route Table so its default route is directed toward DRG and thus to the VPN
- Create a Route Rule with traffic to DRG - add a CIDR block of 0.0.0.0/0 (all non-intra-VCN traffic that is not already covered by other rules in the route table will go to the DRG)
- Create Security List rules that allow the traffic (for example: port 1521 for Oracle databases)
- Create a Private Subnet within a specific AD with the Route Table and Security List

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## Private Subnet with a VPN



- Create an IPSec connection for VPN
- Data center admin must configure the on-premises router before network traffic can flow between your on-premises network and VCN
- At your end of the IPSec VPN is the actual router in your on-premises network (hardware or software). A virtual representation of the router in Bare Metal Cloud Services is referred to as Customer-Premises Equipment (CPE)

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## DNS Choice

- The Domain Name System (DNS) enables lookup of other computers using host names.
- You choose the DNS for each subnet in the cloud network.
  - **Default Choice:** Internet and VCN Resolver. This is an Oracle-provided option that includes two parts:
    - **Internet Resolver:** Lets instances use host names that are publicly published on the Internet. The instances do not need to have Internet access by way of either an IGW or an IPSec VPN DRG.
    - **VCN Resolver:** Lets instances use host names (which you can assign) to communicate with other instances in the VCN.
  - **Custom Resolver:** Use your own DNS servers. These could be Internet IP addresses for DNS servers in your VCN, or DNS servers in your on-premises network, which is connected to your VCN by way of an IPSec VPN connection.

Instance FQDN: <hostname>.<subnet DNS label>.<VCN DNS label>.oraclevcn.com  
(you can specify VCN, Subnet and hostname DNS labels)



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If you choose to use the default option of DNS, that is, Internet and VCN Resolver with DNS Hostnames Across the VCN, then all instances in the VCN can communicate with each other without knowing their IP addresses. Make sure to assign a DNS label to the VCN and every subnet. Then make sure to assign every instance a host name (or at least a display name) at launch. The instances can then communicate with each other using FQDNs instead of IP addresses. If you also set the Search Domain DHCP option to the VCN domain name, the instances can then communicate with each other using just <hostname>.<subnet DNS label> instead of the FQDN.

If you use Custom DNS Servers to Resolve DNS Hostnames, then you can set up an instance to be a custom DNS server within your VCN and configure that instance to resolve the hostnames for your instances. You must configure the servers to use 169.254.169.254 as the forwarder for the VCN domain.

## DHCP Configuration

- The VCN comes with the default DHCP options.
- You can also create your own DHCP options and the initial value.
- The DHCP options are applied at the subnet level.
- You can't change which set of DHCP options is associated with a subnet after the subnet is created.
- Do not disable Network Manager unless you use another method to ensure renewal of the lease.

The screenshot shows the 'Create DHCP Options' dialog box. It has fields for 'CREATE IN COMPARTMENT' (BMFun), 'NAME' (MyDHCP), and 'DNS TYPE' (INTERNET AND VCN RESOLVER selected). A note says 'Instances can resolve host names within the VCN and internet host names. No Internet Gateway is required.' There's a 'SEARCH DOMAIN' field with 'example.com' and a 'Create DHCP Options' button at the bottom.

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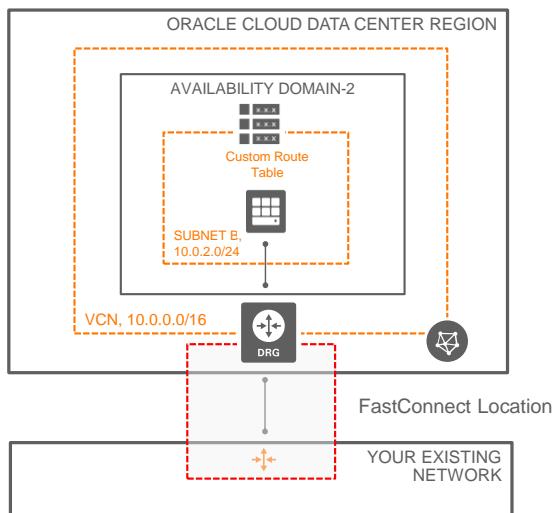
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Your cloud network uses DHCP options to automatically provide configuration information to the instances when they boot up. Each cloud network comes with a default set of DHCP options with an initial value that you can change. If you don't specify otherwise, every subnet will use the VCN's default set of DHCP options.

You can't change which set of DHCP options is associated with a subnet after the subnet is created. If you don't want to use the default set, make sure to create your desired set of DHCP options before creating the subnet. However, remember that you can also change the values for the options. Whenever you change the value of one of the DHCP options, you need to either restart the DHCP client on the instance, or reboot the instance, for the change to take effect on existing instances in the subnets associated with that set of DHCP options.

Be sure to keep the DHCP client running so you can always access the instance. If you stop the DHCP client manually or disable Network Manager, the instance can't renew its DHCP lease and will become inaccessible when the lease expires (typically within 24 hours). Do not disable Network Manager unless you use another method to ensure renewal of the lease. Stopping the DHCP client might remove the host route table when the lease expires. Also, loss of network connectivity to your iSCSI connections might result in loss of the boot drive.

## FastConnect

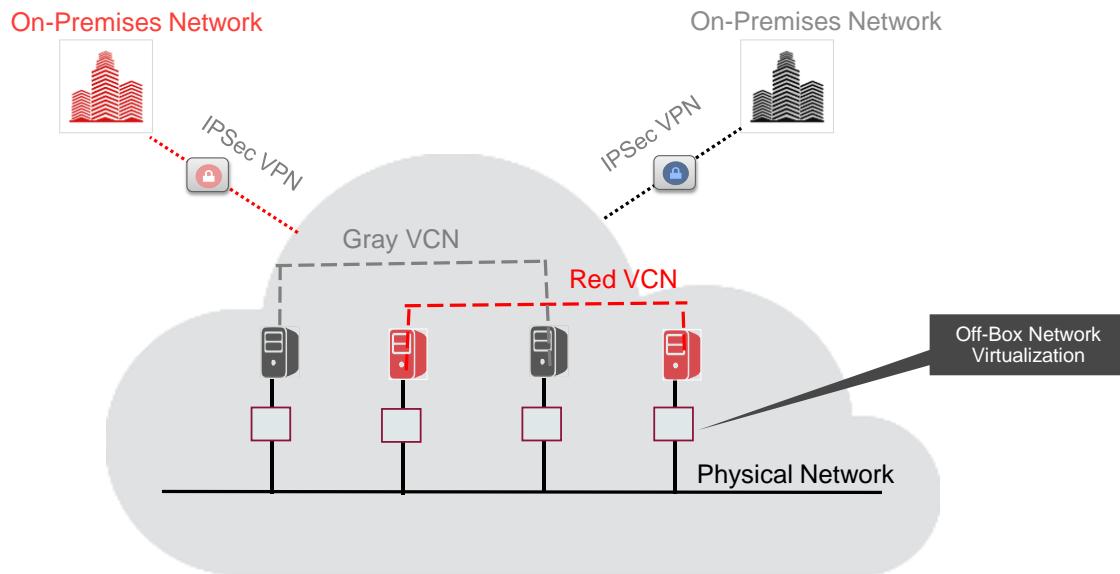


The general concept of a connection between your existing network and your VCN over a private physical network instead of the internet.

With FastConnect, you can establish a connection in one of these ways:

- Colocation: By co-locating with Oracle in a FastConnect location
- Provider: By connecting to a FastConnect provider

## Off-box Network Virtualization



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We use 'Off Box Network Virtualization'. Note that the virtualization layer is well isolated from the Bare-Metal nodes and as a result, it is much harder for a bad actor to compromise the virtualization layer.

## Bandwidth and Latency between BM instances

```
[opc@iperf-client ~]$ sudo iperf3 -c 10.0.0.5
Connecting to host 10.0.0.5, port 5201
[ 4] local 10.0.2.3 port 45988 connected to 10.0.0.5 port 5201
[ ID] Interval      Transfer     Bandwidth     Retr Cwnd
[ 4]  0.00-1.00  sec  1.13 GBytes   9.67 Gbits/sec  25  2.54 MBytes
[ 4]  1.00-2.00  sec  1.15 GBytes   9.87 Gbits/sec  0   3.02 MBytes
[ 4]  2.00-3.00  sec  1.15 GBytes   9.86 Gbits/sec  66  3.02 MBytes
[ 4]  3.00-4.00  sec  1.15 GBytes   9.86 Gbits/sec  6   2.12 MBytes
[ 4]  4.00-5.00  sec  1.15 GBytes   9.87 Gbits/sec  3   3.02 MBytes
[ 4]  5.00-6.00  sec  1.15 GBytes   9.87 Gbits/sec  0   3.02 MBytes
[ 4]  6.00-7.00  sec  1.15 GBytes   9.87 Gbits/sec  0   3.02 MBytes
[ 4]  7.00-8.00  sec  1.15 GBytes   9.87 Gbits/sec  0   3.02 MBytes
[ 4]  8.00-9.00  sec  1.15 GBytes   9.86 Gbits/sec  0   3.02 MBytes
[ 4]  9.00-10.00 sec  1.15 GBytes   9.87 Gbits/sec  0   3.02 MBytes
-----
[ ID] Interval      Transfer     Bandwidth     Retr
[ 4]  0.00-10.00 sec 11.5 GBytes  9.85 Gbits/sec 100
[ 4]  0.00-10.00 sec 11.5 GBytes  9.84 Gbits/sec
```

```
[opc@iperf-client ~]$ sudo iperf3 -c 129.213.56.64
Connecting to host 129.213.56.64, port 5201
[ 4] local 10.0.2.3 port 34528 connected to 129.213.56.64 port 5201
[ ID] Interval      Transfer     Bandwidth     Retr Cwnd
[ 4]  0.00-1.00  sec  666 MBytes  5.59 Gbits/sec 428  1.43 MBytes
[ 4]  1.00-2.00  sec  462 MBytes  3.88 Gbits/sec 556  1.32 MBytes
[ 4]  2.00-3.00  sec  462 MBytes  3.88 Gbits/sec 550  1.22 MBytes
[ 4]  3.00-4.00  sec  461 MBytes  3.87 Gbits/sec 499  1.25 MBytes
[ 4]  4.00-5.00  sec  462 MBytes  3.88 Gbits/sec 509  1.24 MBytes
[ 4]  5.00-6.00  sec  476 MBytes  3.99 Gbits/sec 512  446 KBytes
[ 4]  6.00-7.00  sec  491 MBytes  4.12 Gbits/sec 600  428 KBytes
[ 4]  7.00-8.00  sec  486 MBytes  4.08 Gbits/sec 565  376 KBytes
[ 4]  8.00-9.00  sec  480 MBytes  4.03 Gbits/sec 522  376 KBytes
[ 4]  9.00-10.00 sec 482 MBytes  4.05 Gbits/sec 590  227 KBytes
-----
[ ID] Interval      Transfer     Bandwidth     Retr
[ 4]  0.00-10.00 sec 4.82 GBytes 4.14 Gbits/sec 5331
[ 4]  0.00-10.00 sec 4.81 GBytes 4.13 Gbits/sec
```



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## Summary

In this lesson, you should have learned how to:

- Describe key Virtual Cloud Network (VCN) concepts
- Manage your cloud network components, such as:
  - Route Table
  - Security List
  - Internet Gateway
  - Dynamic Routing Gateway
- Evaluate the different options of connecting to the Internet



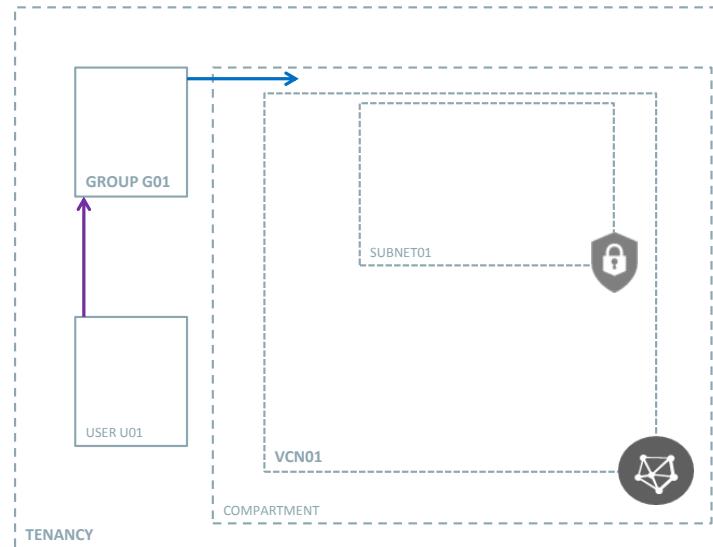
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## Practice 3: Network Management

In this practice, each participant uses their assigned compartment and:

- Creates a virtual cloud network (VCN)
- Creates a subnet within the VCN



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4

# Compute Service

September 2017



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## Objectives

After completing this lesson, you should be able to:

- Describe Compute Service
- Describe images, shapes, local storage
- Create and launch a compute instance
- Set up the credentials necessary for accessing the compute resource
- Add block volume to a compute instance



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## Compute: Bare Metal & Virtual Machines

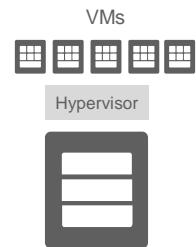
### Bare Metal (BM)

No hypervisor involved – customers get the full bare metal server with 36 cores (single-tenant model)



### Virtual Machine (VM)

A hypervisor to virtualize the underlying bare metal server into smaller VMs (multi-tenant model)



VM compute instances runs on the same hardware as a Bare Metal instances, leveraging the same cloud-optimized hardware, firmware, software stack, and networking infrastructure



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Latency: Same Random and Sequential: ~90 µsec Read, ~20 µsec Write

## Shape: Processor and Memory Resources

- Oracle Compute Cloud Service enables you to select from a range of predefined shapes that determine the number of CPUs available in an instance and the amount of RAM available in an instance.
- Several predefined shapes are available for both bare metal and virtual machine instances.



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While creating Compute instances, you can assign CPU and memory resources by selecting from a wide range of resource profiles (called shapes), each of which is a carefully designed combination of processor and memory limits.

## Available Shapes

Shape	Instance type	OCPUs	RAM (GB)	Local Disk (TB)
BM.Standard1.36	Standard compute capacity	36	256	Block Storage only
BM.HighIO1.36	High I/O compute capacity	36	512	12.8 TB NVMe SSD
BM.DenseIO1.36	Dense I/O compute capacity	36	512	28.8 TB NVMe SSD
VM.Standard1.1	Standard	1	7	Block Storage only
VM.Standard1.2	Standard	2	14	Block Storage only
VM.Standard1.4	Standard	4	28	Block Storage only
VM.Standard1.8	Standard	8	56	Block Storage only
VM.Standard1.16	Standard	16	112	Block Storage only
VM.DenseIO1.4	Dense I/O compute capacity	4	60	3.2 TB NVMe SSD
VM.DenseIO1.8	Dense I/O compute capacity	8	120	6.4 TB NVMe SSD
VM.DenseIO1.16	Dense I/O compute capacity	16	240	12.8 TB NVMe SSD



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In the case of standard VM instances, NVMe storage is not available. For all the shapes, Block Volume storage is offered.

The *Dense I/O* instances are configured with 28.8 TB of local NVMe storage and are ideal for extreme transactional workloads that work on large datasets and require low latency and high throughput, such as Big Data and High Performance Compute (HPC) applications.

## NVMe SSD Devices

- Locally attached SSDs are not protected
- Bare Metal Cloud Service provides no RAID, snapshots, backups capabilities for these devices
- Customers are responsible for the durability of data on the local SSDs

Instance type	NVMe SSD Devices
BM.HighIO1.512	4 drives = 12.8TB raw
BM.DenseIO1.512	9 drives = 28.8TB raw
VM.DenseIO1.4	1 drive = 3.2 TB raw
VM.DenseIO1.8	2 drives = 6.4 TB raw
VM.DenseIO1.16	4 drives = 12.8 TB raw

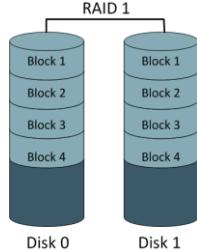
```
ubuntu@nvme:~$ lsblk
NAME   MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda     8:0    0 46.6G  0 disk
└─sda1  8:1    0 46.5G  0 part /
└─sda14 8:14   0   4M  0 part
└─sda15 8:15   0 106M  0 part /boot/efi
nvme0n1 259:4  0 2.9T  0 disk
nvme1n1 259:5  0 2.9T  0 disk
nvme2n1 259:3  0 2.9T  0 disk
nvme3n1 259:6  0 2.9T  0 disk
nvme4n1 259:7  0 2.9T  0 disk
nvme5n1 259:8  0 2.9T  0 disk
nvme6n1 259:1  0 2.9T  0 disk
nvme7n1 259:0  0 2.9T  0 disk
nvme8n1 259:2  0 2.9T  0 disk
```



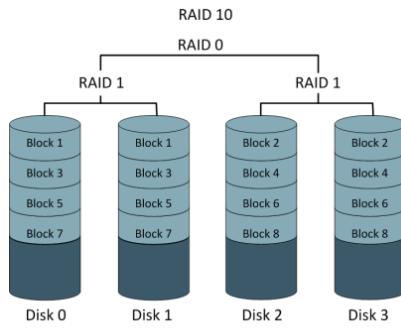
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# Protecting NVMe SSD Devices

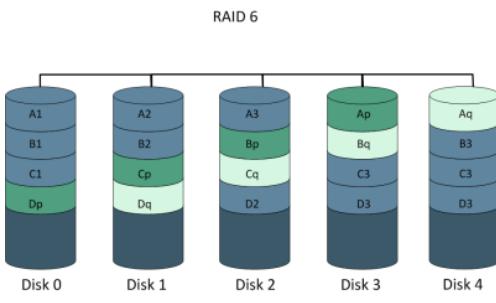
RAID 1: An exact copy (or mirror) of a set of data on two or more disks



RAID 10: Stripes data across multiple mirrored pairs. As long as one disk in each mirrored pair is functional, data can be retrieved



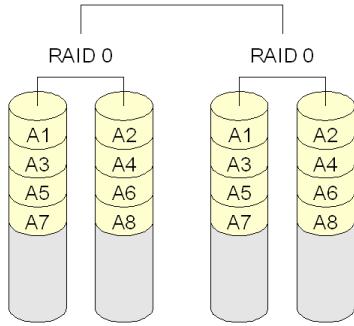
RAID 6: Block-level striping with two parity blocks distributed across all member disks



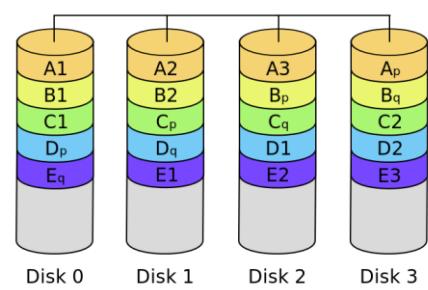
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## BM.HighIO1.512 Options

RAID 10 across all 4 SSDs with 6.4 TB usable space, can survive the failure of one device; fast performance



RAID 6 across all 4 SSDs with 6.4 TB usable space, but can survive the failure of two devices; slower, but higher durability



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## BM.DenseIO1.512 Options

- **RAID 6 across all nine SSDs**  
Single LUN with ~23.8TB of usable space that will survive the failure of any two devices
- **Four device RAID 10 and five device RAID 6 arrays**  
Results in two arrays with isolated I/O (data and log files) with 6.4TB and 9.6TB of usable space
- **RAID 10 array across 8 devices**  
Single LUN with ~12.8TB of space that will survive the failure of any one device and a hot spare
- **Two RAID 10 arrays of 4 devices each**  
Two LUNs, each with ~6.4TB of space and a global hot spare

```
$ sudo yum install mdadm -y
```

```
$ sudo mdadm --create /dev/md0 --raid-devices=9 --level=6 /dev/nvme0n1 /dev/nvme1n1 /dev/nvme2n1 /dev/nvme3n1 /dev/nvme4n1 /dev/nvme5n1 /dev/nvme6n1 /dev/nvme7n1 /dev/nvme8n1
```

```
$ sudo mdadm --detail --scan | sudo tee -a /etc/mdadm.conf >> /dev/null
```



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## Images

A template of a virtual hard drive that determines the operating system and other software for an instance. Images can be Oracle-provided, custom, or BYOI. Oracle-provided images -

Image	Name	Description
Oracle Linux 7 Unbreakable Enterprise Kernel Release 4	Oracle-Linux-7.x-	The UEK is Oracle's optimized operating system kernel
Oracle Linux 6 Unbreakable Enterprise Kernel Release 4	Oracle-Linux-6.x-	The UEK is Oracle's optimized operating system kernel
CentOS 7	CentOS-7-x	CentOS is a free, open-source Linux distribution
CentOS 6	CentOS-6.x-	CentOS is a free, open-source Linux distribution
Ubuntu 16.04 LTS	Canonical-Ubuntu-16.x-<date>-<number>	Ubuntu is a free, open-source Linux distribution
Windows Server 2012 R2 – Bare Metal (BM)	Windows-Server-2012-R2-Standard-Edition-BM	Windows Server 2012 R2 Standard Edition
Windows Server 2012 R2 - Virtual Machine (VM)	Windows-Server-2012-R2-Standard-Edition-VM	Windows Server 2012 R2 Standard Edition



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All Oracle-provided images include rules that allow only "root" on Linux instances or "Administrators" on Windows instances to make outgoing connections to the iSCSI network endpoint (169.254.0.2:3260) that serves the instance's boot and block volumes.

Oracle recommends that you do not reconfigure the firewall on your instance to remove these rules. Removing these rules allows non-root users or non-administrators to access the instance's boot disk volume. Oracle recommends that you do not create custom images without these rules unless you understand the security risks.

## Custom Images

- Possible to create a custom image of an instance's boot disk and use it to launch other instances.
- Instances you launch from your image include customizations, configuration, and software installed when you created the image.
- When you create an image of a running instance, the instance shuts down and remains unavailable for several minutes. When the process completes, the instance restarts.
- Custom images do not include the data from any attached block volumes.
- Custom images cannot be > 50 GB in size.
- Custom images cannot be downloaded or exported.
- Support Generalized and Specialized images for Windows.
  - Generalized image - generalized OS disk, cleaned of computer-specific information.
  - Specialized image - OS disk that is already fully installed, and a copy of the original BM or VM.



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## Launching a Compute Instance

The steps to launch a compute instance are:

1. Create a Key Pair
2. Choose a Compartment
3. Create a Virtual Cloud Network
4. Launch an Instance
5. Connect to Your Instance
6. Add a Block Volume

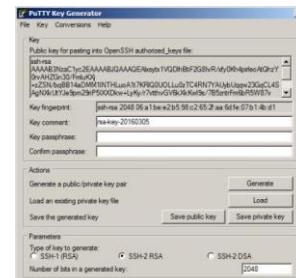


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The creation of a compute instance is referred to as Launching an Instance. To create an instance irrespective of the type of image, you must follow the sequence of steps. In the previous lessons you have already gained familiarity with the compartment and virtual network.

## Creating a Key Pair

- Instances use an SSH key pair instead of a password to authenticate a remote user.
- A key pair file contains a private key and public key.
- You keep the private key on your computer and provide the public key every time you launch an instance.
- To create key pairs, you can use a third-party tool such as:
  - OpenSSH on UNIX-style systems (including Linux, Solaris, BSD, and OS X)
  - PuTTY Key Generator on Windows



```
ssh-keygen -t rsa -N "" -b 2048 -C "<key_name>" -f <path/root_name>
```

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While use of PuTTY is shown in the slide for accessing from Windows environments, you could also install a bash shell – such as the Ubuntu based bash shell or Git bash – in a Windows environment. When you use a bash environment, the Linux commands work the same way in bash shell in Windows environment.

## Choosing a Compartment

- Compartments help you organize and control access to your resources.
- Only users with permission to a compartment can manage the servers and volumes in that compartment.
- Depending on your requirements, access the compartment in which you want to create the resource.

The screenshot shows the Oracle Bare Metal Cloud interface. At the top, there's a navigation bar with the Oracle logo, 'Bare Metal Cloud', and user information ('sandboxuser'). The 'Networking' tab is selected. Below the navigation, a sidebar lists 'Virtual Cloud Networks', 'Dynamic Routing Gateways', 'Customer-Premise Equipment', and 'Compartment'. Under 'Compartment', it shows 'CompanyABC (root)', 'HumanResources', and 'Sandbox'. The main content area is titled 'Virtual Cloud Networks in Sandbox compartment' and displays a message: 'There are no virtual cloud networks in the Sandbox compartment.' A blue 'Create Virtual Cloud Network' button is visible. At the bottom right of the main content area, there's a note: 'No cloud networks'.



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As we already mentioned, compartment is a collection of related resources that can be accessed only by those groups that have permission. For example, one compartment could contain all the instances and storage volumes that make up the production version of your company's Human Resources system. Only users with permission to that compartment can manage those instances and volumes.

The compute instances, or any resource for that matter, once created in a compartment cannot be moved to another compartment. You can however create an image and using that image clone a compute instance to another compartment within your tenancy.

## Using a Virtual Cloud Network

- In the Console, click Networking.
- Click Create Virtual Cloud Network.
- Enter the values:
  - **Create in Compartment:** Select the compartment you want to create the VCN in, if not already selected.
  - **Name:** Enter a name for your cloud network.
  - **Select:** Create VCN plus related resources. The dialog box expands to list the items that will be created with your cloud network.
- Scroll to the bottom of the dialog box and click Virtual Cloud Network.

The screenshot shows the 'Create Virtual Cloud Network' dialog box. At the top, there are two radio button options: 'CREATE VIRTUAL CLOUD NETWORK ONLY' (selected) and 'CREATE VIRTUAL CLOUD NETWORK PLUS RELATED RESOURCES'. Below this, a note explains that the second option automatically sets up a VCN with internet access, firewall rules, and security lists. The 'NAME OPTIONAL' field contains 'FunVCN'. Under 'DNS RESOLUTION', the 'USE DNS HOSTNAMES IN THIS VCN' checkbox is checked. A note below it states that this allows assignment of a DNS hostname when launching an instance. The 'Name' field is set to 'FunVCN', 'CIDR' to '10.0.0.0/16', 'DNS Label' to 'funvcn', and 'DNS Domain Name' to 'funvcn.oraclevcn.com'. At the bottom is a blue 'Create Virtual Cloud Network' button.

