

ExaCS Overview

Level 300

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Safe Harbor Statement

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Exadata Cloud Service - Objectives

After completing this lesson, you should be able to:

- What is Exadata Cloud Service(ExaCS)
- Understand the core components of Exadata systems
- Describe the Exadata Storage and architecture
- Understand Exadata Cloud Service deployment options
- Describe the architecture of Exadata Cloud Service
- Have an understanding of deployment best practices.
- Sizing and Consolidation Best practices on ExaCS

Exadata Cloud Service(ExaCS)

- Exadata Cloud Service is offered on Oracle Cloud Infrastructure, within OCI regions.
- Exadata Cloud Service available in quarter Rack, Half Rack or full Rack configurations.
- Exadata rack in OCI includes DB nodes, storage nodes and InfiniBand switches.
- The storage and compute nodes are connected via high bandwidth Infiniband network that provides RDMA based storage access to the compute nodes.
- Exadata storage software runs on storage servers and offloads database SQL processing overheads.

Exadata Cloud Service(ExaCS)

- Currently, a single VM per compute node is supported. It allows root access for customers while protecting hardware and network, DB nodes are virtualized using Xen based OVM.
- Oracle Manages storage cells, switches, management or IB network while customer manages database compute nodes.
- Exadata Cloud Service provides a control Plane, a Web-based self-service management interface for Exadata provisioning and interactive access to service administration function.

ExaCS-Operational Overview

- REST APIs are also provided for service administration functions.
- Applications can connect to ExaCS databases using standard JDBC, SQL *Net based connections from OCI or on-premises or other cloud based deployments
- You can establish Secure Shell (SSH) connections for accessing ExaCS compute nodes
- ExaCS uses network interfaces and subnet exclusively for database backups to an Oracle Storage Cloud Service buckets, separate from the client subnet used for database connection
- The customer facing API for Exadata management are integrated with OCI Identity management console. Essentially, Customers can control API access via standard identity authorization policies.