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Before you can launch an instance, you need to have a Virtual Cloud Network (VCN). In the VCN, you launch the instance into a subnet. A subnet is a subdivision of your VCN that you define in a single Availability Domain. The subnet directs traffic according to a route table. The subnet also uses a security list to control traffic in and out of the instance.

When you created a VCN, you would have noted the details of the VCN that you just created. The VCN has the following resources and characteristics:

- CIDR block range of 10.0.0.0/16
- An Internet Gateway
- A route table with a default route rule to enable traffic to and from the Internet Gateway
- A Default Security List that allows specific ingress traffic to and all egress traffic from the instance
- A public subnet in each Availability Domain.
- The VCN will automatically use the Internet and VCN Resolver for DNS.

## Launching an Instance

- In the Console, click Compute.
- Click Launch Instance.
- In the Launch Instance dialog box:
  - **Name:** Enter a name for the instance.
  - **Availability Domain:** Select the first Availability Domain in the list.
  - **Image:** Select a suitable OS image.
  - **Shape:** Select a size suitable for your project.
    - The shape defines the number of CPUs and amount of memory allocated to the instance.
  - **Virtual Cloud Network:** Select the cloud network you created.
  - **Subnet:** Select the subnet created with your cloud network.
  - **Hostname:** Enter a name for the virtual host.
  - **SSH Keys:** Paste in the public key.

The screenshot shows the 'Launch Instance' dialog box with the following fields filled in:

- NAME:** BMCS-Fun00
- AVAILABILITY DOMAIN:** OBze.PHX-AD-1
- IMAGE:** Oracle-Linux-7.3-2017.04.18-0
- SHAPE:** VM.Standard1.2
- VIRTUAL CLOUD NETWORK:** FunVCN
- SUBNET:** Public Subnet OBze:PHX-AD-1
- HOSTNAME:** bmcsfun00
- FULLY QUALIFIED DOMAIN NAME:** bmcsfun00.sub04282145240.funvcn.oraclevcn.com
- SSH KEYS:** A public SSH key is pasted into this field.

A blue 'Launch Instance' button is at the bottom right of the dialog.

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The instance is displayed in the Console in a provisioning state. Expect provisioning to take a few minutes before the status changes to Running. Do not refresh the page. Once the instance is running, wait a few more minutes for the operating system to boot before you attempt to connect.

The shape you select determines the number of CPUs, memory to be allocated to your Compute instances.

## Getting the Public IP Address

- You need the public IP address of your instance to connect to it.
- To get the instance public IP address:
  - Click the instance name to see its details.
  - The Public IP Address is displayed on the details page.

The screenshot shows the 'Compute » Instances » Instance Details' page for an instance named 'BMCS-Fun00'. The instance is currently 'RUNNING'. On the right side, there are several configuration details:

Availability Domain: OBze:PHX-AD-1	Region: phx
OCID: ...gydzjq <a href="#">Show Copy</a>	Shape: VM.Standard1.2
Launched: Fri, 28 Apr 2017 21:56:15 GMT	Private IP Address: 10.0.0.2
Image: <a href="#">Oracle-Linux-7.3-2017.04.18-0</a>	Fully Qualified Domain Name: bmcsfun00... <a href="#">Show Copy</a>
Compartment: BMFun	Public IP Address: (highlighted with a red dotted box)
Virtual Cloud Network: FunVCN	Subnet: Public Subnet OBze:PHX-AD-1

A note at the bottom states: 'This Instance's traffic is controlled by its firewall rules in addition to the associated [Subnets](#) Security Lists.'

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The public IP address of your instance is what you need to connect to the instance and configure other resources within that instance.

Use the following SSH command to access the instance. Enter the passphrase welcome1 when prompted.

```
$ ssh opc@<public-ip-address>
```

- <public-ip-address> is your instance IP address that you retrieved from the Console.

## Using a Block Volume

- In the Console, click Storage > Block Volumes.
- Click Create Block Volume.
- In the Create Block Volume dialog box, enter the following:
  - **Create in Compartment:** Select the compartment in which you want to create the volume.
  - **Name:** Enter a user-friendly name.
  - **Availability Domain:** Select the same Availability Domain that you selected for your instance.
  - **Size:** Select an appropriate size.
- Click Create Block Volume.



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Block Volume Service provides network storage to use with your Compute instances. After you create, attach, and mount a volume to your instance, you can use it just as you would a physical hard drive on your computer. A volume can be attached to a single instance at a time, but you can detach it from one instance and attach to another instance, keeping your data intact.

## Attaching Volume to an Instance

- In the Console, click **Compute** and then click **Instances**.
- Click your instance name to view its details.
- Click **Attach Block Volume**.
- In the dialog box, enter or select the following:
  - **Block Volume Compartment:** Select the compartment where you created the block volume.
  - **Block Volume:** Select the block volume from the list.
  - Require CHAP Credentials
- Click **Attach**.

The screenshot shows a dialog box titled 'Attach Block Volume'. It has a 'BLOCK VOLUME COMPARTMENT' dropdown set to 'BMFun' and a 'BLOCK VOLUME' dropdown set to 'FunVol'. A checkbox labeled 'REQUIRE CHAP CREDENTIALS' is checked. At the bottom is a blue 'Attach' button.



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Challenge-Handshake Authentication Protocol (CHAP) is a security protocol. When you set up your production environment, Oracle recommends that you use CHAP credentials.

## Summary

In this lesson, you should have learned how to:

- Describe Compute Service
- Describe images, shapes, local storage
- Create and launch a compute instance
- Set up the credentials necessary for accessing the compute resource
- Add block volume to a compute instance



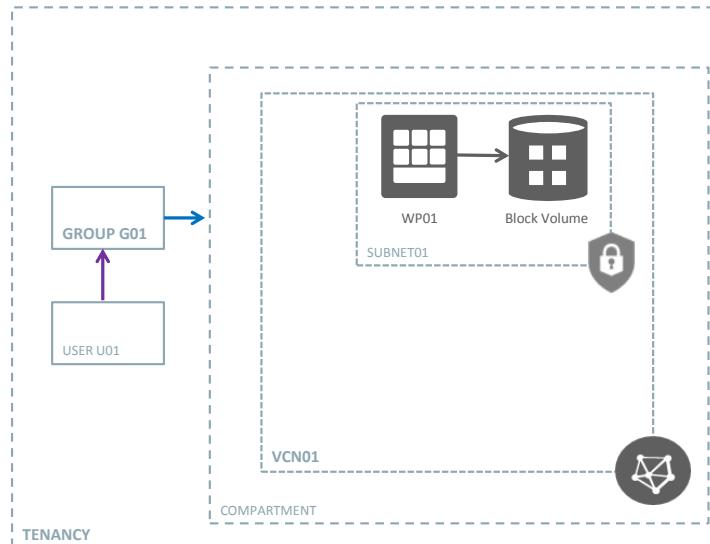
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## Practice 4: Instance Management

In this practice, each participant uses their assigned compartment and:

- Launches an Oracle Linux VM
- Attaches the block volume created in the previous practice
- Mounts the block volume and transfers some content
- Customizes the instance and deploys the LAMP stack followed by WordPress





5

# Block Volume and Object Storage Service

September 2017



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## Objectives

After completing this lesson, you should be able to:

- Create, attach, configure, and mount block volumes
- Back up and restore block volumes
- Detach and delete block volumes
- Describe concepts and uses of object storage
- Create object storage
- Upload objects to object storage
- Upload multipart objects to object storage



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## Storage Services

Oracle Cloud Infrastructure offers two main storage services

- Block Volume Service
  - Block storage operates at the raw storage device level and manages data as a set of numbered, fixed-size blocks using protocols such as iSCSI.
  - Block Volume Service lets you dynamically provision and manage block storage volumes.
  - You can create, attach, connect, and move volumes, as needed, to meet your storage and application requirements.
- Object Storage Service
  - Object storage is independent of a server and accessed over the Internet
  - Data is managed as objects using an API built on standard HTTP verbs
  - It is an ideal storage platform to store very large amounts of data



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## Overview of Block Volume Service

- Block Volume Service lets you dynamically add storage capacity to an instance.
- You can create, attach, connect, and move volumes, as needed, to meet your storage and application requirements.
- Once attached and connected to an instance, you can use a volume like a regular hard drive.
- Volumes can also be disconnected and attached to another instance without the loss of data, thereby providing persistence and portability.
- Elastic block storage volumes are configurable from 50GB to 2TB
- The service offers 60 IOPS per GB and scales linearly
- Data is encrypted at rest in both volumes and backups
- All volumes are automatically replicated for you helping to protect against data loss.
- Typically used for persistent and durable storage.



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A common usage of Block Volume Service is to add storage capacity to an instance. To use a block storage volume, you should:

- Create a block storage volume through the console or the API
- Attach the volume to an instance using a volume attachment
- Connect to the volume from your instance's guest OS using iSCSI
- Mount the volume and use within your instance

A Block Volume Service volume can be detached from an instance and moved to a different instance without loss of data. This data persistence allows you to easily migrate data between instances and ensures that your data is safely stored, even when it is not connected to an instance. Any data will remain intact until you reformat or delete the volume.

To move your volume to another instance, unmount the drive from the initial instance, terminate the iSCSI connection, and attach it to the second instance. From there, you simply connect and mount the drive from that instance's guest OS to instantly have access to all of your data. Additionally, Block Volume Service volumes offer a high level of data durability compared to standard, attached drives. All volumes are automatically replicated for you, helping to protect against data loss.

## Block Volume Service Components

The components required to create a volume and attach it to an instance are briefly described as follows:

- Instance
  - An Oracle Cloud Infrastructure compute host
- iSCSI
  - A TCP/IP-based standard used for communication between the instance and the attached volume
- Volume
  - A detachable block storage device that allows you to dynamically expand the storage capacity of an instance
- Resource Identifier
  - Each Oracle Bare Metal Cloud Services resource has a unique, Oracle-assigned identifier called an Oracle Cloud ID (OCID).

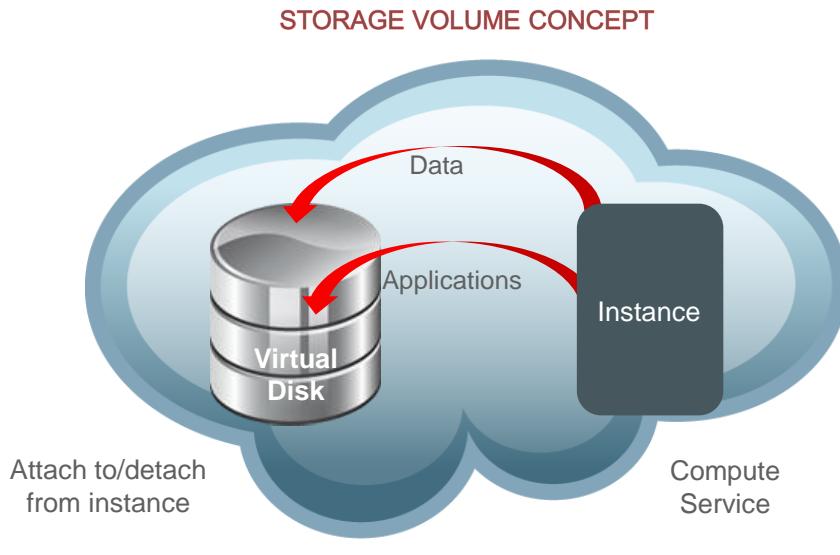


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The Internet Small Computer System Interface (iSCSI) is an IP-based standard for connecting storage devices. iSCSI encapsulates SCSI commands in IP network packets, which allows data transfer over long distances and sharing of storage by client systems. As iSCSI uses the existing IP infrastructure, it does not require the purchase and installation of fiber-optic cabling and interface adapters that are needed to implement Fibre Channel (FC) storage area networks.

Oracle Linux supports iSCSI initiator functionality in software. The kernel-resident device driver uses the existing network interface card (NIC) and network stack to emulate a hardware iSCSI initiator. As the iSCSI initiator functionality is not available at the level of the system BIOS, you cannot boot an Oracle Linux system from iSCSI storage.

## How Can I Use Block Storage with My Instance?



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A storage volume is a virtual disk that provides persistent block storage for Compute instances.

You can use storage volumes to store data and applications.

Block Volume Service, a part of Oracle Cloud Infrastructure, allows you to:

- Create block storage volumes and attach them to your Compute instances. When you create a storage volume, you can specify the capacity that you need.
- Attach one or more storage volumes to an instance either while creating the instance or later, while the instance is running.
- Scale up or scale down the block storage capacity for the instance by attaching or detaching storage volumes even while the instance is running. Also, remember that, when a storage volume is detached from an instance or when the instance is deleted, data stored on the storage volume is not lost.

# Creating and Attaching a Block Volume Using the Console

The figure consists of three screenshots of the Oracle Cloud Infrastructure console:

- Create Block Volume:** A form for creating a new block volume. Fields include: COMPARTMENT (BMFun), NAME (FunVol), AVAILABILITY DOMAIN (OBze:PHX-AD-2), and SIZE (256.0GB). A "Create Block Volume" button is at the bottom.
- Attach Block Volume:** A form for attaching a block volume to an instance. It shows the BLOCK VOLUME COMPARTMENT (BMFun) and the selected BLOCK VOLUME (FunVol). A "Require CHAP Credentials" checkbox is unchecked. An "Attach" button is at the bottom.
- Attached Block Volumes:** A list of attached volumes. One volume is shown: FunVol (OCID: ...43f7a, Attachment Type: iSCSI, Size: 256.0GB, Compartment: BMFun). The volume is labeled "ATTACHED". A "Detach" button is highlighted with a red box and a cursor icon.

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## To create a Block Volume:

In the console, click Storage.

- Click Create Block Volume.
- Fill in the required volume information:
  - Name:** A user-friendly name or description.
  - Domain:** Must be in the same Availability Domain as the instance.
  - Size:** Can be between 50 GB to 2TB.
- Click Create.

The volume will be ready to attach once its icon no longer lists it as PROVISIONING in the volume list.

## To Attach a Block Volume:

In the Console, click Compute.

- In the Instances list, select the instance you want to attach to the volume.
- Click the name of the instance to display the instance details.
- Click Attach Volume and select the volume you want from the Volume drop-down menu.
- Click Attach.

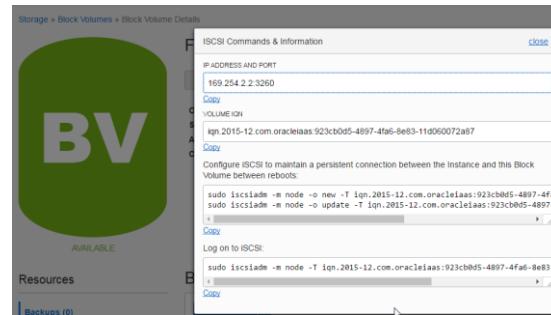
You can connect to the volume once the volume's icon no longer lists it as Attaching.

## To Connect to the Block Volume:

The Console provides the commands required to configure, authenticate, and log on to iSCSI.

## Managing Block Storage Volumes

- You use the iSCSI protocol to connect to and configure the block volume.
- After you configure the volume, you can mount and use it like a normal hard drive.
- When you attach a block volume to an instance, the console provides the volume information. Click the Actions icon (...) on your volume's row, and then click iSCSI Commands and Information.
- You can use that information to configure and mount the volume to the instance.



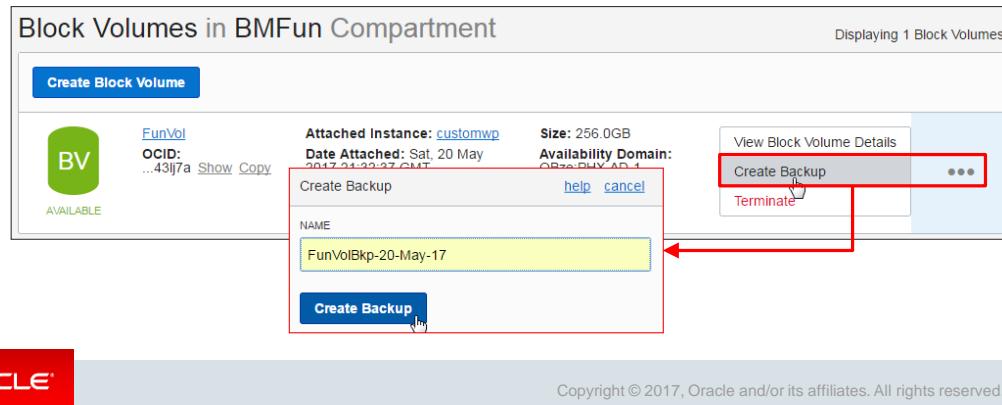
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You use the `iSCSI` protocol to attach a volume to an instance. Once the volume is attached, you log on to the instance and use the `iscsiadm` command-line tool to configure the `iSCSI` connection. After you configure the volume, you can mount it and use it like a normal hard drive.

## Backup and Restoration

- You can take point-in-time complete image backups of your block volumes.
- Backups are encrypted and stored in the Object Storage Service, and can be restored as new volumes to any Availability Domain within the same region.
- This capability provides you with a spare copy of a volume and gives you the ability to successfully complete recovery within the same region.



### To take a backup:

- In the console, click Storage.
- Click Backups.
- Click the block volume for which you want to create a backup.
- Click Create Backup.
- Enter a name for the backup, and then click Create Backup.

The backup will be completed once its icon no longer lists it as CREATING in the volume list.

### To restore a new volume from a backup:

- In the Console, click Storage, and then click Backups.
  - A list of the block volumes in the compartment you're viewing is displayed. If you don't see the one you're looking for, make sure you're viewing the correct compartment.
- Select the block volume backup you want to restore.
- Click Create Block Volume.
- Enter a name for the block volume and choose the Availability Domain in which you want to restore it.
- Click Create.

The volume will be ready to attach once its icon no longer lists it as PROVISIONING in the volume list.

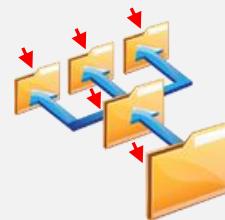
## What's a Mount Point?



Storage Volume  
with file system

Mount on any  
Mount Point

Various Mount Points



Directory structure on the  
Operating System

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### About Mount Points

The process of associating a storage volume with an operating system is called **mounting**.

A **mount point** is the place in the current system's directory hierarchy where the storage volume and its file system will be attached. The mount point is always a normal directory. The mount point doesn't have to be created directly at the root (/); it can be created anywhere in the hierarchy of the system.

### The /etc/fstab File System Table

Linux systems maintain a list of file systems and options in the `/etc/fstab` file. This is a plain text file. To ensure that your storage volumes are mounted at boot time, add the mount point details as an entry in the `/etc/fstab` file.

## Detaching and Deleting Block Volumes

- When an instance no longer requires a block volume, you can disconnect and then detach it from the instance without any loss of data.
- When you attach the same volume to another instance or to the same instance, DO NOT FORMAT the disk volume. Otherwise, you will lose all the data on the volume.
- When the volume itself is no longer needed, you can delete the block volume.
- You cannot undo a delete operation. Any data on a volume will be permanently deleted once the volume is deleted.



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## Performance Benchmark

- Create 1TB volume
- Attach to BM compute instance
- Run sample performance benchmarks per volume
- IOPS
  - sudo fio --filename=/dev/sdb --direct=1 --rw=randwrite --bs=4k --ioengine=libaio --iodepth=64 --runtime=30 --numjobs=16 --time\_based --group\_reporting --name=client-max
- Throughput
  - sudo fio --filename=/dev/sdb --direct=1 --rw=randwrite --bs=256k --ioengine=libaio --iodepth=64 --runtime=30 --numjobs=4 --time\_based --group\_reporting --name=client-max
- Latency
  - sudo fio --filename=/dev/sdb --direct=1 --rw=randrw --bs=4k --ioengine=libaio --iodepth=1 --runtime=30 --numjobs=1 --time\_based --group\_reporting --name=client-max



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## Overview of Object Storage Service

- Object storage is where data is handled as an object, also known as unstructured data.
- Object Storage use cases:
  - **Big Data:** Object Storage Service enables you to not only store large data sets, but also operate seamlessly on them. You can generate business insights by using the [HDFS connector](#) to interface with analytics engines such as Apache Spark and MapReduce.
  - **Archive and Storage:** Backup or archive data is typically written once and read many times. The durability and low cost characteristics of Object Storage Service make it suitable to store data for long durations.
  - **Content Repository:** Object Storage Service supports any content type, images, logs, and video. You can store this data for a long time and the storage scales in tune with your need.



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- Object storage is where data is handled as an object, also known as unstructured data. The main differences between object storage and traditional storage (also known as *block storage*), are listed as follows:
  - Stored data contains customized metadata.
  - Data is indexed, allowing for much faster search results.
  - Data can be located by using pointers instead of finding its location based on tracks and sectors on the hard disk (that is, the standard *file system* that we have used for many years).
- This type of storage is used as an essential part of cloud services, in data centers, and it is normally integrated with virtual machines.
- Because object storage allows for additional attributes as part of the “bundle,” applications, programs and storage devices are able to better manipulate data.
- Nearly any file type can be stored in the form of object storage. Some popular files include media files (images, videos, music, and photos), documents, PDFs, backups, archives, and so on.
- Multiple users can access the data.

With Object Storage Service, you can safely and securely store or retrieve data directly from the Internet or from within the cloud platform. Object Storage Service is agnostic to data content type. It enables a variety of use cases and works equally well with them. The Object Storage Service is a regional service. It is not tied to any specific compute instance. You can access data from anywhere within or outside the context of the Oracle Cloud Infrastructure, as long as you have Internet connectivity and can access the Object Storage Service API endpoint.

(HDFS Connector: <https://docs.us-phoenix-1.oraclecloud.com/Content/Object/Tasks/hadoopsupport.htm>)

## Overview of Object Storage Service

- Object
- Bucket
- Namespace
- Compartment



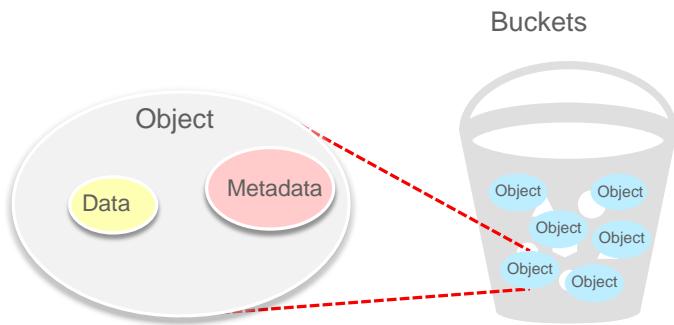
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The Object Storage Service resources are:

- **Object:** Any type of data, regardless of content type, is stored as an object. The object is composed of the object itself and metadata about the object. Each object is stored in a bucket.
- **Bucket:** A logical container for storing objects. Buckets are created by users or systems as needed. A bucket is associated with a single compartment which, in turn, has policies that indicate what actions a user can perform on a bucket and all the objects in the bucket.
- **Namespace:** The logical entity that lets you own your personal bucket names. Bucket names need to be unique within the context of a namespace, but bucket names can be repeated across namespaces. Each tenant is associated with one default namespace (tenant name) that spans all compartments. Within a namespace, buckets and objects exist in flat hierarchy, but you can simulate directories to help navigate a large set of objects (for example, guitars/fender/stratocaster.jpg, guitars/gibson/lespaul.jpg).
- **Compartment:** Compartments help you organize resources to make it easier to control access to them. A bucket can only exist in one compartment.

## Object Storage Elements

- Object: any type of data, regardless of content type, is stored as an object. The object is comprised of the object itself and metadata about the object.
- Buckets: a logical container for storing objects. A bucket is associated with a single compartment.



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- A bucket is a user-created resource, which can hold an unlimited number of objects.
- When using this form of storage, data is treated as an object. Think of an object as a document file. Users can add additional attributes to each object such as: notes about the file, location where the file was created, compatibility options, and so on.
- Traditional data storage (block storage) does not support additional metadata and attributes. Additionally, the file location must be specified by the user; this way, the operating system calls up that file from the hard drive directly.
- Object storage allows for searchable metadata, automatic indexing, multiple copies/backups of stored data, and the ability to access storage nodes found in different parts of the world.
  - If the storage container is about to reach its capacity limit, a new storage node is created to allow the user to continue adding data.
- A common analogy to better understand object storage is valet parking:
  - Even though you do not know where the car is parked—or if it has been relocated multiple times while you were away—when you are ready to leave, your ticket number is used to trace your car and return it to you. The car is the object; the ticket number is the object's unique identifying number that provides the location of the car; and the valet's parking lot is the container where the vehicles are parked in a flat area.

## Object Storage Service Features

The salient features of Object Storage include:

- Strong consistency - When a read request is made, the Object Storage Service always serves the most recent copy of the data that was written to the system
- Durability - Data stored redundantly across multiple storage servers across multiple ADs. Data integrity is actively monitored and corrupt data detected and auto repaired
- Performance - Compute and the Object Storage Services are co-located on the same fast network
- Custom metadata - define your own extensive metadata as key-value pairs
- Hadoop support - use the Object Storage Service as the primary data repository for big data
- Encryption - employs 256-bit Advanced Encryption Standard (AES-256) to encrypt object data. Each object is encrypted with its own key and object keys are encrypted with a master encryption key that is frequently rotated.



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Following are some salient features of object storage:

- **Strong Consistency:** When a read request is made, the Object Storage Service always serves the most recent copy of the data that was written to the system. The Object Storage Service also offers a high-performing, high-bandwidth network.
- **Durability:** Data is stored redundantly across multiple storage servers across multiple Availability Domains. Data integrity is actively monitored using checksums and corrupt data is detected and auto repaired. Any loss of data redundancy is actively managed by recreating a copy of the data from the redundant copy.
- **Performance:** The Compute Service and the Object Storage Service are co-located on the same network. This means that instances running on the Compute Service can expect very high, non-blocking network bandwidth to the object store.
- **Custom Metadata:** You can define your own extensive metadata as key-value pairs for any purpose. For example, you can create descriptive tags for objects, retrieve those tags, and sort through the data.
- **Hadoop Support:** You can use the Object Storage Service as the primary data repository for big data. The HDFS connector provides connectivity to various big data analytic engines. This connectivity enables the analytics engines to work directly with data stored in the Object Storage Service.
- **Encryption:** The Object Storage Service employs 256-bit Advanced Encryption Standard (AES-256) to encrypt object data on the server. Each object is encrypted with its own key. Object keys are encrypted with a master encryption key that is frequently rotated. Encryption is enabled by default and cannot be turned off.

## Managing Buckets and Objects

- A bucket is a container for storing objects in a compartment within a namespace.
- In the console, access a compartment. Then navigate to **Storage > Object Storage** and click **Create bucket**. Enter a name and click **Create**.
- To upload an object:
  - Click the bucket name. A list of objects in the bucket is displayed.
  - Click **Upload Object**. Then click **Browse**, navigate to and select the file you want to upload, and then click **Open**.
    - If you want to change the name of the object, edit the name in the **Object Name** field.
  - Click **Upload Object**. The object is uploaded and displayed in the list of objects.
- You can also download or delete an object using the console.



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A bucket is associated with a single compartment. The compartment has policies that indicate what actions a user can perform on a bucket and all the objects in the bucket.

An object is a file or unstructured data such as: multimedia files, data backups, static web content, or logs that you upload to a bucket within a compartment within a namespace. Objects are processed as a single entity. You can't edit or append data to an object, but you can replace the entire object.

**Note:** In this course, while you can create a bucket and upload data as objects, we will not use object storage resources in the hands-on labs and practices.

## Managing Multipart Uploads

- Object Storage Service supports multipart uploads for more efficient and resilient uploads, especially for large objects.
- You can use the retry feature to upload only the failed upload.
- You can use multipart upload REST API calls or the Java Software Development Kit (SDK) to manage multipart uploads, but not the Console.



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With multipart uploads, individual parts of an object can be uploaded in parallel to reduce the amount of time you spend uploading. Multipart uploads can also minimize the impact of network failures by letting you retry a failed part upload instead of requiring you to retry an entire object upload. Oracle recommends that you perform a multipart upload to upload objects larger than 100 MB. The maximum size for an uploaded object is 10 TB. Object parts must be no larger than 50 GB. For very large uploads, a multipart upload also offers you the flexibility of pausing and resuming at your own pace.

A multipart upload consists of the following steps:

- Initiating an upload
- Uploading object parts
- Committing the upload

In the initiating step, you should create the parts to upload. The Object Storage Service provides API operations for the remaining steps. The service also provides API operations for listing in-progress multipart uploads, listing the object parts in an in-progress multipart upload, and aborting in-progress multipart uploads.

### Creating Object Parts

With multipart upload, you split the object you want to upload into individual parts. Individual parts can be as large as 50 GB or as small as 10 MB. (The Object Storage Service waives the minimum part size restriction for the last uploaded part.) Decide what part number you want to use for each part. Part numbers can range from 1 to 10,000. You do not need to assign contiguous numbers, but the Object Storage Service will construct the object by ordering part numbers in ascending order.

**Initiating an Upload:** After you finish creating object parts, initiate a multipart upload by making a CreateMultipartUpload REST API call. Provide the object name and any object metadata. The Object Storage Service responds with a unique upload ID that you must include in any requests related to this multipart upload. The Object Storage Service also marks the upload as active. The upload remains active until you explicitly commit it or abort it.

**Uploading Object Parts:** Make an UploadPart request for each object part upload. In the request parameters, provide the namespace, bucket name, upload ID, and part number. In the request body, include the object part. Object parts can be uploaded in parallel and in any order. When you commit the upload, the Object Storage Service uses the part numbers to sequence object parts. Part numbers do not have to be contiguous. If multiple object parts are uploaded using the same upload ID and part number, the last upload overwrites the part and is committed when you call the CommitMultipartUpload API.

- The Object Storage Service returns an ETag value for each part uploaded. You need both the part number and corresponding ETag value for each part when you commit the upload.
- In the event of network issues, you can restart a failed upload for an individual part. You do not need to restart the entire upload. If, for some reason, you cannot perform an upload all at once, multipart upload lets you continue uploading parts at your own pace. While a multipart upload is still active, you can keep adding parts as long as the total number is less than 10,000.
- You can keep track of an active multipart upload by listing all parts that have been uploaded. (You cannot list information for an individual object part in an active multipart upload.) The ListMultipartUploadParts operation requires the namespace, bucket name, and upload ID. The Object Storage Service will respond with information about the parts associated with the specified upload ID. Parts information includes the part number, ETag value, MD5 hash, and part size (in bytes).

**Committing the Upload:** When you have uploaded all object parts, complete the multipart upload by committing it. Use the CommitMultipartUpload request parameters to specify the namespace, bucket name, and upload ID. Include the part number and corresponding ETag value for each part in the body of the request. When you commit the upload, the Object Storage Service constructs the object from its constituent parts. The object is stored in the specified bucket and namespace. You can treat it like you would any other object. Garbage collection will release storage space occupied by any part numbers you uploaded, but did not include in the CommitMultipartUpload request.

- You cannot list or retrieve parts from a completed upload. You cannot append or remove parts from the completed upload either. If you want, you can replace the object by initiating a new upload.
- If you decide to abort a multipart upload instead of committing it, wait for in-progress part uploads to complete and then use the AbortMultipartUpload operation. If you abort an upload while part uploads are still in progress anyway, the Object Storage Service cleans up both completed and in-progress parts. Upload IDs from aborted multipart uploads cannot be reused.

## Summary

In this lesson, you should have learned how to:

- Create, attach, configure, and mount block volumes
- Back up and restore block volumes
- Detach and delete block volumes
- Describe concepts and uses of object storage
- Create object storage
- Upload objects to object storage
- Upload multipart objects to object storage

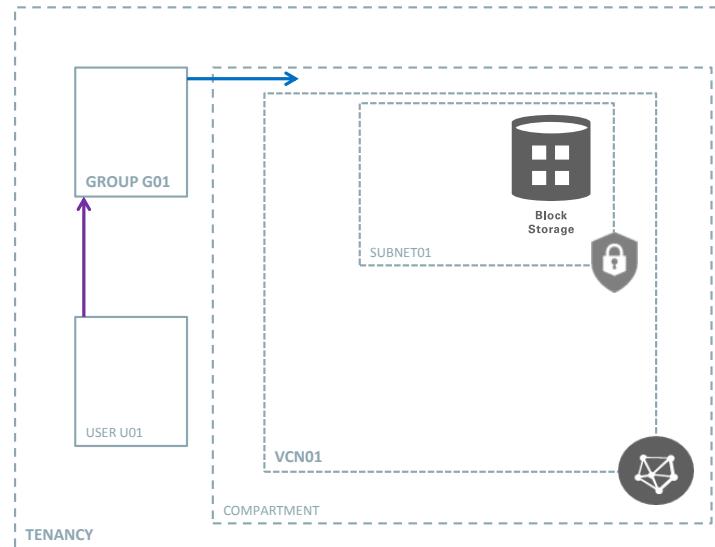


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## Practice 5: Storage Management

In this practice, each participant uses their assigned compartment and creates a block volume of 256 GB.



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# Load Balancing Service

September 2017



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## Objectives

After completing this lesson, you should be able to:

- Describe Oracle Cloud Infrastructure Load Balancing Service concepts
- Create and test a Public Load Balancer



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## Load Balancing Service

- Provides automated traffic distribution from one entry point to multiple servers in VCN
- Improves resource utilization, facilitates scaling, and helps ensure high availability
- Regional Load Balancer for your VCN; redundant across two ADs (No single point of failure)
- Supported Protocols – TCP, HTTP/1.0, HTTP/1.1, HTTP/2, WebSocket
- SSL Offloading – SSL Termination, End to End SSL, SSL Tunneling
- Key differentiators
  - Private or Public Load Balancer and Public or Private IP address
  - Provisioned Bandwidth – 100 Mbps, 400 Mbps, 8 Gbps
  - Single LB for TCP and HTTP protocols

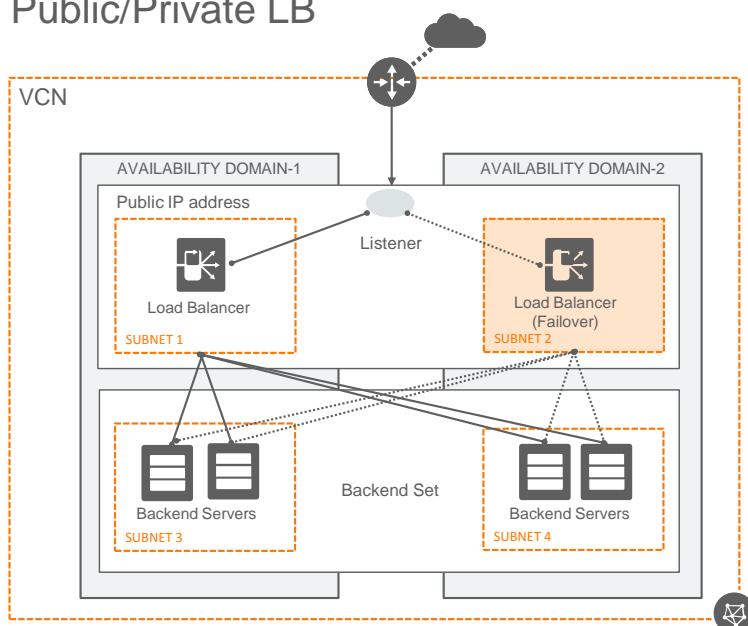


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You want a single entry point to your application cluster. Load Balancing Service, a part of Oracle Cloud Infrastructure, offers you an IP-based load balancer that is highly available across availability domains within a region. The Load Balancing Service is primarily a regional service and offers a public IPv4 address within your VCN.

The service provides a load balancer with a public IP address, provisioned bandwidth, and high availability. Load Balancing Service provisions the public IP address across two subnets within your VCN to ensure accessibility even during an Availability Domain outage. You can configure multiple listeners for the IP address to load balance transport Layer 4 and Layer 7 (TCP and HTTP) traffic.

## Public/Private LB



- **Public Load Balancer**

- Requires 2 subnets, each in a separate AD
- subnet1 – primary LB; subnet2 – stand-by LB for high availability in case of an AD outage
- Public IP attached to subnet1; LB and IP switch to subnet2 in case of an outage
- Service treats the two LB subnets as equivalent and you cannot denote one as "primary"

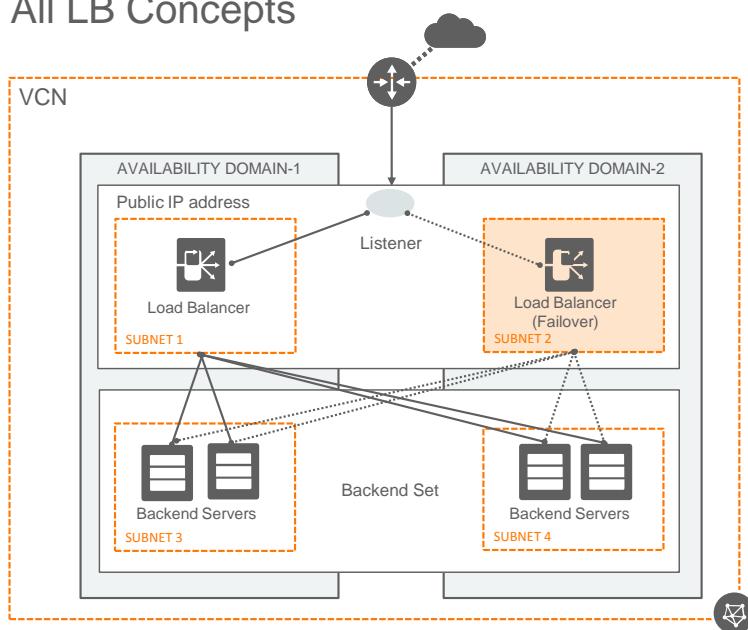
- **Private Load Balancer**

- Private IP address that serves as the entry point for incoming traffic
- Requires only 1 subnet – local to AD; no HA in case of any AD outage

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## All LB Concepts



- Backend Server – application server responsible for generating content in reply to the incoming TCP or HTTP traffic
- Backend Set – logical entity defined by a list of backend servers, a load balancing policy, and a health check policy
- Health Checks – a test to confirm the availability of backend servers; supports TCP & HTTP health checks
- Listener – an entity that checks for incoming traffic on the load balancer's IP address
- Load Balancing Policy – tells the load balancer how to distribute incoming traffic to the backend servers (round-robin, IP hash, least connection)

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## Load Balancing Service: Shapes

A template that determines the load balancer's total pre-provisioned maximum capacity (bandwidth) for ingress plus egress traffic. Available shapes are:

100 Mbps	400 Mbps	8000 Mbps
Process 100 Mbps total bandwidth when multiple clients connected	Process 400 Mbps total bandwidth when multiple clients connected	Process 8000 Mbps total bandwidth when multiple clients connected
Key characteristics: Up to 1K SSL handshakes per sec with cipher (ECDHE-RSA2K)	Key characteristics: Up to 4K SSL handshakes per sec with cipher (ECDHE-RSA2K)	Key characteristics: Up to 40K SSL handshakes per sec with cipher (ECDHE-RSA2K)



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ECDHE is Elliptic Curve Diffie-hellman key Exchange, an encrypted key exchange standard.

## Load Balancing Service: Protocol Support

### HTTP Load Balancer

- Operates at higher app layer
- HTTP/1.x, WebSocket, HTTP/2 protocol support for incoming HTTP traffic
- SSL Termination, End-to-End SSL
- Traffic Shaping Policy:
  - (Weighted) Round-Robin/Least-Connection/IP-Hash
  - Mark Backend Servers as Drain/Backup for maintenance window
  - Supports X-forwarded-for header
- Health Check Policy:
  - Application-specific check with response code/body match

### TCP Load Balancer

- Operates at intermediate transport layer
- SSL Termination, End-to-End SSL
- Traffic Shaping Policy:
  - (Weighted) Round-Robin/Least-Connection/IP-Hash
  - Mark Backend Servers as Drain/Backup for maintenance window
  - Use IP-Hash Load Balancing policy for client-IP persistence
- Health Check Policy:
  - Standard TCP Ping-based health check

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## Public Load Balancer example configuration

To create and test a public load balancer, complete the following steps:

- Create a public load balancer
- Create a backend set with health check
- Add backend servers to your backend set
- Create a listener
- Update the public load balancer subnet security list to allow Internet traffic to the listener
- Verify your public load balancer
- Update rules to protect your backend servers



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## Summary

In this lesson, you should have learned how to:

- Describe Oracle Cloud Infrastructure Load Balancers concepts
- Create and test a Public Load balancer



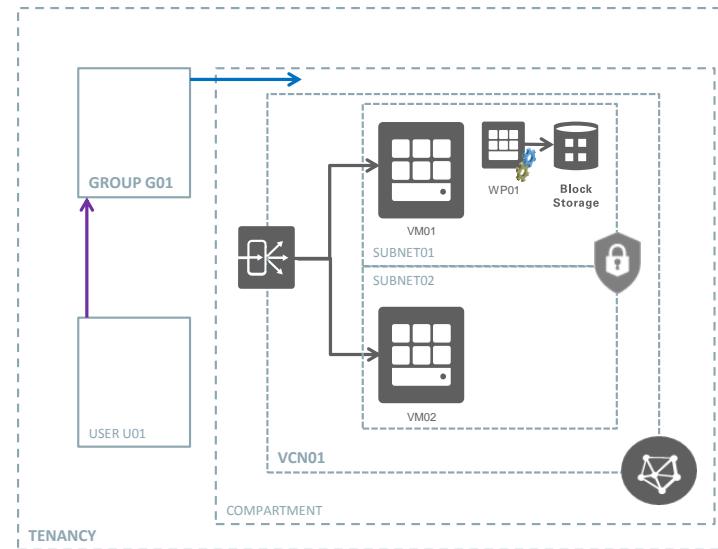
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## Practice 6: Implementing Public Load Balancer and High Availability

In this practice, each participant:

- Creates a new subnet in another Availability Domain
- Launches another instance using the custom image
- Creates a Public Load Balancer
- Configures security rules
- Configures the two Instances as backend servers
- Verifies access through Load Balancer, and checks high availability



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# Database Service

September 2017



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## Objectives

After completing this lesson, you should be able to:

- Describe the options of database systems available with Oracle Cloud Infrastructure
- Launch a one-node database system



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## Oracle Cloud Infrastructure – Database Service

- Oracle Cloud Infrastructure - Database Service provides Oracle Database systems in the cloud.
- Database system has these features:
  - Bare Metal compute instance for high performance
  - 10 gigabit network connection
  - Local NVMe storage is two-way and three-way mirrored for redundancy
  - Oracle Transparent Data Encryption is enabled by default
- You can increase or decrease your licensed cores dynamically as per your requirement.
- The two types of Database Systems offered by Oracle Cloud Infrastructure are:
  - Bare Metal DB Systems
  - Exadata DB Systems



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The Oracle Cloud Infrastructure - Database Service lets you quickly launch an Oracle Database System (DB System) and create one or more databases on it. You have full access to the features and operations available with Oracle Database, but Oracle owns and manages the infrastructure.

The Database Service supports several types of DB Systems, ranging in size, price, and performance.

Customers control and manage software that directly affects their application

- Database, OS, Clusterware

Oracle manages underlying infrastructure

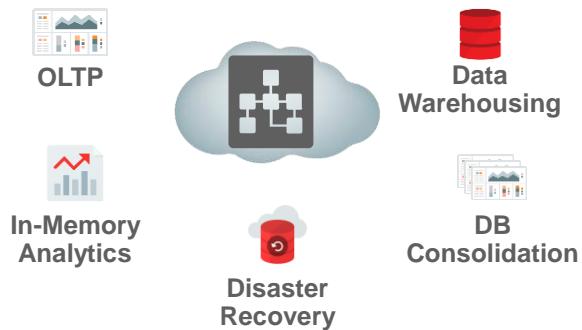
- Facilities, servers, storage, storage software, networking, firmware, hypervisor, etc.

Customers have administrator privileges for compute VMs and databases so they can configure and run the system as they like

- Customers initiate automated database update script when it is convenient for them
- Can be run rolling across nodes to avoid database down time

## Use Cases

- Mission Critical Production Databases
  - Very large databases (VLDB)
  - Database consolidation
  - OLTP, Data Warehousing, Analytics, Reporting
  - AppsU (EBS,JDE,PSFT)
- Test, Development, Certification, Try before Buy
- Disaster Recovery



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## Exadata DB Systems

- The Exadata DB Systems enable you to leverage the power of Exadata within Oracle Cloud Infrastructure.
- Exadata DB Systems are configured with Enterprise Edition - Extreme Performance.
- Exadata DB Systems support the following software releases:
  - Oracle Database 11g Release 2
  - Oracle Database 12c Release 1
  - Oracle Database 12c Release 2



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An Exadata DB System consists of a quarter rack, half rack, or full rack of compute nodes and storage servers, connected by a high-speed, low-latency InfiniBand network and intelligent Exadata software. You can configure automatic backups, optimize for different workloads, and scale up the system to meet increased demands.

## Exadata System Configuration

The following table outlines the system resources based on your choice of configuration:

Resource	Quarter Rack	Half Rack	Full Rack
Number of Compute Nodes	2	4	8
Total Minimum (Default) Number of Enabled CPU Cores	22	44	88
Total Maximum Number of Enabled CPU Cores	84	168	336
Total RAM Capacity	1440 GB	2880 GB	5760 GB
Number of Exadata Storage Servers	3	6	12
Total Raw Flash Storage Capacity	38.4 TB	76.8 TB	153.6 TB
Total Raw Disk Storage Capacity	288 TB	576 TB	1152 TB
Total Usable Storage Capacity	84 TB	168 TB	336 TB



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Exadata DB Systems are offered in quarter rack, half rack or full rack configurations, and each configuration consists of compute nodes and storage servers. The compute nodes are each configured with a Virtual Machine (VM). You have root privilege for the compute node VMs, so you can load and run additional software on them. However, you do not have administrative access to the Exadata infrastructure components, such as the physical compute node hardware, network switches, power distribution units (PDUs), integrated lights-out management (ILOM) interfaces, or the Exadata Storage Servers, which are all administered by Oracle.

You have full administrative privileges for your databases, and you can connect to your databases by using Oracle Net Services from outside the Oracle Bare Metal Cloud Services. You are responsible for database administration tasks such as creating tablespaces and managing database users. You can also customize the default automated maintenance set up, and you control the recovery process in the event of a database failure.

## What's New with Exadata DB Systems?

- Identity and Access Management (IAM) service
- Secure access with tenants, compartments, and resources
- Database backup service to IaaS object store
- Network Infrastructure improvements
- Virtual Cloud Network (VCN) use cases



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- Network service components
  - Virtual Cloud Network (VCN) with private subnets and Availability Domain
  - Internet Gateway - routing between VCN and Internet
  - Dynamic Routing Gateway – private routing between VCN and on-premise network
- New connection use cases
  - Public subnets, private subnets with VPN, public and private subnets with VPN
- New hardware
  - Faster network, faster servers
- New tooling
  - New backup service
  - IaaS object store

## Database Backup to IaaS Object Store

- High bandwidth network and high performance storage servers
- Redundancy across physical servers and availability domains
- Checksums monitor data integrity and corrupt data is automatically repaired
- Required components to implement with ExaCS:
  - VCN with Internet Gateway
  - Object Storage Services bucket (additional purchase)
  - Swift password
  - User with tenancy-level access to object storage



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Data is stored redundantly across multiple storage servers across multiple Availability Domains. Data integrity is actively monitored using checksums and corrupt data is detected and auto repaired. Any loss of data redundancy is actively managed by recreating a copy of the data from the redundant copy.

### What you need

- VCN with Internet Gateway
- Object Storage Services bucket (additional purchase)
- Swift password
- User with tenancy-level access to object storage

### Special notes

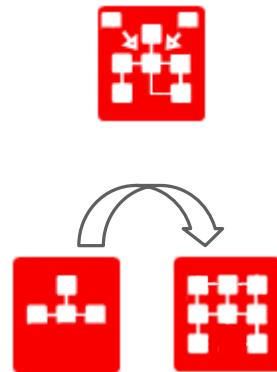
- Backup traffic is contained in VCN (no Internet traffic)

Backup to Object Storage doc: <https://docs.us-phoenix-1.oraclecloud.com/Content/Database/Tasks/backingupOS.htm>

## Scaling Exadata DB Systems

Two ways of scaling Exadata DB Systems:

- Scaling within an Exadata DB System: Lets you modify compute node processing power within the system
  - Can be done without disruption
  - Can be accomplished by the customer
- Scaling across Exadata DB System configurations:  
Lets you move to a different configuration  
(for example, from a quarter rack to a half rack)
  - Requires movement of database deployment
  - Planned and executed in coordination with Oracle



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**Scaling within:** You can scale up the number of enabled CPU cores in the system if an Exadata DB System requires more compute node processing power. For a non-metered Exadata DB System, you can temporarily modify the compute node processing power (bursting) or add compute node processing power on a more permanent basis. For a metered Exadata DB System, you can simply modify the number of enabled CPU cores.

**Scaling across:** Exadata DB System configurations enables you to move to a different system configuration. This is useful when a database deployment requires:

- Processing power that is beyond the capacity of the current system configuration
- Storage capacity that is beyond the capacity of the current system configuration
- A performance boost that can be delivered by increasing the number of available compute nodes
- A performance boost that can be delivered by increasing the number of available Exadata Storage Servers

Scaling from a quarter rack to a half rack, or from a half rack to a full rack, requires that the data associated with your database deployment is backed up and restored on a different Exadata DB System, which requires planning and coordination between you and Oracle.

## Bare Metal Database System

- Bare Metal Database Systems rely on Bare Metal servers running Oracle Linux.
- There are two types of Bare Metal Database Systems:
  - One-node database systems:
    - Single Bare Metal server
    - Locally attached NVMe storage
    - Recommended for test and development
  - Two-node RAC database systems:
    - Two Bare Metal servers in RAC configuration
    - Direct attached shared storage
    - Supports high performance, recommended for production



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There are two types of Bare Metal Database Systems:

- 1-node DB Systems consist of a single bare metal server running Oracle Linux 6.8, with locally attached NVMe storage. This is the least expensive type of system and is recommended for test and development environments. If the node fails, you can simply launch another system and restore databases from current backups.
- 2-Node RAC DB Systems consist of two bare metal server running Oracle Linux 6.8, in a RAC configuration, with direct-attached shared storage. The cluster provides automatic failover. This system supports only Enterprise Edition - Extreme Performance and is recommended for production applications.

You can manage these systems by using the Console, API, Enterprise Manager, Enterprise Manager Express, SQL Developer, and the dbcli CLI.

## Shapes for Bare Metal Database Systems

The available shapes for Bare Metal Database Systems are:

- **BM.HighIO1.36:**
  - One-node DB System with one Bare Metal server, up to 36 CPU cores, 512 GB memory, and four 3.2 TB locally attached NVMe drives (12.8 TB total)
- **BM.DenseIO1.36:**
  - One-node DB System with one Bare Metal server, up to 36 CPU cores, 512 GB memory, and nine 3.2 TB locally attached NVMe drives (28.8 TB total) to the DB System
- **BM.RACLocalStorage1.72:**
  - Two-node RAC DB System with two Bare Metal servers, up to 36 CPU cores on each node (72 total per cluster), 512 GB memory, and direct attached shared storage with twenty 1.2 TB SSD drives (24 TB total)



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## Shapes for 1- and 2-Node RAC DB Systems

When you launch a DB System, you choose a shape, which determines the resources allocated to the DB System. The available shapes are:

- **BM.HighIO1.36:** Provides a 1-node DB System (one bare metal server), with up to 36 CPU cores, 512 GB memory, and four 3.2 TB locally attached NVMe drives (12.8 TB total) to the DB System.
- **BM.DenseIO1.36:** Provides a 1-node DB System (one bare metal server), with up to 36 CPU cores, 512 GB memory, and nine 3.2 TB locally attached NVMe drives (28.8 TB total) to the DB System.
- **BM.RACLocalStorage1.72:** Provides a 2-node RAC DB System (two bare metal servers), with up to 36 CPU cores on each node (72 total per cluster), 512 GB memory, direct attached shared storage with twenty 1.2 TB SSD drives (24 TB total).