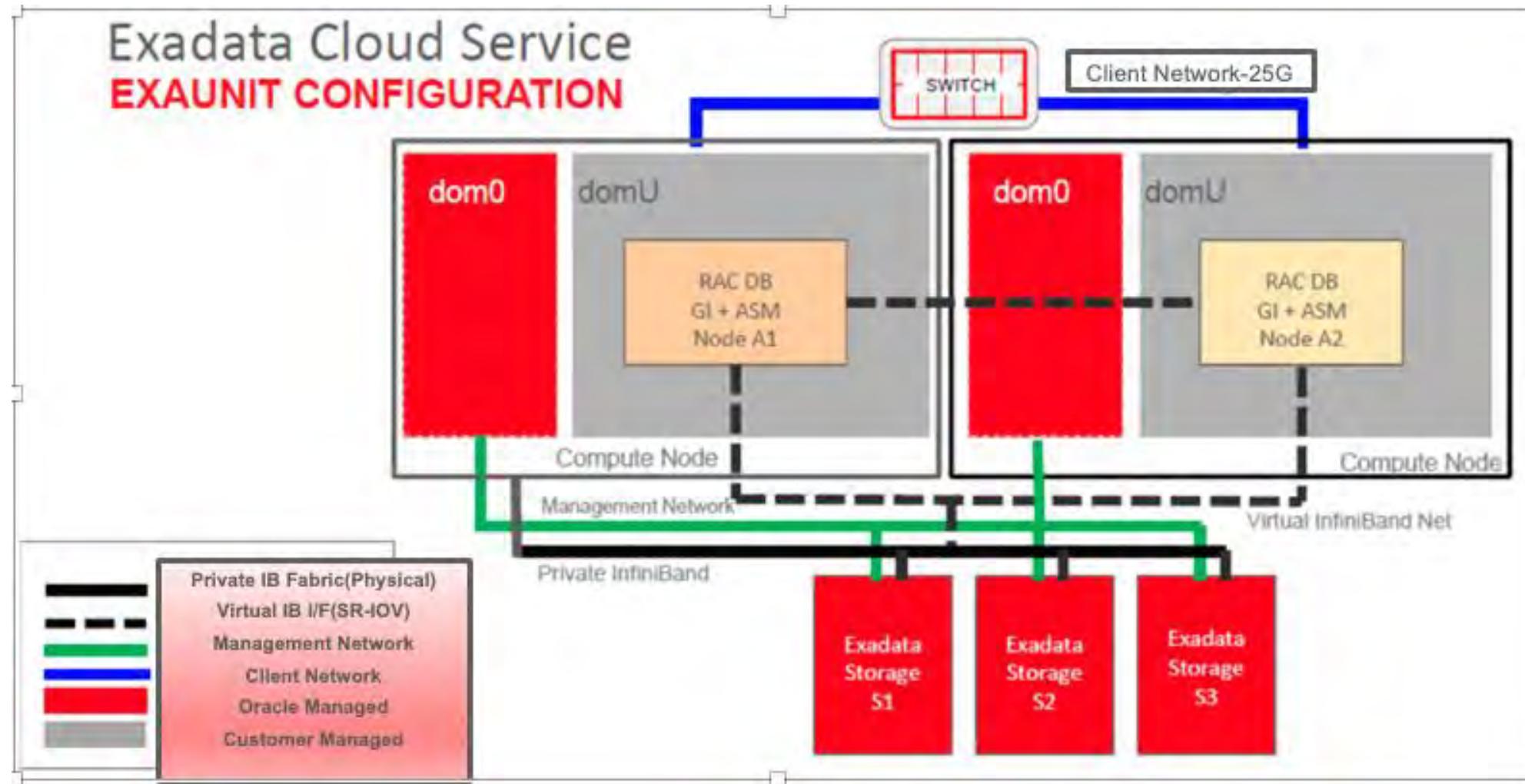
ExaCS Management

- Customers can manage DB compute nodes using root privileges(sudo)
- Components managed by Oracle include Network switch, storage cells , Power distribution and ILOM interfaces
- Customers have full administrative privileges on databases and can perform operations like database backups, recovery, run performance diagnostics etc.
- ExaCS runs on Enterprise Edition- Extreme Performance version which includes all the DB options and EM Packs.
- All database instances are configured with huge pages memory management,
- Customers can customize syslogformat for log analytics and better integration with SIEM products.
- Allow user to have a read only access to Storage Cell via exacli API.
- Block storage volumes can't be attached to Exadata compute nodes currently
- With ExaCS you can either store your backups locally or in OCI Object storage.

ExaCS Networking

- Each compute/DB node has four 25G data/backup ports, one 1G admin port and one 1G iLOM port. Storage nodes have the 1G admin and ILOM ports for management purposes.
- Exadata in OCI platform are integrated with VCN wherein the customer visible DB nodes are presented via regular virtual NICs (VNICs) in customer's VCN
- Customer creates a subnet in a VCN via regular VCN APIs. Customer calls the Exadata Service API to allocate an “Exadata Quarter Rack” and passes in the subnet. Four VNICs will be allocated on each subnet, two for DB client traffic and two for DB backup traffic. Multiple private IP addresses will be allocated for each VNIC as required by DB RAC software, e.g: SCAN host and Floating IP's.
- DB clients in the VCN can access the Exadata DB nodes via private addresses. Customers can use all the standard VCN features, including security lists and routing rules, to control network access to their DB nodes. Additionally, VPN and Fast Connect can be used to connect to this service.
- Service Gateway provides connectivity to OCI Object Storage and other OCI services which eliminates need for NAT gateway or Internet Gateway.

ExaCS Architecture on OCI



Exadata Cloud Service X7 Hardware Infrastructure

	X7 Quarter Rack	X7 Half Rack	X7 Full Rack
Number of DB Compute Nodes	2	4	8
Maximum Number of OCPUs	92	184	368
Total Memory	1440 GB	2880 GB	5760 GB
Total Flash Capacity	76.8 TB	153.6 TB	307.2 TB
Max DB Size (No Local Backup)	85.5 TB	171.1 TB	342.1 TB
Network Connectivity	2x25 Gb Ethernet (bonded)	2x25 Gb Ethernet (bonded)	2x25 Gb Ethernet (bonded)

Note: ExaCS X7 also includes 8x 600GB drives for local drive capacity. Approx. 1.1TB of local capacity now available for Oracle Homes, per database server. Minimum No of OCPU=0

Note: Please plan the shape of ExaCS Service based on sizing, you can scale up/down within shape , currently we are not supporting scaling across shape. e.g-upgrade from 1/4th rack to 1/2 rack will require re deployment.