## Storage

The following table outlines the storage used based on the shape and options of Bare Metal Database System:

Shape	Raw Storage	Usable Storage with Normal Redundancy (2-way Mirroring)	Usable Storage with High Redundancy (3-way Mirroring)
BM.HighIO1.36	12.8 TB NVMe	DATA 3.5 TB RECO 740 GB	DATA 2.3 TB RECO 440 GB
BM.DenseIO1.36	28.8 TB NVMe	DATA 9.4 TB RECO 1.7 TB	DATA 5.4 TB RECO 1 TB
BM.RACLocalStorage1.72	24 TB SSD	DATA 8.6 TB RECO 1.6 TB	DATA 5.4 TB RECO 1 TB



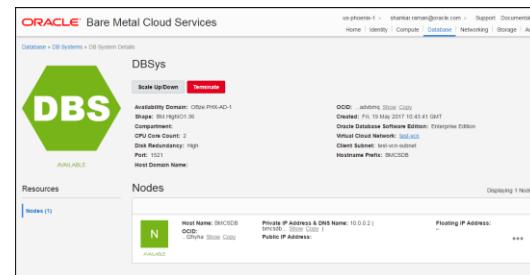
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The shape you choose for a DB System determines its total raw storage, but other options, like 2- or 3-way mirroring and the space allocated for data files, affect the amount of usable storage on the system.

# Managing the Database Systems

You can use the console to perform the following tasks:

- **Launch a DB System:** You can create a database system.
- **Check the status:** You can view the status of your database creation and after that, you can view the runtime status of the database.
- **Start, stop, or reboot**
- **Scale:** You can scale up the number of enabled CPU cores in the system.
- **Terminate:** Terminating a DB System permanently deletes it and any databases running on it.



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To launch a database system, open the Console, click Database, choose your Compartment, and then click Launch DB System. In the Launch DB System dialog enter or select the appropriate values and click Launch. While the task of launching a database is quite simple, you should plan your database implementations with your database architect.

The screenshot shows the 'Launch DB System' dialog box from the Oracle Cloud Infrastructure console. The dialog is titled 'Reuse DB System Launch Parameters' and includes sections for 'DB System Information', 'Network Information', and 'Availability Domain'. The 'DB SYSTEM NAME' field is empty. The 'DB EDITION' is set to 'EE (Enterprise Edition)' and the 'DB SIZING TEMPLATE' is 'SI 4-NVMe DBaaS'. The 'CPU CORE COUNT' is set to '2'. The 'DATA STORAGE PERCENTAGE' is '80' and 'DATA MIRRORING' is '3-way'. The 'SSH KEY' field is empty. In the 'AVAILABILITY DOMAIN' section, 'sxQo:PHX-AD-1' is selected under 'COMPARTMENT'. The 'REGION' is 'America' and the 'TIMEZONE' is 'UTC'. The 'CLOUD NETWORK' dropdown is empty. The 'SUBNET' dropdown also has no selection. At the bottom right of the dialog, there is a 'Launch' button.

Launch DB System

How to launch a DB System.

Reuse DB System Launch Parameters

Select a DB System to reuse its launch parameters below.

SOURCE DB SYSTEM (optional)

Select a DB system...

DB System Information

DB SYSTEM NAME

DB EDITION

EE (Enterprise Edition)

DB SIZING TEMPLATE

SI 4-NVMe DBaaS

CPU CORE COUNT

Increment by 2, maximum of 32

2

DATA STORAGE PERCENTAGE

Must be between 10 and 90

80

DATA MIRRORING

3-way

SSH KEY

AVAILABILITY DOMAIN

sxQo:PHX-AD-1

COMPARTMENT

Current Compartment Name

REGION

America

TIMEZONE

UTC

Network Information

CLOUD NETWORK

Select a cloud network

SUBNET

First select an availability domain and cloud network above

Launch

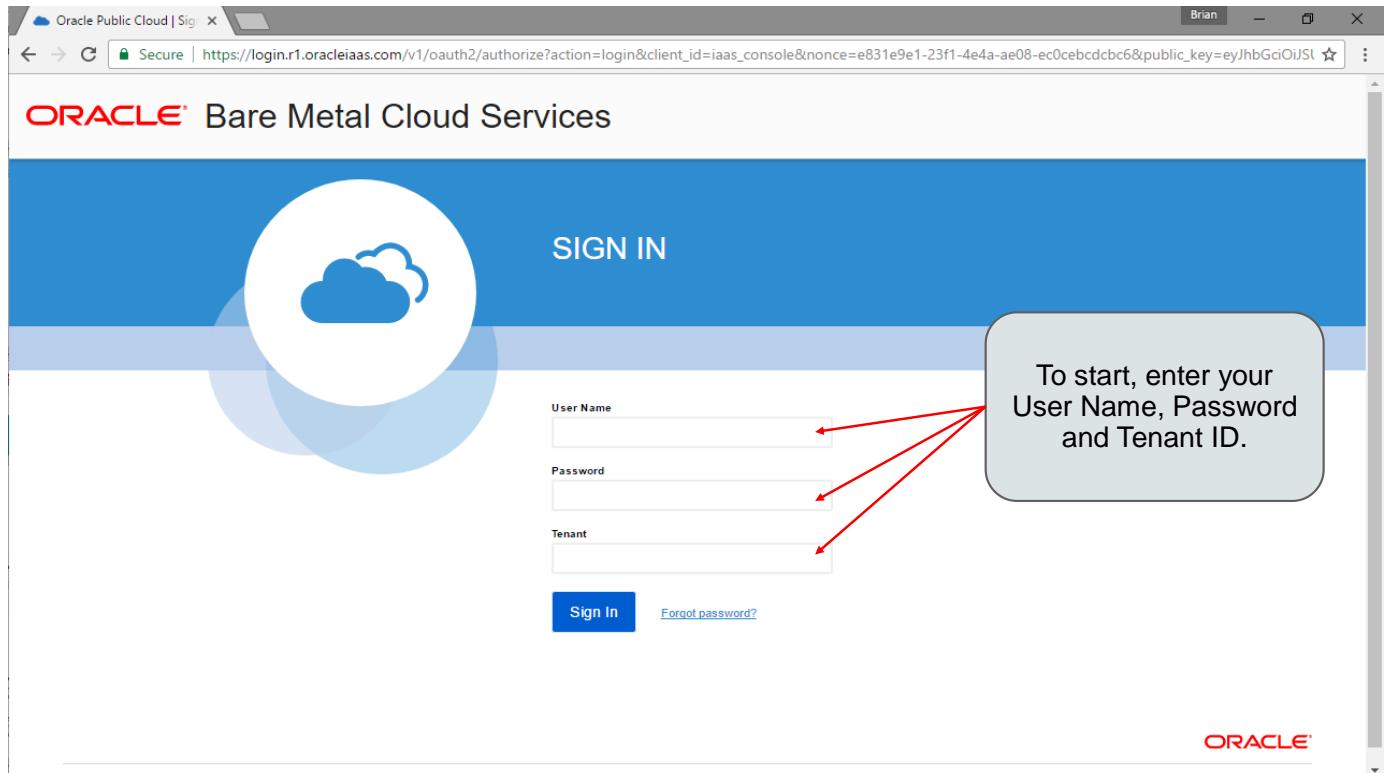
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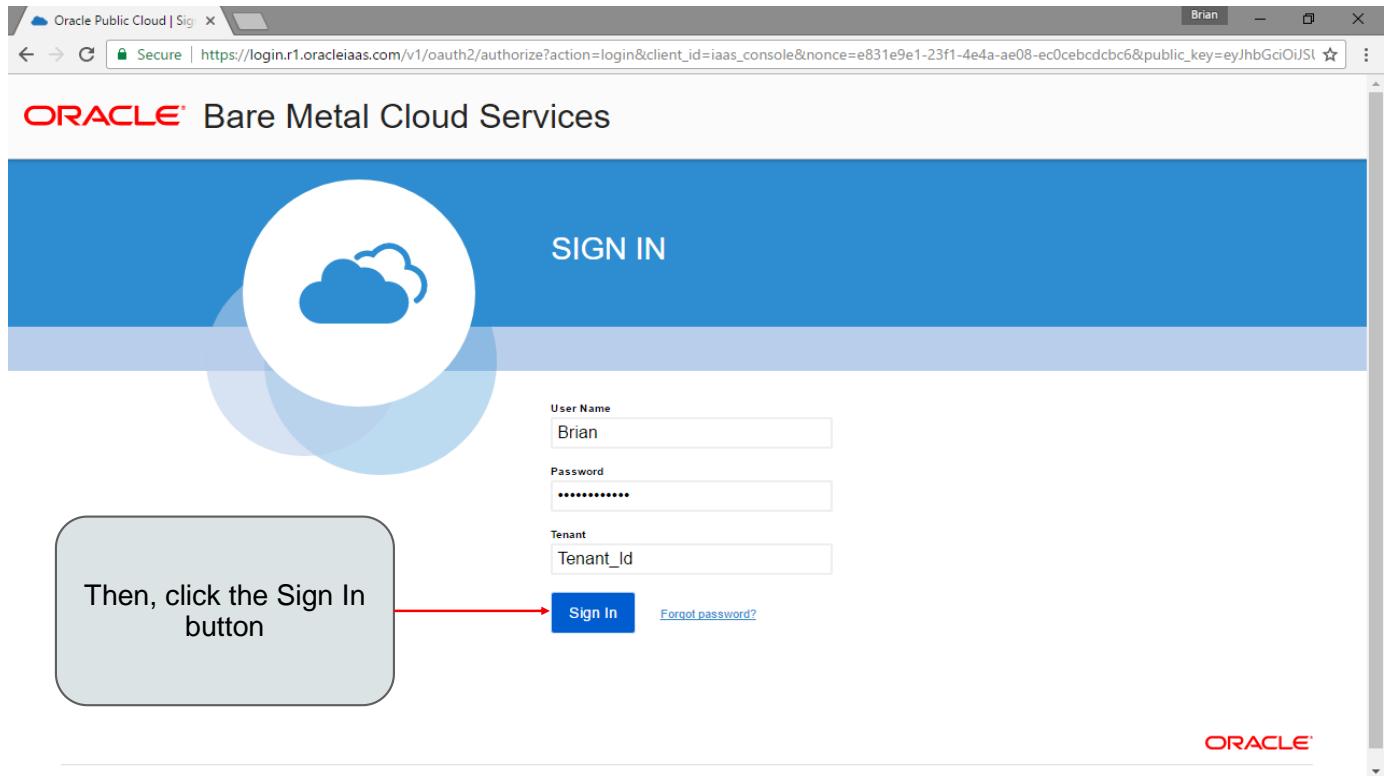
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# Provision Exadata CS in the Bare Metal Cloud



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The screenshot shows the Oracle Bare Metal Cloud Service console at <https://console.r1.oracleiaas.com/#/a/>. The navigation bar includes links for Home, Identity, Compute, Database (which is highlighted in red), Networking, Storage, and Audit. A user profile 'brian' is shown.

**New to Bare Metal Cloud**  
Go to the Getting Started Guide to learn more.  
[Getting Started Guide](#)

**Using Compartments**  
Learn about how Compartments work in Oracle Bare Metal Cloud  
[Compartments](#)

**Want to Know More?**  
Go to the Oracle Bare Metal Cloud Service Support page.  
[Documentation](#)    [Contact Support](#)

A large callout box points to the 'Networking' tab in the navigation bar with the text: "Start by clicking the Networking tab". Another callout box points to the 'Networking' section in the main content area with the text: "Before we can create our Exadata Cloud Service, we first need to set up our Virtual Cloud Network(VCN)".

Tenancy OCID: ocid1.tenancy.oc1..aaaaaaaaajl3p2iquu45w7kfydtigbkmwcoshrlyxjjv5yn3deux3fa6cyxda

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Bare Metal Cloud Service x

Secure | https://console.r1.oracleiaas.com/#/a/ Brian

ORACLE Bare Metal Cloud Services

Then select Virtual Cloud Networks

New to Bare Metal Cloud Services?  
Go to the Getting Started Guide to learn more.  
[Getting Started Guide](#)

Using Compartments  
Learn about how Compartments work in Oracle Bare Metal Cloud Services.  
[About Compartments](#)

Want to Know More?  
Go to the Oracle Bare Metal Cloud Services documentation portal.  
[Documentation](#)

Need Assistance?  
Contact Oracle Support to get help with issues and questions.  
[Contact Support](#)

Tenancy OCID: ocid1.tenancy.oc1..aaaaaaaaajl3p2iquu45w7kfytigbkmwcoshrlxjjv5yn3deux3fa6cyxda

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https://console.r1.oracleiaas.com/#/a/networking/vcns

The screenshot shows the Oracle Bare Metal Cloud Services Networking page. On the left, a sidebar lists options like Virtual Cloud Networks, Dynamic Routing Gateways, Customer-Premises Equipment, Load Balancers, FastConnect, and Compartments. Under Compartments, it shows 'dbaasexadatacustomersea1 (root)'. The main content area is titled 'Virtual Cloud Networks in dbaasexadatacustomersea1 Compartment' and displays three existing VCNs:

VCN	DNS Domain Name	Created
192 OCID: ...nav2za	customer1	Thu, 09 Mar 2017 00:18:40 GMT
customer2	customer2...	Thu, 09 Mar 2017 00:19:02 GMT

A red arrow points from a callout box to the 'Create Virtual Cloud Network' button at the top left of the VCN list. The callout box contains the text: 'Start by clicking the Create Virtual Cloud Network button.' Another callout box is overlaid on the VCN list, containing the text: 'Here on the Virtual Cloud Networks home page, we can create a new VCN for our Exadata Cloud Service to use.'

Bare Metal Cloud Service x

Secure | https://console.r1.oracleiaas.com/#/a/networking/vcns

ORACLE® Bare Metal Cloud Services

brian Support Documentation

Home | Identity | Compute | Database | **Networking** | Storage | Audit

Networking

**Virtual Cloud Networks**

Dynamic Routing Gateways

Customer-Premises Equipment

Load Balancers

Start by naming our VCN.

Create Virtual Cloud Network

CREATE IN COMPARTMENT  
dbaseadatasea1 (root)

NAME *OPTIONAL*

CREATE VIRTUAL CLOUD NETWORK ONLY

CREATE VIRTUAL CLOUD NETWORK PLUS RELATED RESOURCES

Creates a Virtual Cloud Network only. You'll still need to set up at least one Subnet and Route Rule to have a working Virtual Cloud Network.

CIDR BLOCK

Example: 10.0.0.0/16

CIDR range must fall within 10.0.0.0/8, 172.16.0.0/12, 192.168.0.0/16

USE VCN RESOLVER FOR DNS

DNS LABEL

Auto-generated if no name is specified

Only letters and numbers, starting with a letter. 15 characters max.

DNS DOMAIN NAME *(READ-ONLY)*

<dns-label>.oraclevcn.com

The Create Virtual Cloud Network modal is now shown.

root) Displaying 3 Virtual Cloud Networks

2017 00:18:40 GMT

Name	Created
show	Thu, 09 Mar 2017 00:19:02 GMT

**Create Virtual Cloud Network**

**CREATE IN COMPARTMENT**  
dbaseadatcustomersea1 (root)

**NAME OPTIONAL**  
ExaCS\_Network

CREATE VIRTUAL CLOUD NETWORK ONLY  
 CREATE VIRTUAL CLOUD NETWORK PLUS RELATED RESOURCES

Creates a Virtual Cloud Network only. You'll still need to set up at least one Subnet, Gateway, and Route Rule to have a working Virtual Cloud Network.

**CIDR BLOCK**   
CIDR range must fall within 10.0.0.0/8, 172.16.0.0/12, 192.168.0.0/16

USE VCN RESOLVER FOR DNS

**DNS LABEL**  
exacsnetwork

Only letters and numbers, starting with a letter. 15 characters max.

**DNS DOMAIN NAME (READ-ONLY)**  
exacsnetwork.oraclevcn.com

**root) Displaying 3 Virtual Cloud Networks**

Name	Created	Actions
show	Thu, 09 Mar 2017 00:18:40 GMT	... ...
show	Thu, 09 Mar 2017 00:19:02 GMT	... ...

We have our choice of CIDR ranges to use. We can use 10.0, 172.16 or 192.168. Once we select our range, we can then add the selected range and the bits used for the network block we are referencing. This is indicated by the number after the /.

In our page below, we have selected 172.16.0.0 as our range and 22 as the bit length. This would give us an IP range from 172.16.0.0 to 172.16.3.255, 1024 IP addresses we can use in this block for our VCN.

Leave this checked. The VCN Resolver for DNS allows hostname resolution at VCN level. When creating our ExaCS, we can set a hostname and reference that hostname on other compute or ExaCS nodes in our VCN.

The VCN resolver allows you to add a single host name in your TNS entry file on the app servers. For example, a typical SCAN IP TNS entry would consist of 3 IP address in the file, say 10.0.0.1, 10.0.0.2 and 10.0.0.3. With the VCN Resolver, you can put a single hostname, say myexacs.bmcloud.com and that entry would round robin to the SCAN IPs automatically.

The screenshot shows the Oracle Bare Metal Cloud Service Networking interface. On the left, a sidebar lists 'Networking' options: 'Virtual Cloud Networks' (selected), 'Dynamic Routing Gateways', 'Customer-Premises Equipment', 'Load Balancers', and 'FastConnect'. Under 'Compartment', it shows 'dbaasexadatacustomersea1 (root)'. The main area is titled 'CREATE IN COMPARTMENT' with 'dbaasexadatacustomersea1 (root)' selected. The 'NAME' field contains 'ExaCS\_Network'. Below it, there are two radio buttons: 'CREATE VIRTUAL CLOUD NETWORK ONLY' (selected) and 'CREATE VIRTUAL CLOUD NETWORK PLUS RELATED RESOURCES'. A note explains that creating only the network requires setting up subnets, gateways, and route rules. The 'CIDR BLOCK' field contains '172.16.0.0/22'. A note specifies CIDR ranges and IP addresses. The 'USE VCN RESOLVER FOR DNS' checkbox is checked. The 'DNS LABEL' field is 'exacsnetwork' and the 'DNS DOMAIN NAME (READ-ONLY)' field is 'exacsnetwork.oraclevcn.com'. A red arrow points from a callout bubble to the 'Create Virtual Cloud Network' button. The callout bubble contains the text: 'Now create the VCN by clicking the Create Virtual Cloud Network button.' To the right, a list of existing VCNs is shown with columns for Name, Created, and GMT. One entry is highlighted: 'Name: exacsnetwork, Created: Thu, 09 Mar 2017 00:19:02 GMT'.

The screenshot shows the Oracle Bare Metal Cloud Services Networking page. On the left, there's a sidebar with 'FastConnect' and 'Compartment' sections. Under 'Compartment', it says 'dbaseexadatacustomersea1 (root)'. The main area lists three VCNs:

- customer1**: CIDR Block: 10.0.0.0/16, Default Route: Default Route 1 (customer1). Created: 09 Mar 17 18:40 GMT.
- customer2**: CIDR Block: 10.0.0.0/16, Default Route: Default Route 1 (customer2). Created: 09 Mar 17 00:19:02 GMT.
- ExaCS\_Network**: CIDR Block: 172.16.0.0/2, Default Route: Default Route 1 (ExaCS\_Network).

A red arrow points from the text 'We now need to create two subnets for our Exadata Cloud Service: a data and a backup subnet. We click on our VCN to view the details and start this process.' to the 'ExaCS\_Network' VCN entry. A callout box contains the text 'Our VCN is now created.'

Tenancy OCID: ocid1.tenancy.oc1..aaaaaaaaajj3p2iquu45w7kfydtigblkmcoshrlxyjv5yn3deux3fa6cyxda

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Bare Metal Cloud Service x Brian

Secure | https://console.r1.oracleiaas.com/?#/a/networking/vcns/ocid1.vcn.oc1.seaaaaaaaaaawn3eojyvrtus5vpetb5bxujrk5ea67rjflqqchquigssfpmlta

ORACLE® Bare Metal Cloud Services

Networking » Virtual Cloud Networks » Virtual Cloud Network Details

ExaCS\_Network

Terminate

On the VCN details page, we need to create the 2 subnets.

CIDR Block: 172.16.0.0/22

Compartment: dbaasexadatacustomersea1

Created: Wed, 19 Apr 2017 12:44:09 GMT

OCID: ...pmilta Show Copy

Default Route Table: Default Route Table for ExaCS\_Network

DNS Domain Name: exacsnetwork... Show Copy

AVAILABLE

Resources

Subnets (0)

Route Tables (1)

Internet Gateways (0)

Dynamic Routing Gateways (0)

Security Lists (1)

Subnets in dbaasexadatacustomersea1 Compartment

Create Subnet

No Subnets

Start by clicking the Create Subnet button.

There are no Subnets in this Virtual Cloud Network.

The Create Subnet modal is now open.

Cloud Services

Cloud Network Details

Create Subnet

If the Route Table, DHCP Options, or Security Lists are in a different Compartment than the Subnet, [click here](#) to enable Compartment selection for those resources.

NAME OPTIONAL

AVAILABILITY DOMAIN

CIDR BLOCK

ROUTE TABLE

USE VCN RESOLVER FOR DNS

DNS LABEL

DNS DOMAIN NAME (READ-ONLY)

Start by giving the new subnet a name. Here we will call it data and use it for the client network of the ExaCS.

No Subnets

Network.

VCN AVAILABLE

Resources

Subnets (0)

Route Tables (1)

Internet Gateways (0)

Dynamic Routing Gateways (0)

Security Lists (1)

The screenshot shows the Oracle Bare Metal Cloud Services interface. On the left, there's a sidebar with a large green hexagon containing the letters 'VCN' and the word 'AVAILABLE'. Below it, under 'Resources', are links for Subnets (0), Route Tables (1), Internet Gateways (0), Dynamic Routing Gateways (0), and Security Lists (1). The main area is titled 'Networking > Virtual Cloud Networks > Virtual Cloud Network Details'. A modal window titled 'Create Subnet' is open. It has fields for 'NAME OPTIONAL' (containing 'data'), 'AVAILABILITY DOMAIN' (with a dropdown menu labeled 'Select an Availability Domain' and a red arrow pointing to it), 'CIDR BLOCK' (containing 'Example: 10.0.0.0/16'), 'ROUTE TABLE' (containing 'Select a Route Table'), and 'DNS LABEL' (containing 'data'). A checkbox 'USE VCN RESOLVER FOR DNS' is checked. A tooltip on the right says 'Next, we choose an Availability Domain.' and another one below says 'I Network.'

Next, we choose an Availability Domain.

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Bare Metal Cloud Service × Brian

Secure | https://console.r1.oracleiaas.com/?#/a/networking/vcns/ocid1.vcn.oc1.seaaaaaaaaaawn3eojyvrtus5vpetb5bxujrk5ea67rjflgqchquigssfpmlta

Networking » Virtual Cloud Networks » Virtual Cloud Network Details

VCN AVAILABLE

Resources

- Subnets (0)
- Route Tables (1)
- Internet Gateways (0)
- Dynamic Routing Gateways (0)
- Security Lists (1)

Create Subnet

If the Route Table, DHCP Options, or Security Lists are in a different Compartment than the Subnet, [click here](#) to enable Compartment selection for those resources.

NAME OPTIONAL

AVAILABILITY DOMAIN

Select an Availability Domain

GBTE SEA-AD-1

Example: 10.0.0.0/16

ROUTE TABLE

Select a Route Table

USE VCN RESOLVER FOR DNS

DNS LABEL

Only letters and numbers, starting with a letter. 15 characters max.

DNS DOMAIN NAME (READ-ONLY)

DUPLICATES

built Route Table for ExaCS\_Network  
snetwork... Show Copy

No Subnets

I Network.

The screenshot shows the Oracle Bare Metal Cloud Services interface. On the left, there's a large green hexagonal icon with 'VCN' in white. Below it, the word 'AVAILABLE' is displayed. To the right, a sidebar lists 'Resources' including 'Subnets (2)', 'Route Tables (1)', 'Internet Gateways (0)', 'Dynamic Routing Gateways (0)', and 'Security Lists (1)'. The main area is titled 'Create Subnet' and contains fields for 'NAME (OPTIONAL)' (set to 'data'), 'AVAILABILITY DOMAIN' (set to 'GBTE:SEA-AD-1'), and 'CIDR BLOCK' (set to '172.16.1.0/24'). A red arrow points from the text in the callout box to the 'CIDR BLOCK' field. A callout box with the following text is overlaid on the interface:

Now we create a CIDR block that is a subset of our VCN. Here we use a larger bit length to create a smaller range of IPs.

Below the subnet creation form, a message says 'Specified IP addresses: 172.16.1.0-172.16.1.255 (256 IP addresses)'. To the right, a sidebar shows 'Displaying 2 Subnets' with a list of existing subnets. At the bottom right of the sidebar, there's a red button labeled 'Terminate'.

We are going to use the default route table.

Bare Metal Cloud Service x Brian

Secure | https://console.r1.oracleiaas.com/#/a/networking/vcn/ocid1.vcn.oc1.seaaaaaaaaaawn3eojyvrtus5vpetb5bxujlk5ea67rjfigqchquigssfpmlta

ORACLE® Bare Metal Cloud Services

brian Support Documentation

Home | Identity | Compute | Database | Networking | Storage | Audit

Networking » Virtual Cloud Networks » Virtual Cloud Network Details

VCN AVAILABLE

Resources

- Subnets (2)
- Route Tables (1)
- Internet Gateways (0)
- Dynamic Routing Gateways (0)
- Security Lists (1)

Create Subnet help cancel

If the Route Table, DHCP Options, or Security Lists are in a different Compartment than the Subnet, [click here](#) to enable Compartment selection for those resources.

NAME OPTIONAL

data

AVAILABILITY DOMAIN

GBTE:SEA-AD-1

CIDR BLOCK

172.16.1.0/24

Specified IP addresses: 172.16.1.0-172.16.1.255 (256 IP addresses)

ROUTE TABLE

Select a Route Table

Default Route Table for ExaCS\_Network

DNS LABEL

data

Only letters and numbers, starting with a letter. 15 characters max.

DNS DOMAIN NAME (READ-ONLY)

data.

Table: Default Route Table for ExaCS\_Network

DHCP Options: Default DHCP Options for ExaCS\_Network

Security Lists: [ ]

Terminate

The screenshot shows the Oracle Bare Metal Cloud Service Networking interface. A callout bubble contains the text: "As well as the default DHCP Options. You can use custom ones if we had previously created them." A red arrow points from this callout to the "Default DHCP Options" dropdown menu, which is currently displaying "Default DHCP Options for ExaCS\_Network".

Specified IP addresses: 172.16.1.0-172.16.1.255 (256 IP addresses)

ROUTE TABLE

Default Route Table for ExaCS\_Network

USE VCN RESOLVER FOR DNS

DNS LABEL

data

Only letters and numbers, starting with a letter. 15 characters max.

DNS DOMAIN NAME (READ-ONLY)

data.

DHCP OPTIONS

Select DHCP Options

Select DHCP Options

Default DHCP Options for ExaCS\_Network

X Default Security List for ExaCS\_Network

Create

Displaying 2 Subnets

	backup	CIDR Block:	Availability Domain:	Route Table:	DHCP Options:
S	OCID: ...us7adq	172.16.2.0/3 0	GBTE:SEA-AD-1 Virtual Router MAC	Default Route Table for ExaCS_Network	Default DHCP Options for ExaCS_Network
				Security Lists:	Terminate

The screenshot shows the Oracle Bare Metal Cloud Service Networking interface. A modal window is open for creating a new subnet. The modal contains fields for 'ROUTE TABLE' (set to 'Default Route Table for ExaCS\_Network'), 'USE VCN RESOLVER FOR DNS' (checkbox checked), 'DNS LABEL' (text input 'data'), 'DNS DOMAIN NAME' (text input 'data'), 'DHCP OPTIONS' (text input 'Default DHCP Options for ExaCS\_Network'), and 'Security Lists' (list containing 'Default Security List for ExaCS\_Network'). A large callout bubble points to the 'Create' button at the bottom-left of the modal. Below the modal, a table lists existing subnets: one named 'backup' with OCID ...us7adq, CIDR Block 172.16.2.0/3, Availability Domain GBTE:SEA-AD-1, Route Table Default Route Table for ExaCS\_Network, and DHCP Options Default DHCP Options for ExaCS\_Network. A red arrow points from the callout bubble to the 'Create' button.

Specified IP addresses: 172.16.1.0-172.16.1.255 (256 IP addresses)

ROUTE TABLE

Default Route Table for ExaCS\_Network

USE VCN RESOLVER FOR DNS

DNS LABEL

data

Only letters and numbers, starting with a letter. 15 characters max.

DNS DOMAIN NAME (READ-ONLY)

data.

DHCP OPTIONS

Default DHCP Options for ExaCS\_Network

Security Lists

Default Security List for ExaCS\_Network

When done, we can click the Create button.

	Subnet Name	OCID	CIDR Block	Availability Domain	Route Table	DHCP Options
	backup	...us7adq	172.16.2.0/3	GBTE:SEA-AD-1	Default Route Table for ExaCS_Network	Default DHCP Options for ExaCS_Network

Displaying 2 Subnets

Bare Metal Cloud Service X Brian

Secure | https://console.r1.oracleiaas.com/#/a/networking/vcns/ocid1.vcn.oc1.seaaaaaaaaaawn3eojyvrtus5vpetb5bxujirk5ea67rjfigqchquigssfpmlta

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Home | Identity | Compute | Database | **Networking** | Storage | Audit

**VCN**

AVAILABLE

CIDR Block: 172.16.0.0/22  
Compartment: dbaasexadat...  
Created: Wed, 19 Apr 2017 12:42:00

We have now created our data subnet.

Subnets in dbaasexadat... (root) Compartment

Displaying 1 Subnets

**Create Subnet**

Subnet	data	CIDR Block:	Availability Domain:	Route Table:	DHCP Options:
S	data OCID: ...jejagg	172.16.1.0/24	GBTE:SEA-AD-1	Default Route Table for ExaCS_Network	Default DHCP Options for ExaCS_Network
		Virtual Router MAC Address: 00:00:17:47:DB:A1	DNS Domain Name: data...	Security Lists: Default Security List for ExaCS_Network	

AVAILABLE

Terminate

Resources

Subnets (1)

Route Tables (1)

Internet Gateways (0)

Dynamic Routing Gateways (0)

Security Lists (1)

DHCP Options (1)

Compartment

Bare Metal Cloud Services - Oracle

Secure | https://console.r1.oracleiaas.com/#/a/networking/vcn/ocid1.vcn.oc1.seaaaaaaaaaaw3eojyvrtus5vpeth5bwu1dk5ea67rifqachquqisfomita

**ORACLE® Bare M**

Resources

Subnets (2)

- Route Tables (1)
- Internet Gateways (0)
- Dynamic Routing Gateways (0)
- Security Lists (1)
- DHCP Options (1)

Compartment

Customersea1

Displaying 2 Subnets

**Create Subnet**

**172.16.2.0**

<b>S</b> AVAILABLE	backup OCID: ...lctdq... <a href="#">Show</a> <a href="#">Copy</a>	CIDR Block: 172.16.2.0/24 Availability Domain: GBTE:SEA-AD-1 DNS Domain Name: backup... Virtual Router MAC Address: 00:00:17:47:DB:A1	Route Table: Default Route Table for ExaCS Network Security Lists: Default Security List for ExaCS Network DHCP Options: Default DHCP Options for ExaCS Network
-----------------------	--	--	---

<b>S</b> AVAILABLE	data OCID: ...jejagg... <a href="#">Show</a> <a href="#">Copy</a>	CIDR Block: 172.16.1.0/24 Availability Domain: GBTE:SEA-AD-1 DNS Domain Name: data... Virtual Router MAC Address: 00:00:17:47:DB:A1	Route Table: Default Route Table for ExaCS Network Security Lists: Default Security List for ExaCS Network DHCP Options: Default DHCP Options for ExaCS Network
-----------------------	---	--	---

Using the same process as we did for the data subnet, we can create a backup subnet. We just use a slightly different IP range.

Tenancy OCID: ocid1.tenancy.oc1..aaaaaaaaaj3p2iquu45w7kfydtigbkmwcoshrlyxjv5yn3deux3fa6cyxda

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Bare Metal Cloud Service x

Secure | https://console.r1.oracleiaas.com/#/a/networking/vcn/ocid1.vcn.oc1.seaaaaaaaaaaw3eojyvrtus5vpertb5bxujrk5ea67rjflqchquigssfpmlta Brian X

**ORACLE® Bare Metal Cloud Services**

Home | Identity | Compute | **Database** | **Networking** | Storage | Audit

customersea1 (root) Displaying 2 Subnets

Click the DB Systems menu item under the Database tab.

**Resources**

**Subnets (2)**

- Route Tables (1)
- Internet Gateways (0)
- Dynamic Routing Gateways (0)
- Security Lists (1)
- DHCP Options (1)

**Compartment**

- dbaasexadatacustomersea1 (root)

**Create Subnet**

Subnet	Backup OCID: ...lctdq... <a href="#">Show</a> <a href="#">Copy</a>	CIDR Block: 172.16.2.0/24	Availability Domain: GBTE:SEA-AD-1	Route Table: Default Route Table for ExaCS Network	DHCP Options: Default DHCP Options for ExaCS Network
 AVAILABLE	backup OCID: ...lctdq... <a href="#">Show</a> <a href="#">Copy</a>	CIDR Block: 172.16.2.0/24	Availability Domain: GBTE:SEA-AD-1	Route Table: Default Route Table for ExaCS Network	DHCP Options: Default DHCP Options for ExaCS Network
 AVAILABLE	data OCID: ...jejagg... <a href="#">Show</a> <a href="#">Copy</a>	CIDR Block: 172.16.1.0/24	Availability Domain: GBTE:SEA-AD-1	Route Table: Default Route Table for ExaCS Network	DHCP Options: Default DHCP Options for ExaCS Network

Tenancy OCID: ocid1.tenancy.oc1..aaaaaaaaaj3p2iquu45w7kfydtigbkkmwcoshrlyxjv5yn3deux3fa6cyxda

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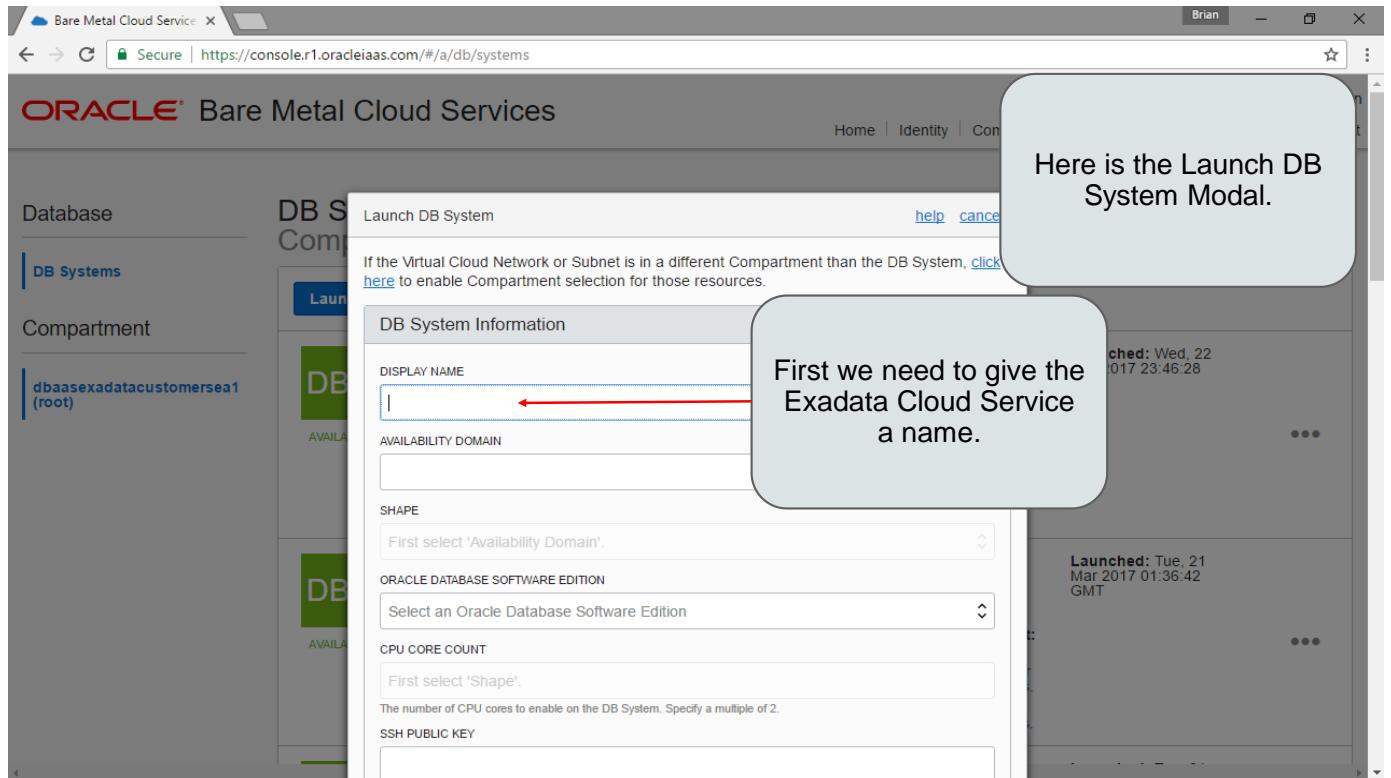
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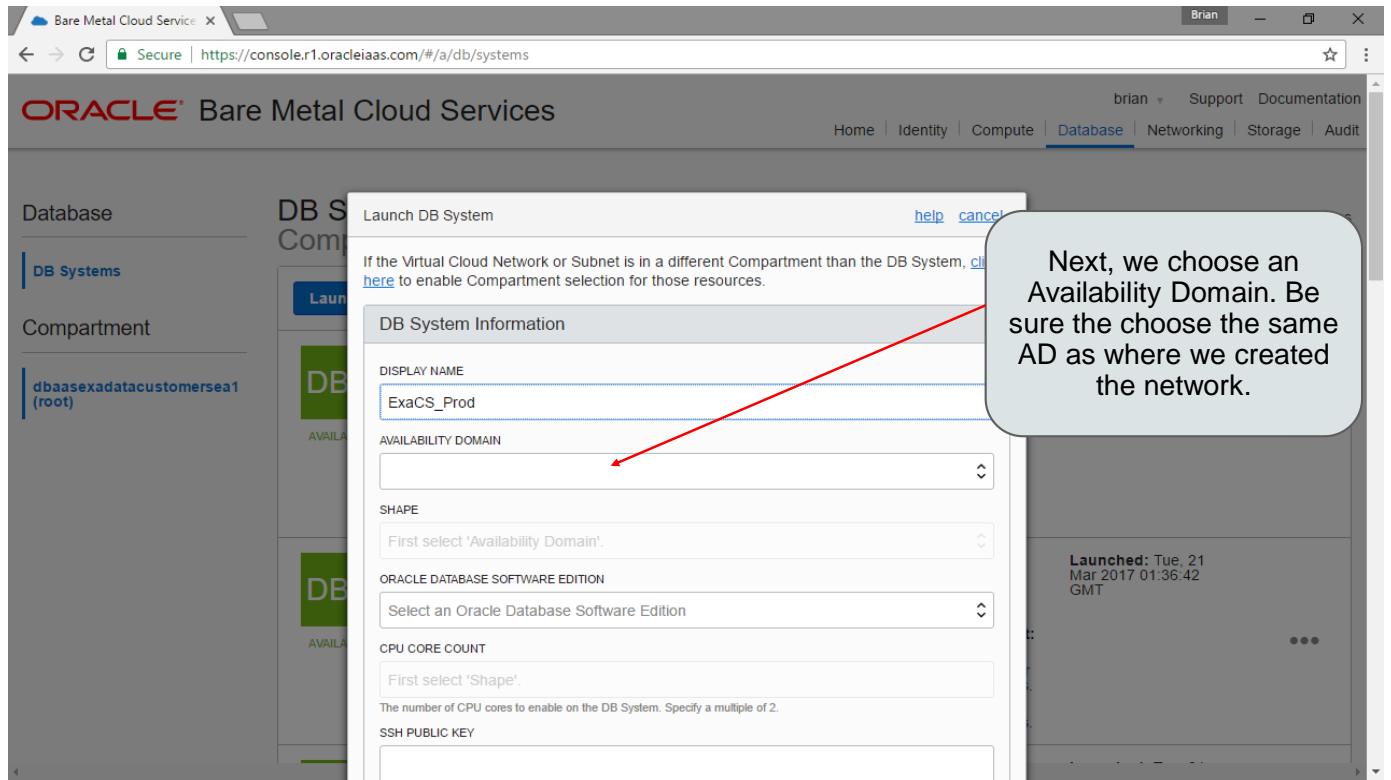
https://console.r1.oracleiaas.com/#/a/db/systems

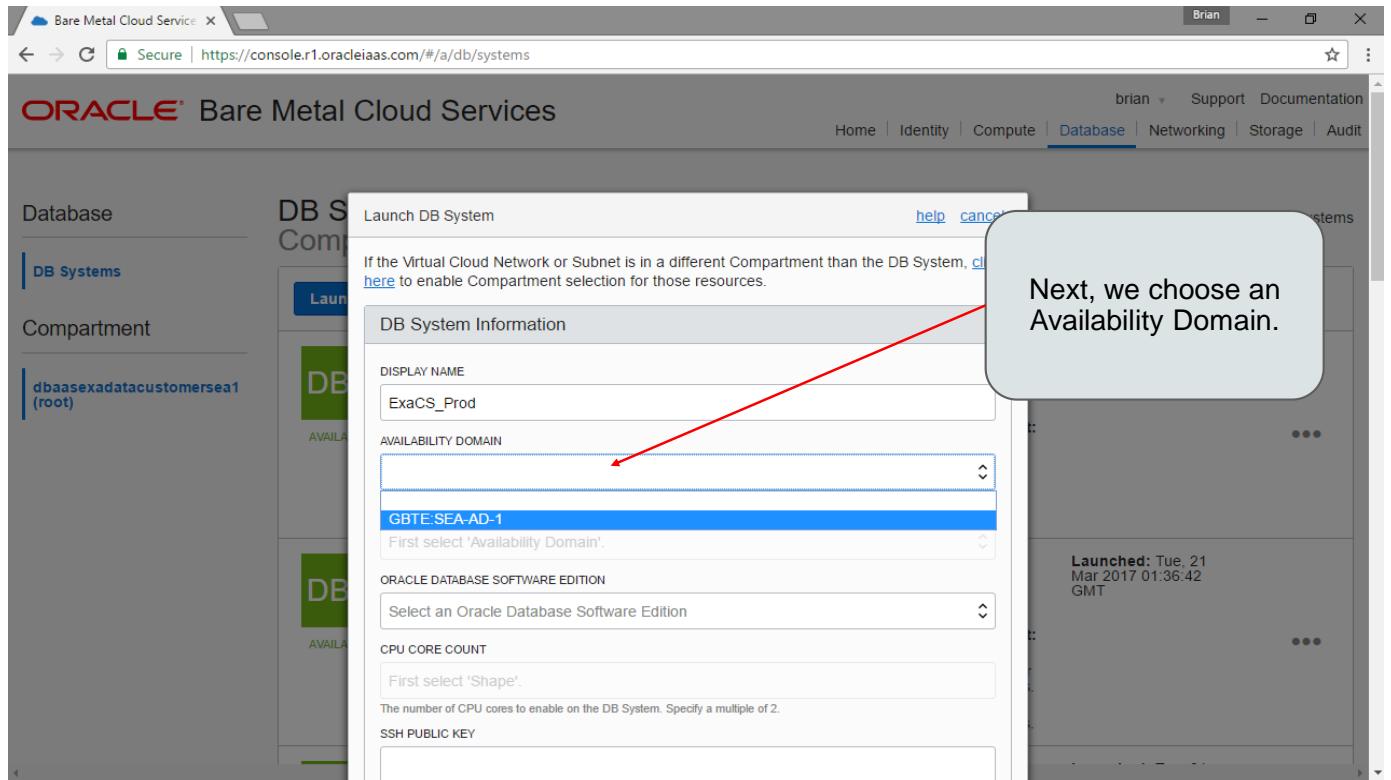
The screenshot shows the Oracle Bare Metal Cloud Services console. The URL is https://console.r1.oracleiaas.com/#/a/db/systems. The top navigation bar includes 'Bare Metal Cloud Service' (selected), 'Secure', and the user 'Brian'. The main menu has links for Home, Identity, Compute, Database (selected), Networking, Storage, and Audit.

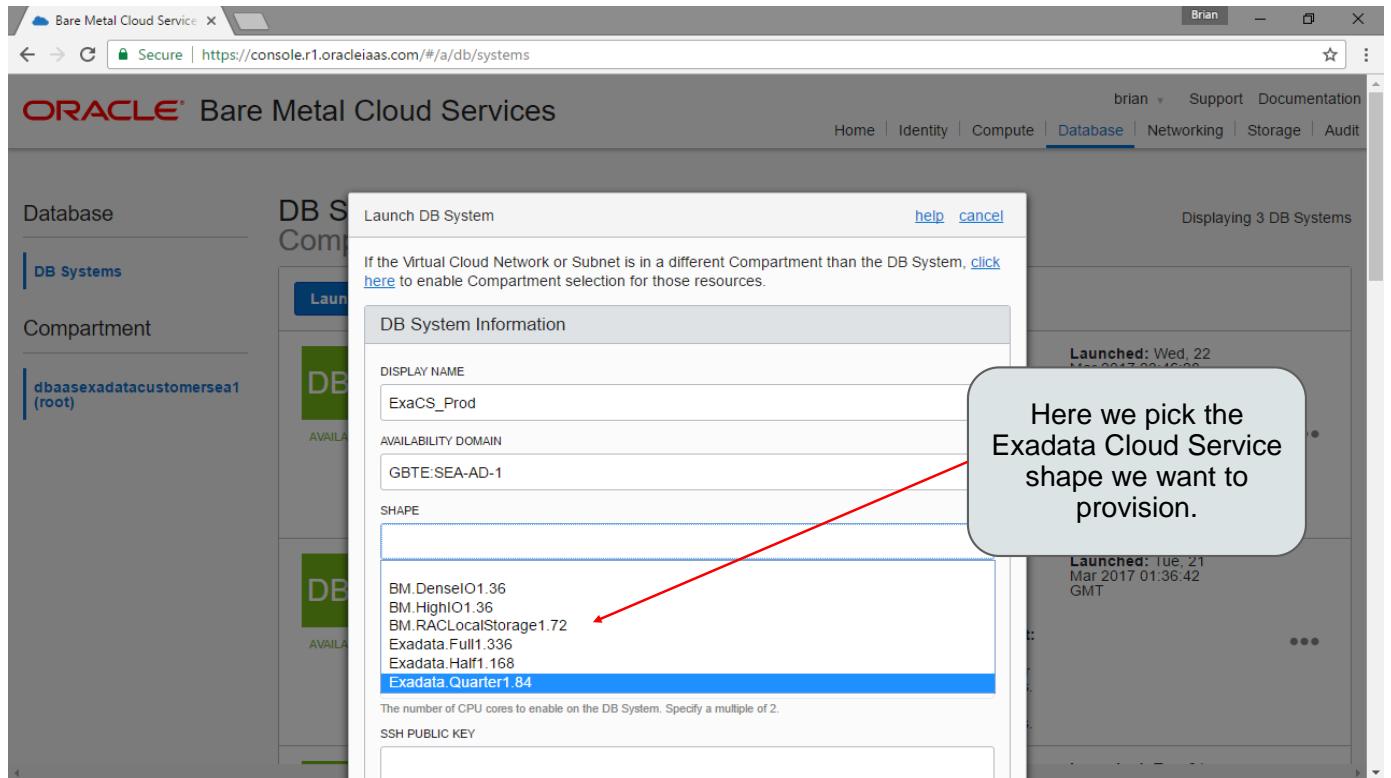
The left sidebar shows 'Database' and 'DB Systems' (selected). Under 'Compartment', it lists 'dbasesexadatacustomersea1 (root)'. The main content area displays 'DB Systems in dbasesexadatacustomersea1 (root) Compartment' with a message: 'Nothing here? Possible reasons: • This Compartment does not exist • You don't have access to this Compartment'. A blue button labeled 'Launch DB System' is visible. A red arrow points from a callout box to this button. The callout box contains the text: 'To start the Exadata Cloud Service provisioning and DB creation process, click the Launch DB System button.'

At the bottom, there is tenant information: 'Tenancy OCID: ocid1.tenancy.oc1..aaaaaaaaaj3p2iquu45w7kfydtigbkrmwcoshrlxyjjv5yn3deux3fa6cyda' and links for About Oracle, Contact Us, Legal Notices, Terms of Use, and Privacy. Copyright notice: 'COPYRIGHT © 2016, ORACLE AND/OR ITS AFFILIATES. ALL RIGHTS RESERVED.'









Bare Metal Cloud Service x Brian

Secure | https://console.r1.oracleiaas.com/#/a/db/systems

# ORACLE® Bare Metal Cloud Services

brian Support Documentation

Home | Identity | Compute | **Database** | Networking | Storage | Audit

Database

DB Systems

Compartment

dbasecustomersea1 (root)

DB System Information

DISPLAY NAME: ExaCS\_Prod

AVAILABILITY DOMAIN: GBTE:SEA-AD-1

SHAPE: Exadata.Quarter1.84

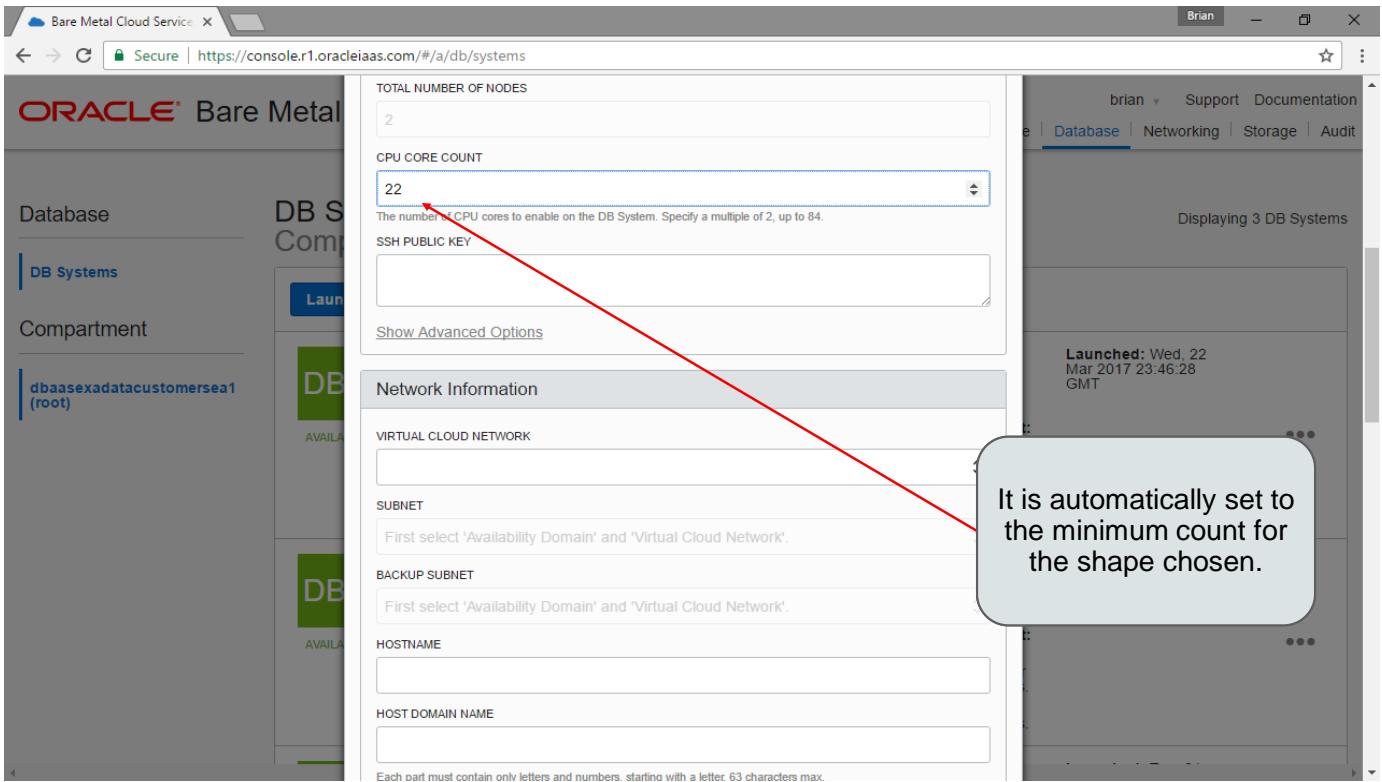
ORACLE DATABASE SOFTWARE EDITION: Enterprise Edition Extreme Performance

CLUSTER NAME (Optional): exacscls

TOTAL NUMBER OF NODES: 2

Launched: Wed, 22 Mar 2017 23:46:28 GMT

We can also name the RAC cluster.



**ORACLE® Bare Metal**

**Database**

**DB Systems**

**Compartment**

**dbasecustomersea1 (root)**

**DB System Configuration**

**Launched**

**DE**

**AVAILABLE**

**TOTAL NUMBER OF NODES**  
2

**CPU CORE COUNT**  
22

The number of CPU cores to enable on the DB System. Specify a multiple of 2, up to 84.

**SSH PUBLIC KEY**

```
ssh-rsa AAAAB3NzaC1yc2EAAAQABAAQDKtJyM5NJH13MUmy9ZKNr1MD712A6xNG
```

[Show Advanced Options](#)

**Network Information**

**VIRTUAL CLOUD NETWORK**

**SUBNET**

First select 'Availability Domain' and 'Virtual Cloud Network'.

Clicking on the Show Advanced Options exposes the following:

Each part must contain only letters and numbers, starting with a letter. 63 characters max.

Here we add a public key to be used for securing the OS on the compute nodes.

Launched: Wed, 22 Mar 2017 23:46:28 GMT

Displaying 3 DB Systems

**TOTAL NUMBER OF NODES**  
2

**CPU CORE COUNT**  
22

The number of CPU cores to enable on the DB System. Specify a multiple of 2, up to 84.

**SSH PUBLIC KEY**

```
ssh-rsa AAAAB3NzaC1yc2EAAAQABAAQDKtJyM5NJDHI3MUmy9ZKNriMD7i2A6xNG
```

**DATA STORAGE PERCENTAGE**

40%  
Select a Data Storage Percentage  
40% (highlighted)  
80%

High disk redundancy (3-way mirroring) is required for all Exadata shapes.

**Network Information**

First select 'Availability Domain' and 'Virtual Cloud Network'.

**Displaying 3 DB Systems**

**Launched:** Wed, 22 Mar 2017 23:46:28 GMT

**Launched:** Tue, 21 Mar 2017 01:36:42 GMT

Here we set if we want to use local and cloud or cloud only backups for our ExaCS. Using 40%, we reserve 60% of the disk for backups and 40% for data, thus allowing local backups. Selecting 80%, we use 80% for data and 20% for backups, which would prevent local backups and enable cloud only backups.

Bare Metal Cloud Service X

Secure | https://console.r1.oracleiaas.com/#/a/db/systems Brian

ORACLE Bare Metal

Database

DB Systems

Compartment

dbasecustomersea1 (root)

DB System Configuration

DB System Status

Launched

DB System Status

DB System Status

DB System Status

TOTAL NUMBER OF NODES  
2

CPU CORE COUNT  
22

The number of CPU cores to enable on the DB System. Specify a multiple of 2, up to 84.

SSH PUBLIC KEY  
`ssh-rsa AAAAB3NzaC1yc2EAAAQABAAQDKtJyM5NJH13MUmy9ZKNriMD7i2A6xNG`

Hide Advanced Options

DATA STORAGE PERCENTAGE  
40%

DISK REDUNDANCY  
High

High disk redundancy (3-way mirroring) is required for all Exadata shapes.

Network Information

VIRTUAL CLOUD NETWORK

SUBNET  
First select 'Availability Domain' and 'Virtual Cloud Network'.

BACKUP SUBNET  
First select 'Availability Domain' and 'Virtual Cloud Network'.

brian Support Documentation

Database Networking Storage Audit

Displaying 3 DB Systems

Launched: Wed, 22 Mar 2017 23:46:28 GMT

Launched: Tue, 21 Mar 2017 01:36:42 GMT

Scanning down the modal we have the Networking section.

Bare Metal Cloud Service

Secure | https://console.r1.oracleiaas.com/#/a/db/systems

ORACLE® Bare Metal

Database

DB Systems

Compartment

dbasecustomersea1 (root)

DB System Configuration

LAUNCH

VIRTUAL CLOUD NETWORK

SUBNET

HOSTNAME

HOST DOMAIN NAME

HOST AND DOMAIN URL

CREATE DATABASE FROM

CREATE NEW DATABASE

CREATE FROM BACKUP

DATABASE NAME

Launched: Wed, 22 Mar 2017 23:46:28 GMT

Launched: Tue, 21 Mar 2017 01:36:42 GMT

Bare Metal Cloud Service

Secure | https://console.r1.oracleiaas.com/#/a/db/systems

ORACLE® Bare Metal

Database

DB Systems

Compartment

dbasecustomerse1 (root)

DB S Comp Launch DB AVAILA DB AVAILA

Network Information

VIRTUAL CLOUD NETWORK

- 192
- customer1
- customer2
- ExaCS\_Network**

First select 'Availability Domain' and 'Virtual Cloud Network'

HOSTNAME

HOST DOMAIN NAME

Each part must contain only letters and numbers, starting with a letter. 63 characters max.

HOST AND DOMAIN URL

First enter a 'Host Name' and 'Host Domain Name'.

Database Information

CREATE DATABASE FROM

CREATE NEW DATABASE

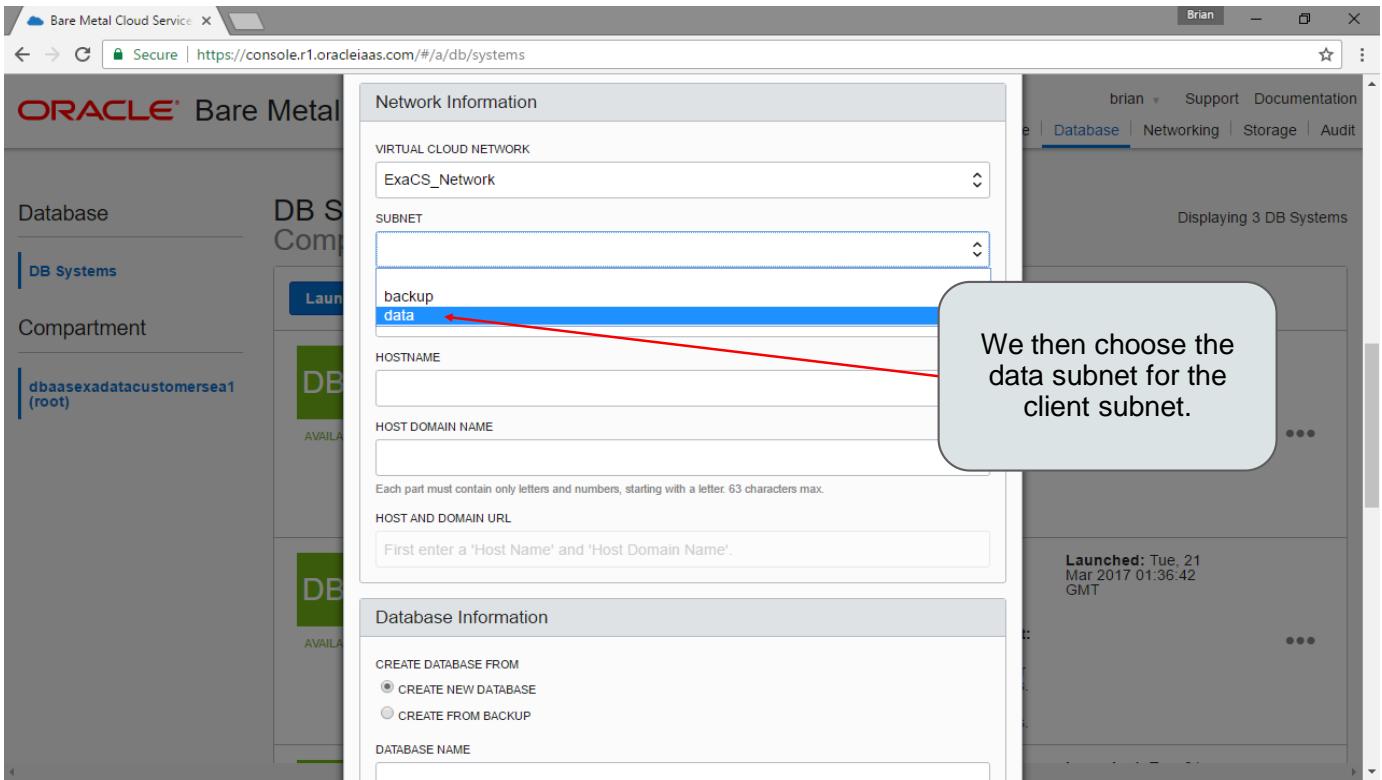
CREATE FROM BACKUP

DATABASE NAME

For the Virtual Cloud Network, we can choose the one we created before we started the DB process.

Displaying 3 DB Systems

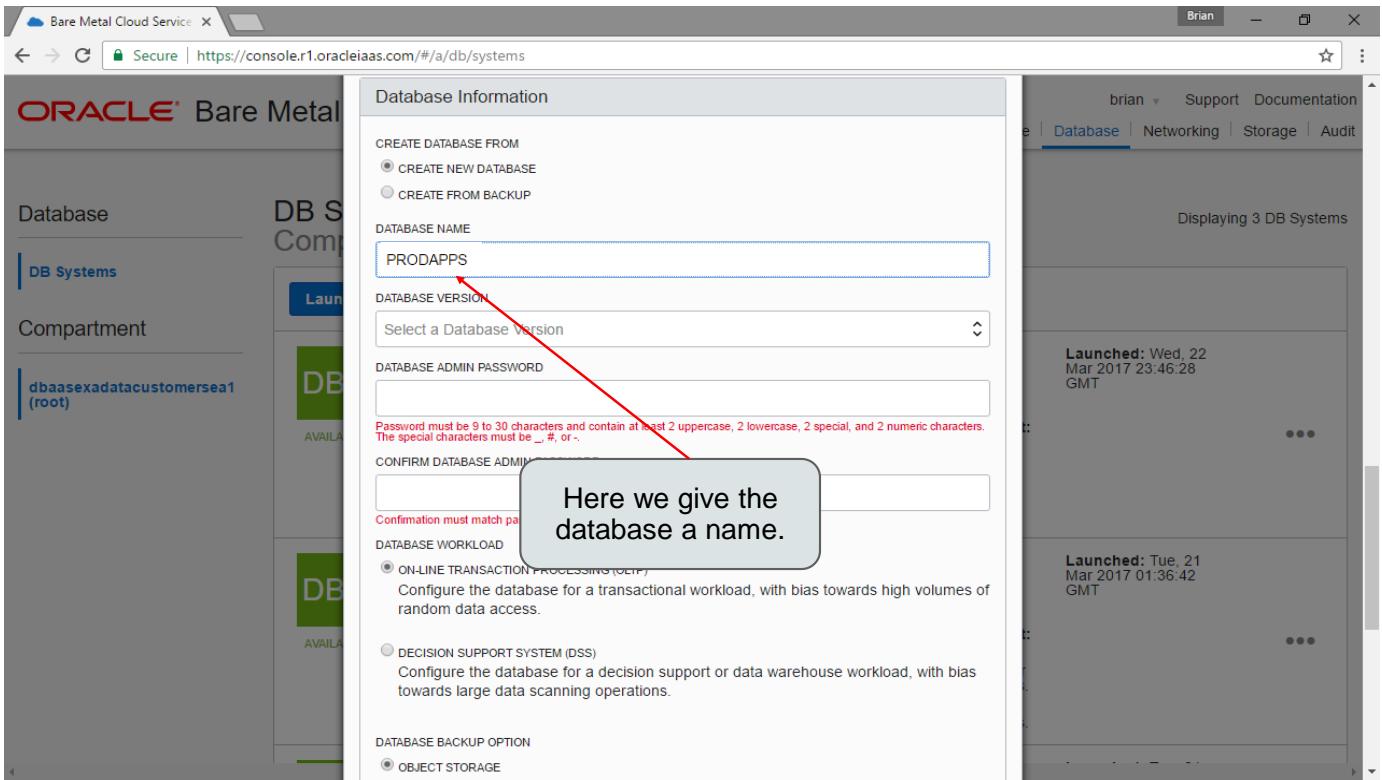
Launched: Tue, 21 Mar 2017 01:36:42 GMT



And the backup subnet we created for the backup subnet attribute.

The screenshot shows the Oracle Bare Metal Cloud Service console interface. On the left, a sidebar navigation includes 'Database' (selected), 'DB Systems' (highlighted in blue), 'Compartment', and a list item 'dbasesexadatacustomersea1 (root)'. The main content area is titled 'Network Information' and contains fields for 'VIRTUAL CLOUD NETWORK' (ExaCS\_Network), 'SUBNET' (data), 'BACKUP SUBNET' (backup), and 'HOSTNAME' (exacs). A red arrow points from a callout bubble to the 'HOSTNAME' input field. The callout bubble contains the text: 'Here we set the hostname for the DB service.' To the right, a list of 'DB Systems' is shown with one entry: 'Launched: Wed, 22 Mar 2017 01:36:42 GMT'. The top right corner shows a user profile 'Brian' and navigation links for 'Support', 'Documentation', 'Database' (selected), 'Networking', 'Storage', and 'Audit'.

The screenshot shows the Oracle Bare Metal Cloud Service interface. On the left, there's a sidebar with 'Database' and 'DB Systems' selected. In the center, a large callout box contains the text: 'Start by choosing either a new database or to create a database from a backup.' A red arrow points from this box to the 'CREATE DATABASE FROM' section of the main form. The main form has a title 'Database Information' and includes fields for 'CREATE DATABASE FROM' (radio buttons for 'CREATE NEW DATABASE' and 'CREATE FROM BACKUP'), 'DATABASE NAME', 'DATABASE VERSION' (a dropdown menu), 'DATABASE ADMIN PASSWORD' (with a note about password complexity), 'FIRM DATABASE ADMIN PASSWORD' (with a note about matching the first password), 'DATABASE WORKLOAD' (radio buttons for 'ON-LINE TRANSACTION PROCESSING (OLTP)' and 'DECISION SUPPORT SYSTEM (DSS)', with notes for each), and 'DATABASE BACKUP OPTION' (radio button for 'OBJECT STORAGE'). To the right, a summary table displays two database systems, each with a 'Launched' timestamp (Wed, 22 Mar 2017 23:46:28 GMT and Tue, 21 Mar 2017 01:36:42 GMT). A callout box on the right side of the main form says: 'Next up is the Database Information details section.'



The screenshot shows the Oracle Bare Metal Cloud Service console at <https://console.r1.oracleiaas.com/#/a/db/systems>. The left sidebar shows 'Database' and 'DB Systems' selected. The main area is titled 'Database Information' and contains fields for 'CREATE DATABASE FROM' (radio buttons for 'CREATE NEW DATABASE' and 'CREATE FROM BACKUP'), 'DATABASE NAME' (text input 'PRODAPPS'), 'DATABASE VERSION' (dropdown menu showing 'Select a Database Version' and options '11.2.0.4', '12.1.0.2', and '12.2.0.1' with '12.2.0.1' highlighted), 'CONFIRM DATABASE ADMIN PASSWORD' (text input), and 'DATABASE WORKLOAD' (radio buttons for 'OLYMPIC TRANSACTION PROCESSING (OLTP)' and 'DECISION SUPPORT SYSTEM (DSS)') with 'OLTP' selected. A callout bubble points to the '12.2.0.1' option in the dropdown. The right sidebar shows a list of three database systems: 'dbasecustomersea1 (root)' (launched Wed, 22 Mar 2017 23:46:28 GMT), 'dbasecustomersea2 (root)' (launched Tue, 21 Mar 2017 01:36:42 GMT), and 'dbasecustomersea3 (root)' (launched Mon, 20 Mar 2017 23:46:28 GMT).

Next, choose a database version. We can pick from 11.2.0.4, 12.1.0.2 and 12.2.0.1.

The screenshot shows the Oracle Bare Metal Cloud Service interface. On the left, a sidebar lists 'Database' and 'DB Systems'. Under 'DB Systems', there is a section for 'Compartment' with a list item 'dbasesexadatacustomersea1 (root)'. The main panel is titled 'Database Information' and contains the following fields:

- CREATE DATABASE FROM**:
  - CREATE NEW DATABASE
  - CREATE FROM BACKUP
- DATABASE NAME**: PRODAPPS
- DATABASE VERSION**: 12.2.0.1
- PDB NAME (Optional)**: OE (highlighted with a red arrow)
- DATABASE ADMIN PASSWORD**: (redacted)
- CONFIRM DATABASE ADMIN PASSWORD**: (redacted)
- Confirmation must match password above.**
- DATABASE WORKLOAD**:
  - ON-LINE TRANSACTION PROCESSING (OLTP)  
Configure the database for a transactional workload, with bias towards high volumes of random data access.
  - DECISION SUPPORT SYSTEM (DSS)  
Configure the database for a decision support or data warehouse workload, with bias towards large data scanning operations.

In the top right corner, a user 'brian' is logged in, and the navigation bar includes 'Support', 'Documentation', 'Database' (which is selected), 'Networking', 'Storage', and 'Audit'. A message at the bottom right says 'Displaying 3 DB Systems' and 'Launched: Wed, 22 Mar 2017 23:46:28 GMT'.

**If we pick 12.1 or 12.2, the Database name will be the CDB name and here we set the PDB name.**

Bare Metal Cloud Service X

Secure | https://console.r1.oracleiaas.com/#/a/db/systems Brian

ORACLE® Bare Metal

Database

DB Systems

Compartment

dbasecustomersea1 (root)

DB S Comp Launch DB AVAILA DB AVAILA

Database Information

CREATE DATABASE FROM

CREATE NEW DATABASE

CREATE FROM BACKUP

DATABASE NAME

PRODAPPS

DATABASE VERSION

12.2.0.1

PDB NAME (Optional)

OE

DATABASE ADMIN PASSWORD

.....

Password must be 9 to 30 characters and contain at least 2 uppercase, 2 lowercase, 2 special, and 2 numeric characters. The special characters must be \_, #, or -.

CONFIRM DATABASE ADMIN PASSWORD

.....

Confirmation must match password above.

DATABASE WORKLOAD

ON-LINE TRANSACTION PROCESSING (OLTP)  
Configure the database for a transactional workload, with bias towards high volumes of random data access.

DECISION SUPPORT SYSTEM (DSS)  
Configure the database for a decision support or data warehouse workload, with bias towards large data scanning operations.

brian Support Documentation Database Networking Storage Audit

The following two fields are for the database password. The password must conform to the rules outlined below the fields.

Launched: Tue, 21 Mar 2017 01:36:42 GMT

The screenshot shows the Oracle Bare Metal Cloud Service console at <https://console.r1.oracleiaas.com/#/a/db/systems>. The left sidebar shows 'Database' and 'DB Systems'. The main area is titled 'OE' and contains fields for 'DATABASE ADMIN PASSWORD' and 'CONFIRM DATABASE ADMIN PASSWORD'. A red box highlights the 'DATABASE WORKLOAD' section, which includes options for 'ON-LINE TRANSACTION PROCESSING (OLTP)' (selected) and 'DECISION SUPPORT SYSTEM (DSS)'. A callout bubble points to this section with the text: 'The database workload section will allow us to choose the type of database we create, an OLTP or DSS database.' The right sidebar shows 'Displaying 3 DB Systems' and a launch timestamp: 'Launched: Wed, 22 Mar 2017 23:46:28 GMT'.

The screenshot shows the Oracle Bare Metal Cloud Service console at <https://console.r1.oracleiaas.com/#/a/db/systems>. The left sidebar shows a tree structure with 'Database' selected, under which 'DB Systems' is highlighted. A sub-tree for 'Compartment' shows a node 'dbasesexadatacustomersea1 (root)' with a green 'AVAILABLE' status. The main panel is titled 'OE' and contains fields for 'DATABASE ADMIN PASSWORD' and 'CONFIRM DATABASE ADMIN PASSWORD'. Below these is a note: 'Password must be 9 to 30 characters and contain at least 2 uppercase, 2 lowercase, 2 special, and 2 numeric characters. The special characters must be \_, #, or -.' Under 'DATABASE WORKLOAD', the 'ON-LINE TRANSACTION PROCESSING (OLTP)' option is selected. In the 'DATABASE BACKUP OPTION' section, the 'LOCAL AND OBJECT STORAGE' option is selected, which is highlighted with a red box and a callout bubble. The callout bubble contains the text: 'Depending on what we chose for the disk percentages, this section will allow us to choose a backup method for the database we are creating.' An arrow points from the top of the 'LOCAL AND OBJECT STORAGE' section towards this callout. The right sidebar shows a navigation menu with 'Database' selected, and a message 'Displaying 3 DB Systems'. At the bottom right of the main panel, it says 'Launched: Tue, 21 Mar 2017 01:36:42 GMT'.

The screenshot shows the Oracle Bare Metal Cloud Service console at <https://console.r1.oracleiaas.com/#/a/db/systems>. A modal window titled "CONFIRM DATABASE ADMIN PASSWORD" is open, prompting for password confirmation. The main configuration area is visible, showing options for "DATABASE WORKLOAD" (ON-LINE TRANSACTION PROCESSING (OLTP) selected), "DATABASE BACKUP OPTION" (LOCAL AND OBJECT STORAGE selected), and "CHARACTER SET" (AL32UTF8). A callout bubble highlights the "Advanced Options" section, which includes "CHARACTER SET" (AL32UTF8) and "NATIONAL CHARACTER SET" (AL16UTF16). A red arrow points from the "Hide Advanced Options" link in the modal to the "Advanced Options" callout.

CONFIRM DATABASE ADMIN PASSWORD

.....

Confirmation must match password above.

DATABASE WORKLOAD

ON-LINE TRANSACTION PROCESSING (OLTP)  
Configure the database for a transactional workload, with bias towards high volumes of random data access.

DECISION SUPPORT SYSTEM (DSS)  
Configure the database for a decision support towards large data scanning operations.

DATABASE BACKUP OPTION

OBJECT STORAGE  
Configure automatic database back up to Oracle

LOCAL AND OBJECT STORAGE  
Configure automatic database back up to both the Fast Recovery Area in the RECO disk group and to Oracle Bare Metal Cloud Object Storage.

NO BACKUP  
Do not configure automatic back up.

Hide Advanced Options

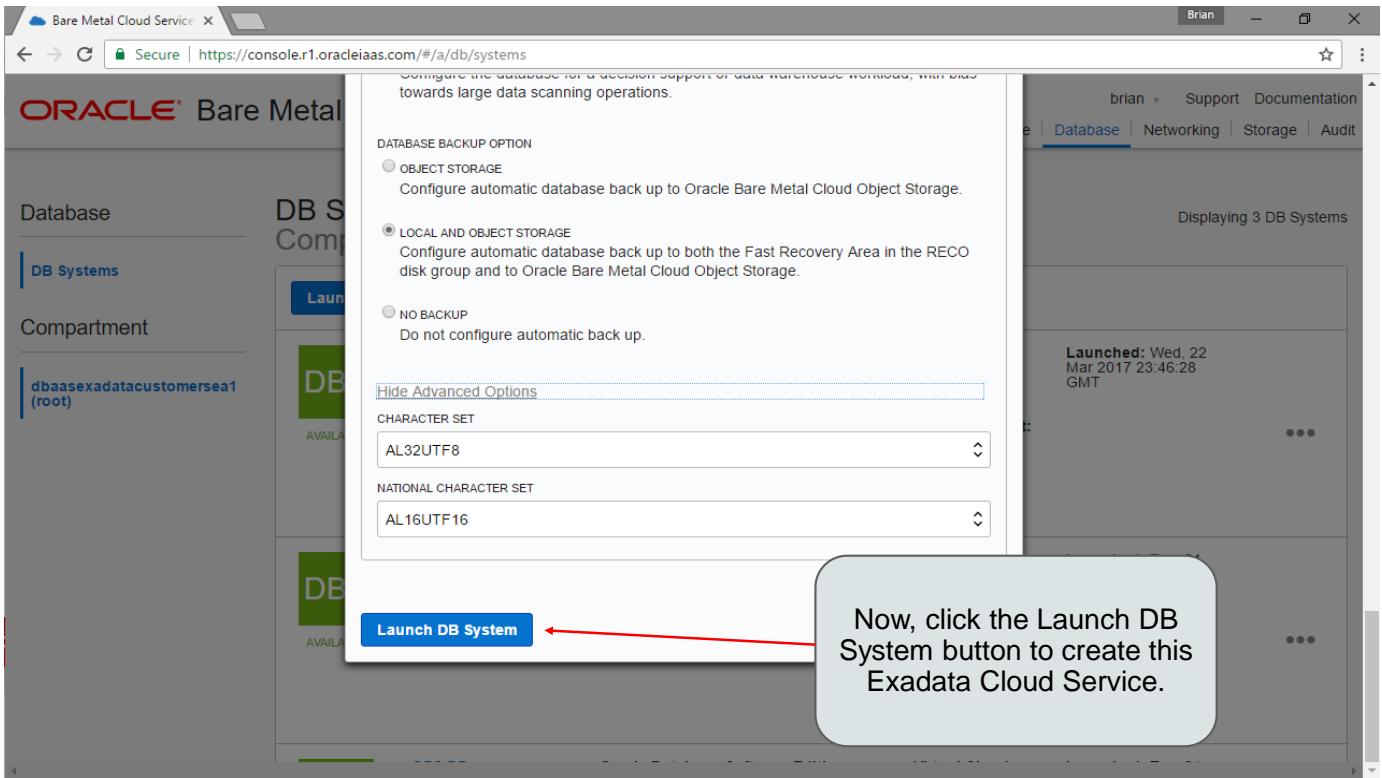
CHARACTER SET

AL32UTF8

NATIONAL CHARACTER SET

AL16UTF16

Opening the Advanced Options, we can choose the database character set and national character set.



Bare Metal Cloud Service X

Secure | https://console.r1.oracleiaas.com/#/a/db/systems Brian

ORACLE® Bare Metal Cloud Services

brian Support Documentation

Home Identity Compute Database Networking Storage Audit

We see our newly created service provisioning in the database systems page.

 PROVISIONING...	<b>PS_DB</b> Availability Domain: GBTE SEA-AD-1 OCID: vzb2kq <a href="#">Show</a> <a href="#">Copy</a>	<b>Oracle Database Software Edition:</b> Enterprise Edition Extreme Performance <b>CPU Core Count:</b> 36 <b>Shape:</b> BM.DenseIO1.36	<b>Virtual Cloud Network:</b> customer1 <b>Subnet:</b> ops <b>Private IP:</b> 10.0.5.2 <b>Public IP:</b> 129.213.241.242
 PROVISIONING...	<b>ExaCS_Prod</b> Availability Domain: GBTE SEA-AD-1 OCID: ...4uraug <a href="#">Show</a> <a href="#">Copy</a>	<b>Oracle Database Software Edition:</b> Enterprise Edition Extreme Performance <b>CPU Core Count:</b> 22 <b>Shape:</b> Exadata.Quarter1.84	<b>Virtual Cloud Network:</b> ExaCS_Network <b>Subnet:</b> data <b>Backup Subnet:</b> backup <b>Private IP:</b> Loading... <b>Public IP:</b> Loading...

Tenancy OCID: ocid1.tenancy.oc1..aaaaaaaaaj3p2iquu45w7kfytigbkmwcoshrlyxjv5yn3deux3fa6cyxda

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Bare Metal Cloud Service X

Secure | https://console.r1.oracleiaas.com/#/a/db/systems Brian

ORACLE® Bare Metal Cloud Services

Home | Identity | Compute | **Database** | Networking | Storage | Audit

Backup

Private IP: Error retrieving values.  
Public IP: Error retrieving values.

And ready to use in a short while.

PS DB

Availability Domain: GBTE SEA-AD-1

OCID: vzb2kq Show Copy

Oracle Database Software Edition: Enterprise Edition Extreme Performance

CPU Core Count: 36

Shape: BM.DenseIO1.36

Virtual Cloud Network: customer1

Subnet: ops

Launched: Tue, 21 Mar 2017 01:09:16 GMT

ExaCS\_Prod

Availability Domain: GBTE SEA-AD-1

OCID: ...4uraug Show Copy

Oracle Database Software Edition: Enterprise Edition Extreme Performance

CPU Core Count: 22

Shape: Exadata.Quarter1

We can click on the database service name to see the details.

PRIVATE IP: Loading...  
PUBLIC IP: Loading...

Tenancy OCID: ocid1.tenancy.oc1..aaaaaaaaajj3p2iquu45w7kfytigbkwmcoshrlyxjv5yn3deux3fa6cyxda

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The screenshot shows the Oracle Bare Metal Cloud Services interface. At the top, there's a navigation bar with links for 'Support' and 'Documentation', and tabs for 'Networking', 'Storage', and 'Audit'. Below the navigation is a main content area for 'ExaCS\_Prod'. On the left, there's a large green hexagonal icon with 'DBS' in white, labeled 'AVAILABLE'. To the right of the icon, the system name 'ExaCS\_Prod' is displayed. Below it are two buttons: 'Scale Up/Down' and 'Terminate'. A callout box highlights the text: 'On the DB System details page we can see all instance level details, databases on the system as well as the networking details.' The main details section lists various configuration parameters:

- Availability Domain: GBTE:SEA-AD-1
- Shape: Exadata.Quarter1.84
- Compartment: dbaasesexadatacustomersea1
- CPU Core Count: 22
- Disk Redundancy: High
- Cluster Name: exacscls
- Port: 1521
- Host Domain Name: data.exacsnetwork.oraclevcn.com

On the right side, more detailed information is shown:

- OCID: ...4uraug [Show](#) [Copy](#)
- Created: Wed, 19 Apr 2017 13:31:11 GMT
- Oracle Database Software Edition: Enterprise Edition Extreme Performance
- Virtual Cloud Network: [ExaCS\\_Network](#)
- Subnet: data
- Backup Subnet: backup
- Hostname: exacs-i8de5

Below this, there's a 'Resources' section with a 'Databases' tab selected, showing one database entry:

Create Database		Displaying 1 Databases	
	PRODAPPS	Database Home: dbhome20170419133111	Database Version: 12.2.0.1
		Launched: Wed, 19 Apr 2017 13:31:11 GMT	Database Workload: OLTP
			Database Unique Name: PRODAPPS_sea1s3
			...

Bare Metal Cloud Service x Brian

Secure | https://console.r1.oracleiaas.com/#/a/db/systems/ocid1.dsbsystem.oc1.sea.abzwljyf4wvbpraero7bepu4gp4s6stdsavg7bl6eme3nj24osh4uraqu

## ORACLE® Bare Metal Cloud Services

Home | Identity | Compute | **Database** | Networking | Storage | Audit

**Created:** Wed, 19 Apr 2017 13:31:11 GMT

**Oracle Database Software Edition:** Enterprise Edition Extreme Performance

**Virtual Cloud Network:** ExaCS\_Network

**Subnet:** data

**Backup Subnet:** backup

**Hostname:** exacs-i8de5

**Shape:** Exadata Quarter1.84

**Compartment:** dbaasexadatacustomersea1

**CPU Core Count:** 22

**Disk Redundancy:** High

**Cluster Name:** exacscls

**Port:** 1521

**Host Domain Name:** data.exacsnetwork.oraclevcn.com

**AVAILABLE**

### Resources

### Databases

Displaying 1 Databases

**Create Database**

DB	PRODAPPS	Database Version: 12.2.0.1
AVAILABLE	Database Home: dbhome20170419133111 Launched: Wed, 19 Apr 2017 13:31:11 GMT	Database Workload: OLTP Database Unique Name: PRODAPPS_sea1s3

Tenancy OCID: ocid1.tenancy.oc1..aaaaaaaaaj3p2iquu45w7kfydtigbkmwcoshrlyxjjv5yn3deux3fa6cyxda

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# OCPU Bursting



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## Online Scale-up Through Compute Bursting

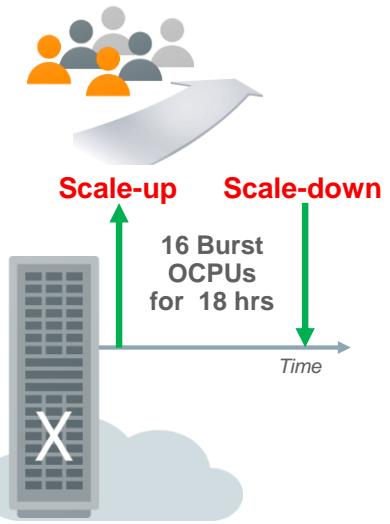
Grow/shrink compute capacity to meet peak or seasonal demands

Dynamically add or reduce OCPUs as often as once an hour

Hourly rates to lower costs – avoids the need to provision for peak

Burst up to 2x the base number of OCPUs or max capacity (whichever is lower)

GUI-based self-service



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The screenshot shows the Oracle Bare Metal Cloud Services interface. The main title is "ExaCS\_Prod". On the left, there's a green hexagonal icon with "DBS" and "AVAILABLE" text. The central area displays system details: Availability Domain: GBTE-SEA-AD-1, Shape: Exadata.Quarter1.84, Compartment: dbaasexadatacustomersea1, CPU Core Count: 22, Disk Redundancy: High, Cluster Name: exacscls, Port: 1521, and Host Domain Name: data.exacsnetwork.oraclevcn.com. A red arrow points from a callout box to the "Scale Up/Down" button. The callout box contains the text: "Click the Scale Up/Down button to enable bursting." To the right, it says "Edition Extreme". Below this, the "Resources" section shows "Nodes (2)" and the "Databases" section shows "Displaying 1 Databases" with a single entry: PRODAPPS, Database Home: dbhome20170419133111, Launched: Wed, 19 Apr 2017 13:31:11 GMT, Database Version: 12.2.0.1, Database Workload: OLTP, Database Unique Name: PRODAPPS\_sea1s3, and a three-dot menu icon.

The screenshot shows the Oracle Bare Metal Cloud Services interface. A modal window titled "Scale Up/Down CPU Core Count" is open, prompting the user to enter a value for the CPU core count. The input field contains the value "22". Below the input field, a note states: "The number of CPU cores to enable on the DB System. Specify a multiple of 2, up to 84." There are "Submit" and "cancel" buttons at the bottom of the modal. In the background, the main page displays details for a DB system named "DBS". The DB system is marked as "AVAILABLE" and has a green hexagonal icon. It is associated with a compartment named "dbasesexadatacustomersea1". Configuration details include: CPU Core Count: 22, Disk Redundancy: High, Cluster Name: exacscls, Port: 1521, Host Domain Name: data.exacsnetwork.oraclevcn.com. To the right, Oracle Database Software Edition is listed as "Enterprise Edition Extreme Performance", and Virtual Cloud Network is "ExaCS\_Network". Subnet is "data", Backup Subnet is "backup", and Hostname is "exacs.i8de65". The timestamp on the page is "7 13:31:11 GMT". On the left, under "Resources", there is a section for "Nodes (2)". On the right, under "Databases", there is a section titled "Displaying 1 Databases" with a single entry for "PRODAPPS".

# Exadata Cloud Service Management with EM



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**Enterprise Manager sees Exadata Cloud Service as a cluster**

Name	Status	Incidents	Compliance Score(%)	Host
has_cfcldv0420m.us2.oraclecloud.com...	Up	0 0 0 0	100	cfcldv0420m.us2.oraclecloud.com
has_cfcldv0421m.us2.oraclecloud.com...	Up	0 0 0 0	100	cfcldv0421m.us2.oraclecloud.com

Database Name	St	Incidents	Compliance Score(%)	Version
BICSDB_ExaCS	Up	0 0 0 0	100	11.2.0.4.0
CRM_ExaCS	Up	0 0 0 0	100	12.1.0.2.0
DG2_ExaCS	Up	0 0 0 0	100	12.1.0.2.0
SALES_ExaCS	Up	0 0 0 0	100	12.1.0.2.0

Name	Minimum Size	Maximum Size	Important	Active Servers
Free	0	Entire Cluster	0	
Generic	0	Entire Cluster	0	cfcldv0420m cfcldv0421m
ora.BICSDB	0	Entire Cluster	1	cfcldv0420m cfcldv0421m
ora.CRM	0	Entire Cluster	1	cfcldv0420m cfcldv0421m
ora.DG2	0	Entire Cluster	1	cfcldv0420m cfcldv0421m
ora.ORCL	0	Entire Cluster	1	cfcldv0420m cfcldv0421m

EXCSPOC2-009 (Cluster) - X

<https://oraclecloudem.com:7802/em/faces/cluster-home?Adf-Page-Id=35&target=EXCSPOC2-009&type=cluster>

ORACLE Enterprise Manager Cloud Control 13c

EXCSPOC2-009

Cluster Administration

**ASM Disk groups**

Name	Status	Incidents	Compliance Score(%)	Host
has_cfcidv0420m.us2.oraclecloud.com...	Up	0 0 0 0	100	cfcidv0420m.us2.oraclecloud.com
has_cfcidv0421m.us2.oraclecloud.com...	Up	0 0 0 0	100	cfcidv0421m.us2.oraclecloud.com

**Cluster Managed Resources**

Name	Status	Incidents	Compliance Score(%)
+ASM_EXCSPOC2-009	Up	0 6 0 0	100

**Server Pools**

Name	Minimum Size	Maximum Size	Important	Active Servers
Free	0	Entire Cluster	0	
Generic	0	Entire Cluster	0	cfcidv0420m cfcidv0421m
ora.BICS0B	0	Entire Cluster	1	cfcidv0420m cfcidv0421m
ora.CRM	0	Entire Cluster	1	cfcidv0420m cfcidv0421m
ora.DG2	0	Entire Cluster	1	cfcidv0420m cfcidv0421m
ora.ORCL	0	Entire Cluster	1	cfcidv0420m cfcidv0421m
ora.SALES	0	Entire Cluster	1	cfcidv0420m cfcidv0421m

Show Latest Run | Search Job Name | Show Jobs

**EXCSPOC2-009 (Cluster) - X**

<https://oraclecloudem.com:7802/em/faces/cluster-home?Adf-Page-Id=35&target=EXCSPOC2-009&type=cluster>

**ORACLE Enterprise Manager Cloud Control 13c**

**EXCSPOC2-009**

**Cluster Administration**

**Summary**

- Status **Up**
- Cluster Name EXCSPOC2-009
- Hosts Status **Up**
- Clusterware Status **Up**
- Cluster Mode Regular Cluster
- Reconfiguration Activities Happened

**Configuration Changes**

Configuration Changes 8

**Patch Recommendations**

View by  Classification  Target Type

Patch recommendations are not available.

⚠ My Oracle Support preferred credential is not set for any super user. Either set the preferred credentials or change the connection setting to offline and manually upload the metadata required for generating patch recommendations.

No recommendations to report [Learn More](#)

**Job Activity**

Summary of jobs whose start date is within the last 7 days.

Show Latest Run Search Job Name

[Show Jobs](#)

**Cluster databases on the Exadata Cloud Service**

**Clusterware**

Name	Status	Incidents	Compliance Score(%)	Host
has_cfcidv0420m.us2.oraclecloud.com...	<span style="color: green;">Up</span>	0 0 0 0	100	cfcidv0420m.us2.oraclecloud.com
has_cfcidv0421m.us2.oraclecloud.com...	<span style="color: green;">Up</span>	0 0 0 0	100	cfcidv0421m.us2.oraclecloud.com

**Cluster Managed Resources**

**Cluster Databases**

Database Name	Status	Incidents	Compliance Score(%)	Version
BICSDB ExaCS	<span style="color: green;">Up</span>	0 0 0 0	100	11.2.0.4.0
CRM ExaCS	<span style="color: green;">Up</span>	0 0 0 0	100	12.1.0.2.0
DG2 ExaCS	<span style="color: green;">Up</span>	0 0 0 0	100	12.1.0.2.0
SALES ExaCS	<span style="color: green;">Up</span>	0 0 0 0	100	12.1.0.2.0

**Server Pools**

Name	Minimum Size	Maximum Size	Important	Active Servers
Free	0	Entire Cluster	0	
Generic	0	Entire Cluster	0	cfcidv0420m cfcidv0421m
ora.BICSDB	0	Entire Cluster	1	cfcidv0420m cfcidv0421m
ora.CRM	0	Entire Cluster	1	cfcidv0420m cfcidv0421m
ora.DG2	0	Entire Cluster	1	cfcidv0420m cfcidv0421m
ora.ORCL	0	Entire Cluster	1	cfcidv0420m cfcidv0421m

**EXCSPOC2-009 (Cluster) - X**

<https://oraclecloudem.com:7802/em/faces/cluster-home?Adf-Page-Id=35&target=EXCSPOC2-009&type=cluster>

**ORACLE Enterprise Manager Cloud Control 13c**

**EXCSPOC2-009**

Cluster Administration

**Summary**

- Status **Up**
- Cluster Name EXCSPOC2-009
- Hosts Status **Up**
- Clusterware Status **Up**
- Cluster Mode Regular Cluster
- Reconfiguration Activities Happened

**Configuration Changes**

Configuration Changes 8

**Patch Recommendations**

View by Classification Target Type

Patch recommendations are not available.

⚠ My Oracle Support preferred credential is not set for any super user. Either set the preferred credentials or change the connection setting to offline and manually upload the metadata required for generating patch recommendations.

No recommendations to report [Learn More](#)

**Job Activity**

Summary of jobs whose start date is within the last 7 days.

Show Latest Run Search Job Name

**Clusterware**

Name	Status	Incidents	Compliance Score(%)	Host
has_cfcldv0420m.us2.oraclecloud.com...	<span style="color: green;">▲</span>	0 0 0	0	cfcldv0420m.us2.oraclecloud.com
has_cfcldv0421m.us2.oraclecloud.com...	<span style="color: green;">▲</span>	0 0 0	0	cfcldv0421m.us2.oraclecloud.com

**Cluster Managed Resources**

View Cluster Databases

Database Name	St	Incidents	Compliance Score(%)	Version
BICSDB ExaCS	<span style="color: green;">▲</span>	0 0 0	0	11.2.0.4.0
CRM ExaCS	<span style="color: green;">▲</span>	0 0 0	0	12.1.0.2.0
DG2 ExaCS	<span style="color: green;">▲</span>	0 0 0	0	12.1.0.2.0
SALES ExaCS	<span style="color: green;">▲</span>	0 0 0	0	12.1.0.2.0

Click the SALES database on the Exadata Cloud Service

**Server Pools**

Name	Minimum Size	Maximum Size	Important	Active Servers
Free	0	Entire Cluster	0	
Generic	0	Entire Cluster	0	cfcldv0420m cfcldv0421m
ora.BICSDB	0	Entire Cluster	1	cfcldv0420m cfcldv0421m
ora.CRM	0	Entire Cluster	1	cfcldv0420m cfcldv0421m
ora.DG2	0	Entire Cluster	1	cfcldv0420m cfcldv0421m
ora.ORCL	0	Entire Cluster	1	cfcldv0420m cfcldv0421m

**We can even manage and monitor this database like an on-premises database, only difference is it's on an Exadata Cloud Service**

**Enterprise Manager even knows that this is a clustered database with 2 instances**

**Enterprise Manager sees this database just as any other on-premises database**

SALES ExaCS (Cluster Database) X

[https://oraclecloudem.com:7802/em/faces/db-rac-home?Adf-Page-id=40&target=SALES+ExaCS&type=rac\\_database](https://oraclecloudem.com:7802/em/faces/db-rac-home?Adf-Page-id=40&target=SALES+ExaCS&type=rac_database)

ORACLE Enterprise Manager Cloud Control 13c

SALES ExaCS (Container Database)

Cluster Database Performance Availability Security Schema Administration

12.1.0.2.0 Version

2 (↑2) Instances 1 (↑1) Pluggable Databases 7 days, 4 hrs Up Time N/A Last Backup

Page Refreshed Sep 9, 2016 4:47:17 PM GMT

Load and Capacity 0.09 Average Active Sessions N/A Used Space (GB)

Incidents and Compliance 0 0 6 0 0 Compliance Not Configured

Recommendations 0 ADDM Findings

High Availability N/A Last Backup Status Data Guard Not Configured

Jobs 0 Running 0 Failed

Performance Instances

Name	Status	Host Name	Incidents	ADDM Findings	ASM Instance
SALES2	Up	cfcldv0421m.us2.oracle...	0 0 0 0 0	+ASM2_cfcldv0421...	Up
SALES1	Up	cfcldv0420m.us2.oracle...	0 0 0 0 0	+ASM1_cfcldv0420...	Up

Active Sessions: 70, 63, 58, 49, 42, 35, 30, 21, 14, 7, 0

SQL Monitor - Last Hour

Status	Duration	SQL ID	Session ID	Instance	Parallel	Database Time	Container
✓	0.04 s	1awzwpx7zhn29	368	SALES1	3	0.04 s	CDB\$ROOT
✓	0.04 s	1awzwpx7zhn29	457	SALES1	3	0.04 s	CDB\$ROOT
✓	0.04 s	1awzwpx7zhn29	368	SALES1	3	0.04 s	CDB\$ROOT
✓	0.05 s	1awzwpx7zhn29	368	SALES1	3	0.05 s	CDB\$ROOT
✓	0.03 s	d5smr902a1rzmq	398	SALES2	3	0.03 s	CDB\$ROOT

The screenshot shows the Oracle Enterprise Manager Cloud Control 13c interface for a SALES ExaCS (Container Database). The main dashboard includes:

- Header:** Shows the URL [https://oraclecloudem.com:7802/em/faces/db-rac-home?Adf-Page-id=36&target=SALES+ExaCS&type=rac\\_database](https://oraclecloudem.com:7802/em/faces/db-rac-home?Adf-Page-id=36&target=SALES+ExaCS&type=rac_database), Page Refreshed Sep 9, 2016 4:46:12 PM GMT, and SYSMAN.
- Left Sidebar:** Contains sections for Load and Capacity (0.00 Average Active Sessions), Incidents and Compliance (N/A Used Space (GB), Compliance Not Configured), Recommendations (0 ADDM Findings), High Availability (N/A Last Backup Status, Data Guard Not Configured), and Jobs (0 Running, 0 Failed).
- Top Center:** Displays the database version 12.1.0.2.0, a navigation tree with nodes like SALES PDB, CDB\$ROOT, and All Containers..., and a summary card showing 1 (1+) Pluggable Databases, 7 days, 4 hrs Up Time, and N/A Last Backup.
- Performance Section:** Features a chart of Active Sessions over time (3:42 PM to 4:39 PM) with values ranging from 0 to 70. Below it is a section titled 'Resources'.
- SQL Monitor - Last Hour:** A table showing SQL execution details for the last hour across three instances (SALES1, SALES2, SALES3).

SALES\_SALESPDB (Pluggable) X

[https://oraclecloudem.com:7802/em/faces/db-rac-pdb-home?Adf-Page-Id=37&target=SALES\\_SALESPDB&type=oracle\\_pdb](https://oraclecloudem.com:7802/em/faces/db-rac-pdb-home?Adf-Page-Id=37&target=SALES_SALESPDB&type=oracle_pdb)

ORACLE Enterprise Manager Cloud Control 13c

SALES ExaCS / SALES PDB

Oracle Database Performance Availability Security Schema Administration

12.1.0.2.0 Version

7 days, 4 hrs Up Time

Page Refreshed Sep 9, 2016 4:46:38 PM GMT

Load and Capacity

0.00 Average Active Sessions  
N/A Used Space (GB)

Incidents and Compliance

0 Critical 6 Minor 0 Minor Compliance Not Configured

Jobs

0 Running 0 Failed

Performance

Activity Class

SQL Monitor - Last Hour

Status	Duration	SQL ID	Session ID	Parallel	Database Time
✓	0.01 s	dq3nc1wbs56h4	368	2	0.01 s
✓	0.23 s	dq3nc1wbs56h4	368	2	0.21 s
✓	0.06 s	1tcg99k38rjq	368	2	0.06 s
✓	0.01 s	1tcg99k38rjq	396	2	0.01 s
✓	0.06 s	1tcg99k38rjq	396	2	0.06 s

Again, Enterprise Manager lets us manage and monitor all aspects of an Exadata Cloud Service database just like it was on-premises

# Availability of Advanced Database Features: Multitenant, In-Memory, etc.



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**Enterprise Manager makes putting tables in-memory simple with a few clicks of the mouse**

Status	Duration	SQL ID	Session ID	Parallel	Database Time	Container
✓	...	1awzwpz7zh29	44	3	0.06 s	CDB\$ROOT
✓	0.05 s	1awzwpz7zh29	44	3	0.05 s	CDB\$ROOT
✓	0.04 s	1awzwpz7zh29	44	3	0.04 s	CDB\$ROOT
✓	0.04 s	1awzwpz7zh29	266	3	0.04 s	CDB\$ROOT
✓	0.04 s	1awzwpz7zh29	45	3	0.04 s	CDB\$ROOT

demo\_primary (Database Instance) X

[https://oraclecloudem.com:7802/em/faces/db-homepage-home?Adf-Page-Id=23&target=demo\\_primary&type=oracle\\_database](https://oraclecloudem.com:7802/em/faces/db-homepage-home?Adf-Page-Id=23&target=demo_primary&type=oracle_database)

ORACLE Enterprise Manager Cloud Control 13c

Exadata Cloud Service (Container Database) ①

Schema Administration

12.1.0.2.0 Version

Load and Capacity

0.02 Average Active Sessions  
2.23 Used Space (GB)

Incidents and Compliance

0 0 6 0 0 0 Compliance Not Configured

Recommendations

0 ADDM Findings

High Availability

N/A Last Backup Status  
Primary Data Guard Role

Jobs

0 Running  
0 Failed

Performance

Activity Class Services

1 Active Sessions

0 days, 4 hrs Up Time

Availability for Last 7 Days 98.82%

Tables N/A Last Backup

Using the Schema menu select: Database Objects -> Tables

Resources

SQL Monitor - Last Hour

Status	Duration	SQL ID	Session ID	Parallel	Database Time	Container
✓	0.05 s	1awzwpz7zh29	44	3	0.06 s	CDB\$ROOT
✓	0.04 s	1awzwpz7zh29	44	3	0.05 s	CDB\$ROOT
✓	0.04 s	1awzwpz7zh29	44	3	0.04 s	CDB\$ROOT
✓	0.04 s	1awzwpz7zh29	266	3	0.04 s	CDB\$ROOT
✓	0.04 s	1awzwpz7zh29	45	3	0.04 s	CDB\$ROOT

Tables: demo\_primary (Database X)

[https://oraclecloudem.com:7802/em/faces/sdk/nonFacesWrapper?target=demo\\_primary&\\_em.coBM=%2Fconsole%2FdatabaseObjectsSearch%3Fevent%3DnoSearch%26target%3Ddemo\\_primary%26type%3Doracle\\_database%26otypr%3Dsche...](https://oraclecloudem.com:7802/em/faces/sdk/nonFacesWrapper?target=demo_primary&_em.coBM=%2Fconsole%2FdatabaseObjectsSearch%3Fevent%3DnoSearch%26target%3Ddemo_primary%26type%3Doracle_database%26otypr%3Dsche...)

ORACLE Enterprise Manager Cloud Control 13c

Exadata Cloud Service (Container Database) !

Logged in as sys ! demo.compute-iaas.oraclecloud.internal

Oracle Database ▾ Performance ▾ Availability ▾ Security ▾ Schema ▾ Administration ▾

Tables

Search

Select an object type and optionally enter a schema name and an object name to filter the data that is displayed in your results set.

Container:  Schema: SALES Object Name:  Go

By default, the search returns all uppercase matches beginning with the string you entered. To run an exact or case-sensitive match, double quote the search string. You can use the wildcard symbol (%) in a double quoted string.

Click Edit button to put it into memory

Actions	Table Name	Tablespace	Partitioned	Rows	Last Analyzed
<a href="#">Edit</a>	DEMO_STATES	APEX_16B06B1501661528	NO	51	Sep 2, 2016 5:00:17 AM UTC
<a href="#">Edit</a>	DEMO_ORDER_ITEMS	APEX_16B06B1501661528	NO	49	Sep 2, 2016 5:00:17 AM UTC
<a href="#">Edit</a>	EMP	APEX_16B06B1501661528	NO	14	Sep 2, 2016 5:00:15 AM UTC
<a href="#">Edit</a>	DEMO_ORDERS	APEX_16B06B1501661528	NO	23453213	Sep 2, 2016 5:00:17 AM UTC
<a href="#">Edit</a>	DEMO_PRODUCT_INFO	APEX_16B06B1501661528	NO	10	Sep 2, 2016 5:00:17 AM UTC
<a href="#">Edit</a>	DEMO_CUSTOMERS	APEX_16B06B1501661528	NO	7	Sep 2, 2016 5:00:15 AM UTC
<a href="#">Edit</a>	DEMO_TAGS	APEX_16B06B1501661528	NO	6	Sep 2, 2016 5:00:15 AM UTC
<a href="#">Edit</a>	DEMO_CONSTRAINT_LOOKUP	APEX_16B06B1501661528	NO	4	Sep 2, 2016 5:00:17 AM UTC
<a href="#">Edit</a>	DEPT	APEX_16B06B1501661528	NO	4	Sep 2, 2016 5:00:15 AM UTC
<a href="#">Edit</a>	DEMO_TAGS_SUM	APEX_16B06B1501661528	NO	3	Sep 2, 2016 5:00:15 AM UTC
<a href="#">Edit</a>	DEMO_TAGS_TYPE_SUM	APEX_16B06B1501661528	NO	3	Sep 2, 2016 5:00:15 AM UTC
<a href="#">Edit</a>	APEX4TEAM_DEV_FILES	APEX_16B06B1501661528	NO	0	Sep 2, 2016 5:00:15 AM UTC
<a href="#">Edit</a>	APEX4_ACL	APEX_16B06B1501661528	NO	0	Sep 2, 2016 5:00:15 AM UTC
<a href="#">Edit</a>	APEX4_WS_FILES	APEX_16B06B1501661528	NO	0	Sep 2, 2016 5:00:15 AM UTC
<a href="#">Edit</a>	APEX4_WS_HISTORY	APEX_16B06B1501661528	NO	0	Sep 2, 2016 5:00:15 AM UTC
<a href="#">Edit</a>	APEX4_WS_LINKS	APEX_16B06B1501661528	NO	0	Sep 2, 2016 5:00:15 AM UTC
<a href="#">Edit</a>	APEX4_WS_NOTES	APEX_16B06B1501661528	NO	0	Sep 2, 2016 5:00:15 AM UTC
<a href="#">Edit</a>	APEX4_WS_ROWS	APEX_16B06B1501661528	NO	0	Sep 2, 2016 5:00:15 AM UTC
<a href="#">Edit</a>	APEX4_WS_TAGS	APEX_16B06B1501661528	NO	0	Sep 2, 2016 5:00:15 AM UTC
<a href="#">Edit</a>	APEX4_WS_WEBPG_SECTIONS	APEX_16B06B1501661528	NO	0	Sep 2, 2016 5:00:15 AM UTC
<a href="#">Edit</a>	APEX4_WS_WEBPG_SECTION_HISTORY	APEX_16B06B1501661528	NO	0	Sep 2, 2016 5:00:15 AM UTC

Oracle Enterprise Manager - X

[https://oraclecloudem.com:7802/em/faces/sdk/nonFacesWrapper?=&target=demo\\_Primary+PDB1&.em.coBM=%2Fconsole%2Fdatabase%2Fschema%2Ftable%3Fname%3DDEMO\\_ORDERS%26event%3Dedit%26target%3Ddemo\\_primary%26cmType%3Dor...](https://oraclecloudem.com:7802/em/faces/sdk/nonFacesWrapper?=&target=demo_Primary+PDB1&.em.coBM=%2Fconsole%2Fdatabase%2Fschema%2Ftable%3Fname%3DDEMO_ORDERS%26event%3Dedit%26target%3Ddemo_primary%26cmType%3Dor...)

ORACLE Enterprise Manager Cloud Control 13c

Exadata Cloud Service / PDB1

Tables > Edit Table: SALES.DEMO\_ORDERS  
Edit Table: SALES.DEMO\_ORDERS

General Constraints Segments Storage In-Memory Column Store Options Statistics Indexes

\* Name: DEMO\_ORDERS  
Schema: SALES  
Tablespace: APDX\_1680681501661528  
Organization Standard (Heap Organized)  
Sharing: NONE

Columns

Add 5 Table Columns

Advanced Attributes Delete Insert Column: Abstract Data Type Insert

Select	Name	Data Type	Size	Scale	Not NULL	Default Value	Encrypted
<input checked="" type="radio"/>	ORDER_ID	NUMBER			<input checked="" type="checkbox"/>		<input type="checkbox"/>
<input type="radio"/>	CUSTOMER_ID	NUMBER			<input checked="" type="checkbox"/>		<input type="checkbox"/>
<input type="radio"/>	ORDER_TOTAL	NUMBER	8	2	<input type="checkbox"/>		<input type="checkbox"/>
<input type="radio"/>	ORDER_TIMESTAMP	TIMESTAMP	6		<input type="checkbox"/>		<input type="checkbox"/>
<input type="radio"/>	USER_NAME	VARCHAR2	100		<input type="checkbox"/>		<input type="checkbox"/>
<input type="radio"/>	TAGS	VARCHAR2	4000		<input type="checkbox"/>		<input type="checkbox"/>
<input type="radio"/>		VARCHAR2			<input type="checkbox"/>		<input type="checkbox"/>
<input type="radio"/>		VARCHAR2			<input type="checkbox"/>		<input type="checkbox"/>
<input type="radio"/>		VARCHAR2			<input type="checkbox"/>		<input type="checkbox"/>

Advanced Attributes Delete Insert Column: Abstract Data Type Insert

Indicates a Primary Key column  
Indicates a Unique Key column  
Indicates a Securefile LOB column

Actions Create Like Go Execute On Multiple Databases Show SQL Revert Apply

Logged in as sys

Use In-Memory tab to put tables into memory with a mouse click

In-Memory Column Store

[https://oraclecloudem.com:7802/em/faces/sdk/nonFacesWrapper?=&target=demo\\_Primary+PDB1&.em.coBM=%2Fconsole%2Fdatabase%2Fschema%2Ftable%3Fname%3DDEMO\\_ORDERS%26event%3Dedit%26target%3Ddemo\\_primary%26cmType%3Dor...](https://oraclecloudem.com:7802/em/faces/sdk/nonFacesWrapper?=&target=demo_Primary+PDB1&.em.coBM=%2Fconsole%2Fdatabase%2Fschema%2Ftable%3Fname%3DDEMO_ORDERS%26event%3Dedit%26target%3Ddemo_primary%26cmType%3Dor...)

ORACLE Enterprise Manager Cloud Control 13c

Exadata Cloud Service / PDB1

Oracle Database Performance Availability Security Schema Administration

Logged in as sys

Tables > Edit Table: SALES.DEMO.ORDERS

Edit Table: SALES.DEMO.ORDERS

General Constraints Segments Storage In-Memory Column Store Options Statistics Indexes

Actions Create Like Go Execute On Multiple Databases Show SQL Revert Apply

Configure In-Memory options by specifying the following inputs.

Enable In-Memory

Compression  Default  
Inherit compression setting from the tablespace, if specified

No Compression  
No compression will be performed when data is populated in-memory.

Compression for DML  
Light weight compression, optimized for DML operations

Query Based Compression  
Specify Low for highest performance. Specify High for balance between performance and capacity.  
 Low  High

Capacity Based Compression  
Specify Low for balance between performance and capacity, weighted towards capacity. Specif  
 Low  High

Loading  Delayed  
Oracle decides when to load data in-memory.

Immediate  
Population of data in-memory will be queued immediately, based on the specified priority.  
Priority  Low  Medium  High  Critical

	Enable In-Memory	Compression
ORDER_ID	<input checked="" type="checkbox"/>	<input type="button" value="Default"/>
CUSTOMER_ID	<input checked="" type="checkbox"/>	<input type="button" value="Default"/>
ORDER_TOTAL	<input checked="" type="checkbox"/>	<input type="button" value="Default"/>
ORDER_TIMESTAMP	<input checked="" type="checkbox"/>	<input type="button" value="Default"/>
USER_NAME	<input checked="" type="checkbox"/>	<input type="button" value="Default"/>

Just check this checkbox and the table is now in-memory

In-Memory Column Store X Brian

[https://oracleclouddem.com:7802/em/faces/sdk/nonFacesWrapper?=&target=demo\\_Primary+PDB1&.em.coBM=%2Fconsole%2Fdatabase%2Fschema%2Ftable%3Fname%3DDEMO\\_ORDERS%26event%3Dedit%26target%3Ddemo\\_primary%26cmType%3Dor...](https://oracleclouddem.com:7802/em/faces/sdk/nonFacesWrapper?=&target=demo_Primary+PDB1&.em.coBM=%2Fconsole%2Fdatabase%2Fschema%2Ftable%3Fname%3DDEMO_ORDERS%26event%3Dedit%26target%3Ddemo_primary%26cmType%3Dor...)

ORACLE Enterprise Manager Cloud Control 13c

Exadata Cloud Service / PDB1

Tables > Edit Table: SALES.DEMO\_ORDERS

Edit Table: SALES.DEMO\_ORDERS

Update Message Table SALES.DEMO\_ORDERS has been modified successfully

In-Memory Column Store Options

Configure In-Memory options by specifying the following inputs.

Enable In-Memory

Compression:  Default (No compression setting from the tablespace, if specified)  No Compression (No compression will be performed when data is populated in-memory)  Compression for DML (Light weight compression, optimized for DML operations)  Query Based Compression (Optimal for highest performance. Specify High for balance between priority and performance)  Low  High  Capacity Based Compression (Specify Low for balance between performance and capacity, weighted toward performance)  Low  High

Loading:  Delayed (Data arrives when to load data in-memory)  Immediate (Population of data in-memory will be queued immediately, based on the priority)  Low  Medium  High  Critical

Data Distribution:  Auto Distribute (Oracle decides the best way to distribute data across instances in the cluster)  By Row ID (Distributes by row-id range)  By Partition (Distributes partitions to different instances in the cluster)  By Subpartition (Distributes subpartitions to different instances in the cluster)  Duplicate (Two copies of the entire data are available in-memory on all instances in the cluster)  No Duplicate (Only one copy of the entire data is available in-memory across the cluster. Used along with distribution)  Duplicate (Two copies of the entire data are available in-memory across the cluster. Used along with distribution)

Columns

You could choose to load selective columns in memory or specify different compression options for some columns. Specify the column level override options in the table below.

Name	Data Type	Enable In-Memory	Compression
ORDER_ID	NUMBER	<input checked="" type="checkbox"/>	Default
CUSTOMER_ID	NUMBER	<input checked="" type="checkbox"/>	Default

Initialization Parameters

In-Memory Central

Storage

Oracle Scheduler

Replication

Migrate to ASM

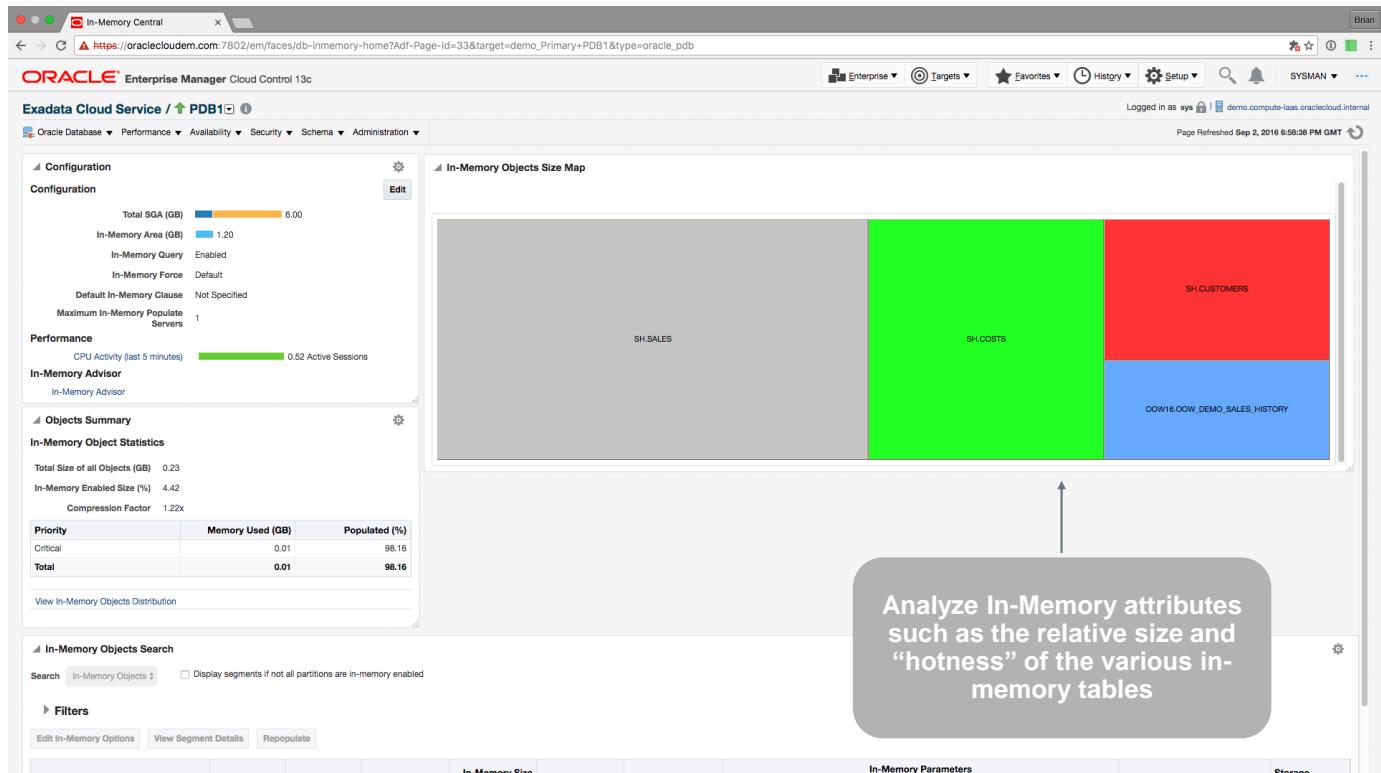
Resource Manager

Database Feature Usage

Actions: Create Like, Go, Execute On Multiple Databases, Show SQL, Revert, Apply

Logged in as sys

Use Enterprise Manager's In-Memory Central to manage and monitor in-memory tables



# Security!! All Tablespaces Created Encrypted in Oracle Cloud



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By default, all new tablespaces are encrypted in the Exadata Cloud Service

Status	Duration	SQL ID	Session ID	Parallel	Database Time
✓	85.00 s	18r58s1d638t5	289		84.49 s
✓	85.00 s	50k08nhadqr74	289		84.54 s
✓	76.00 s	3ur2gc2z9qd7u	289		76.19 s
✓	76.00 s	50k08nhadqr74	289		76.23 s
✓	35.00 s	3ur2gc2z9qd7u	289		35.26 s

The screenshot shows the Oracle Enterprise Manager Cloud Control 13c interface for the Exadata Cloud Service. The main navigation bar at the top includes links for Oracle Database, Performance, Availability, Security, Schema, and Administration. The Administration menu is currently open, displaying various database management options. A red callout box with the text "To see this in action, use the Administration menu to select: Storage -> Tablespaces" points to the "Tablespaces" item in the menu. The central workspace displays performance metrics like Active Sessions over time and an SQL Monitor showing recent queries and their execution times.

To see this in action, use the Administration menu to select:  
Storage -> Tablespaces

**Click Create**

Tables: demo\_primary | X

https://oraclecloudem.com:7802/em/faces/sdk/nonFacesWrapper?target=demo\_Primary+PDB1&.em.coBM=%2Fconsole%2Fdatabase%2FdatabaseObjectsSearch%3Fevent%26search%26target%3Ddemo\_Primary%2520PDB1%26type%3Doracle\_pdb%26obj... Brian

ORACLE Enterprise Manager Cloud Control 13c

Exadata Cloud Service / PDB1

Oracle Database Performance Availability Security Schema Administration

Tablespaces

Search

Select an object type and optionally enter an object name to filter the data that is displayed in your results set.

Object Name:  Go

By default, the search returns all uppercase matches beginning with the string you entered. To run an exact or case-sensitive match, double quote the search string. You can use the wildcard symbol (%) in a double quoted string.

Selection Mode: Single

Actions: Edit View Delete Add Datafile Go

Selected	Name	Available Space Used (%)	Allocated Space Used (%)	Auto Extend	Allocated Size (GB)	Space Used (GB)	Allocated Free Space (GB)	Status	Datafiles	Type	Extent Management	Segment Management
<input checked="" type="radio"/>	SYSAUX	2.77	94.24	YES	0.586	0.552	0.034	✓	1	PERMANENT	LOCAL	AUTO
<input type="radio"/>	SYSTEM	1.35	97.05	YES	0.273	0.265	0.008	✓	1	PERMANENT	LOCAL	MANUAL
<input type="radio"/>	TEMP	10.00	10.00	NO	0.098	0.010	0.088	✓	1	TEMPORARY	LOCAL	MANUAL
<input type="radio"/>	APEX_1680681501661528	23.86	79.42	YES	0.029	0.023	0.006	✓	1	PERMANENT	LOCAL	AUTO
<input type="radio"/>	USERS	0.01	20.00	YES	0.005	0.001	0.004	✓	1	PERMANENT	LOCAL	AUTO

✓ Online   ✘ Offline   ⓘ Read Only

Tip Available Space Used(%) is not available for dictionary managed, read-only and most temporary and undo tablespaces.

Search Results Space Usage Summary

Total Allocated Size (GB) 0.991  
Total Used (GB) 0.851  
Total Allocated Free Space (GB) 0.140

Database Space Usage Summary

Allocated Size (GB)	Space Used (GB)	Allocated Space Used (%)	Allocated Free Space (GB)	Number of Tablespaces
0.991	0.851	85.87	0.140	5

> Show Historical Space Usage Reports

The screenshot shows the Oracle Enterprise Manager Cloud Control 13c interface. A red callout box highlights the text "Create a new tablespace called HR\_DATA".

**General Tab (Visible):**

- Name: HR\_DATA
- Extent Management:
  - Locally Managed (selected)
  - Dictionary Managed
- Type:
  - Permanent (selected)
  - Temporary
- Status:
  - Read Write (selected)
  - Read Only
  - Offline

**Datafiles Tab (Visible):**

Select	Name	Directory	Size (MB)	Maximum File Size (MB)
<input checked="" type="radio"/>	<Default>	/u02/app/oracle/oradata/	100.00	32,767.00

**Buttons at the bottom:**

- Execute On Multiple Databases
- Show SQL
- Cancel
- OK

Keep  
Encryption  
option  
unchecked

Oracle Enterprise Manager - Oracle Database / Exadata Cloud Service / PDB1

Name: HR\_DATA

Extent Management:

- Locally Managed (selected)
- Dictionary Managed

TIP: Since the SYSTEM tablespace is locally managed, only locally managed tablespaces can be created.

Type:

- Permanent (selected)
- Temporary
- Undo

Datafiles:

- Use bigfile tablespace (unchecked)
- Tablespace can have only one datafile with no practical size limit.
- Use DMF (unchecked)
- A default datafile will be created that is 100 MB and is autoextensible with an unlimited maximum size.

TIP: Undo tablespaces can only be created in CDB\$ROOT.

Select	Name	Directory	Size (MB)	Maximum File Size (MB)
<Default>	HR_DATA	/u02/app/oracle/oradata/	100.00	32,767.00

OK

Tablespaces: demo\_primary | X

[https://oraclecloudem.com:7802/em/faces/sdk/nonFacesWrapper?=&target=demo\\_Primary+PDB1&.em.coBM=%2Fconsole%2Fdatabase%2FdatabaseObjectsSearch%3FlastEvent%3Dcreate%26event%3Ddisplay%26target%3Ddemo\\_primary%26cmeType%26](https://oraclecloudem.com:7802/em/faces/sdk/nonFacesWrapper?=&target=demo_Primary+PDB1&.em.coBM=%2Fconsole%2Fdatabase%2FdatabaseObjectsSearch%3FlastEvent%3Dcreate%26event%3Ddisplay%26target%3Ddemo_primary%26cmeType%26)

ORACLE Enterprise Manager Cloud Control 13c

Exadata Cloud Service / PDB1

Oracle Database Performance Availability Security Schema Administration

Update Message  
The object has been created successfully.

Tablespaces

Search  
Select an object type and optionally enter an object name to filter the data that is displayed in your results set.  
Object Name: Go

By default, the search returns all uppercase matches beginning with the string you entered. To run an exact or case-sensitive match, double quote the search term.

Selection Mode: Single

Actions	Name	Available Space Used (%)	Allocated Space Used (%)	Auto Extend	Allocated Size (GB)	Space Used (GB)	Allocated Free Space (GB)	Status	Datafiles	Type	Extent Management	Segment Management	Create
<input checked="" type="radio"/>	SYSAUX	2.78	94.24	YES	0.586	0.552	0.034	✓	1	PERMANENT	LOCAL	AUTO	
<input type="radio"/>	SYSTEM	1.36	97.05	YES	0.273	0.265	0.098	✓	1	PERMANENT	LOCAL	MANUAL	
<input type="radio"/>	HR_DATA	0.01	1.00	YES	0.098	0.001	0.097	✓	1	PERMANENT	LOCAL	AUTO	
<input type="radio"/>	TEMP	10.00	10.00	NO	0.098	0.010	0.088	✓	1	TEMPORARY	LOCAL	MANUAL	
<input type="radio"/>	APEX_1680681501661528	23.86	79.42	YES	0.029	0.023	0.006	✓	1	PERMANENT	LOCAL	AUTO	
<input type="radio"/>	USERS	0.01	20.00	YES	0.005	0.001	0.004	✓	1	PERMANENT	LOCAL	AUTO	

✓ Online ✘ Offline ⓘ Read Only

Tip Available Space Used(%) is not available for dictionary managed, read-only and most temporary and undo tablespaces.

Search Results Space Usage Summary

Allocated Size (GB)	Space Used (GB)	Allocated Space Used (%)	Allocated Free Space (GB)	Number of Tablespaces
1.089	0.852	78.24	0.237	6

Show Historical Space Usage Reports

Tablespace created, click on name to bring up details

Oracle Enterprise Manager - X

[https://oraclecloudem.com:7802/em/faces/sdk/nonFacesWrapper?=&target=demo\\_Primary+PDB1&.em.coBM=%2Fconsole%2Fdatabase%2Fstorage%2Ftablespace%3FcanceledURL%3D%252Fem%252Fconsole%252Fdatabase%252FdatabaseObjectsSearch...](https://oraclecloudem.com:7802/em/faces/sdk/nonFacesWrapper?=&target=demo_Primary+PDB1&.em.coBM=%2Fconsole%2Fdatabase%2Fstorage%2Ftablespace%3FcanceledURL%3D%252Fem%252Fconsole%252Fdatabase%252FdatabaseObjectsSearch...)

ORACLE Enterprise Manager Cloud Control 13c

Exadata Cloud Service / PDB1

View Tablespace: HR\_DATA

Name: HR\_DATA  
 Bigfile tablespace: No  
 Status: ReadWrite  
 Type: Permanent  
 Extent Management: local  
 Encryption: YES

Storage  
 Allocation Type: Automatic  
 Segment Space Management: Automatic  
 Enable Logging: Yes  
 Compression: No Compression  
 Block Size (B): 8192

In-Memory Column Store  
 Status: Disabled  
 Compression: N/A  
 Loading: N/A  
 Data Distribution: N/A

Datafiles

Name	Directory	Size (MB)	Used (MB)	Maximum File Size (MB)	Auto Extend
o1_mf_hr_data_cwmmyfg4_.dbf	/u02/app/oracle/oradata/DEMO/3B716AD1082A1EAD053DA316A0AC2D6/datafile/	100.00	1.00	32,767.00	Yes

Verify that even with the option unchecked, this tablespace has been created encrypted!

## Summary

In this lesson, you should have learned how to:

- Describe the options of database systems available with Oracle Cloud Infrastructure
- Launch a one-node database system



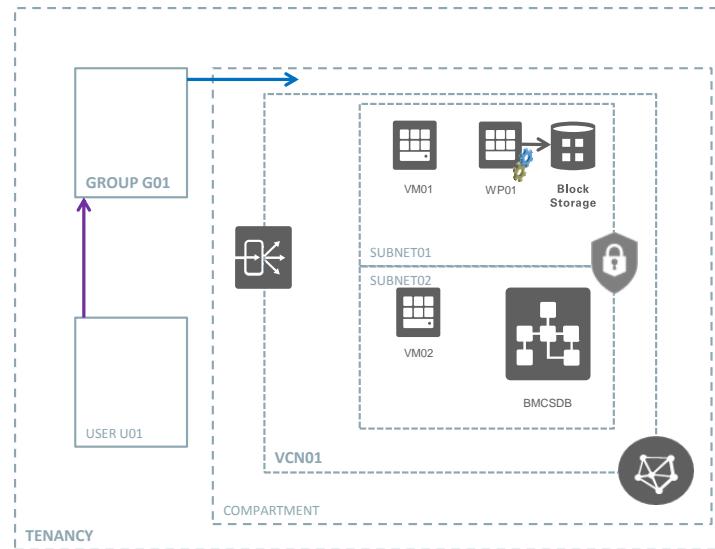
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## Practice 7: Launching a Database System Instance

This practice is to be completed after the training. In this practice, each participant:

- Creates a new database instance
- Connects to the database machine using ssh
- Connects to the database using SQL Plus within the database machine
- Performs start and stop of the database



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