ExaCS- Customer v/s Oracle managed

Customers control and manage software that directly affects their databases

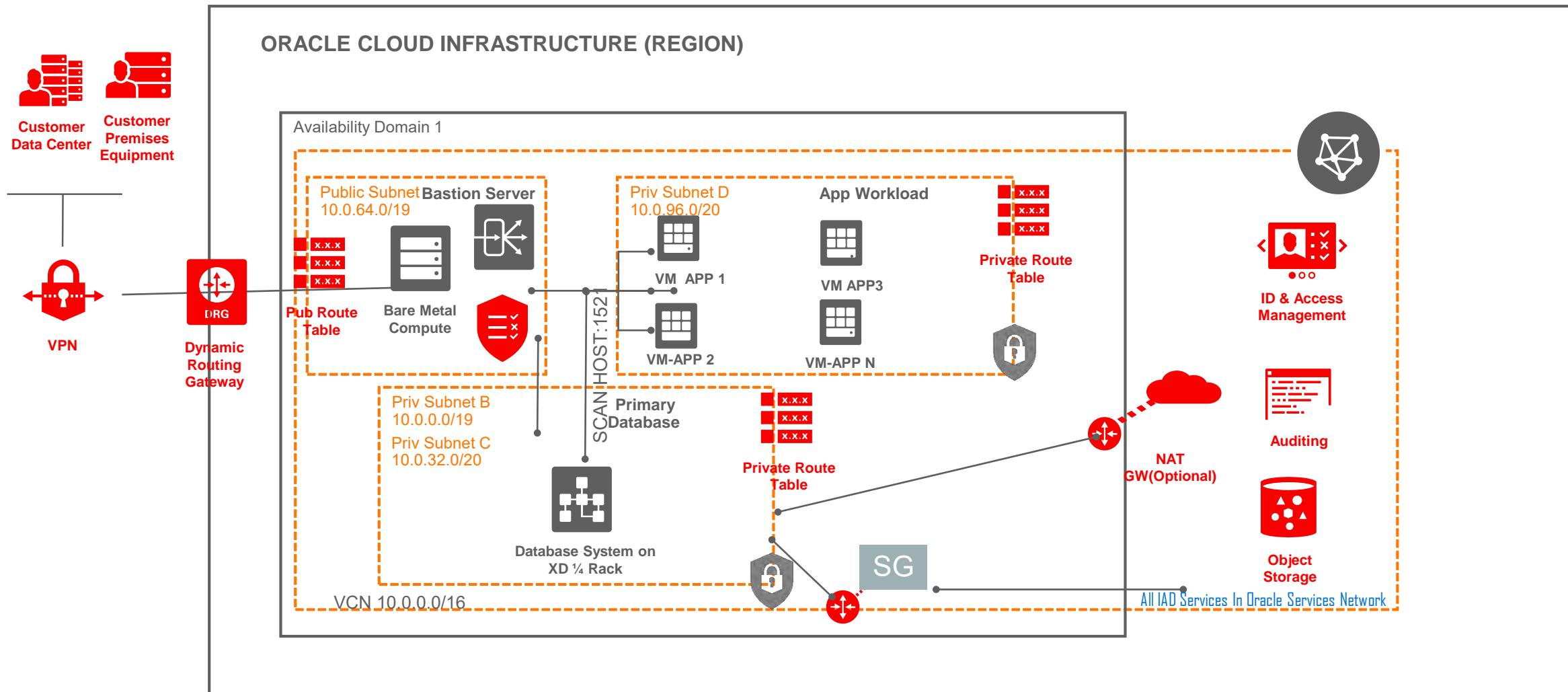
- All Patches pre-staged (OS, GI, DB)
- Patch what you want when you want on your schedule
- Patching automated through cloud tooling
- REST services make scheduling easy

Oracle manages underlying infrastructure

- Proactive Hardware Fault Notification
- Oracle Patches the following rolling
 - Servers(dom0)
 - Storage hardware and software
 - Networking
 - Firmware
 - Hypervisor



Exadata typical deployment Architecture

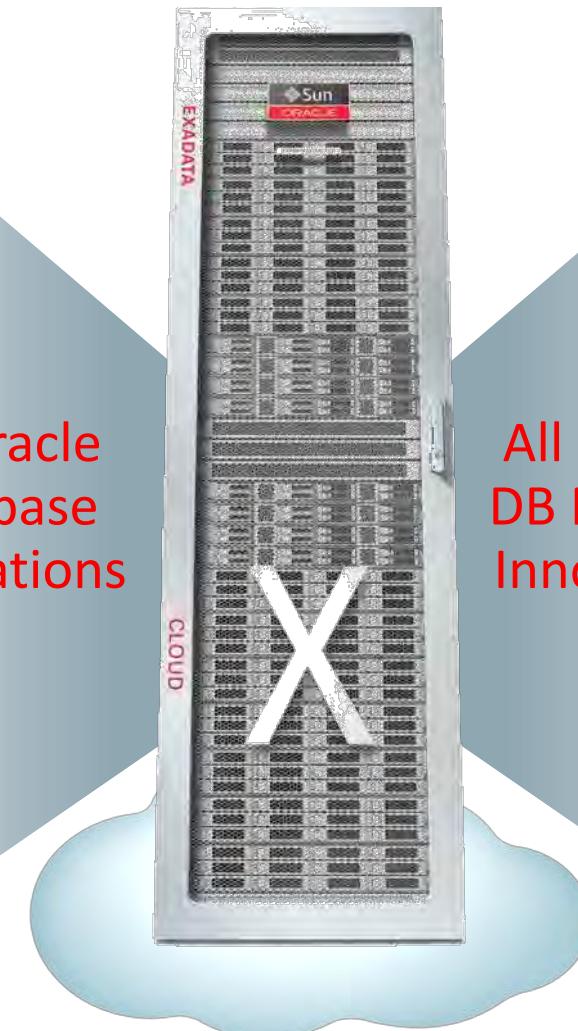


Exadata Basics

Exadata Cloud Service-Technical foundations

	Multitenant
	In-Memory DB
	Real Application Clusters
	Active Data Guard
	Partitioning
	Advanced Compression
	Advanced Security, Label Security, DB Vault
	Real Application Testing
	Advanced Analytics, Spatial and Graph
	Management Packs for Oracle Database

All Oracle Database Innovations



All Exadata DB Machine Innovations

	Offload SQL to Storage
	InfiniBand Fabric
	Smart Flash Cache, Log
	Storage Indexes
	Columnar Flash Cache
	Hybrid Columnar Compression
	I/O Resource Management
	Network Resource Management
	In-Memory Fault Tolerance
	Exafusion Direct-to-Wire Protocol

ExaCS: Operating System

Exadata image contains:

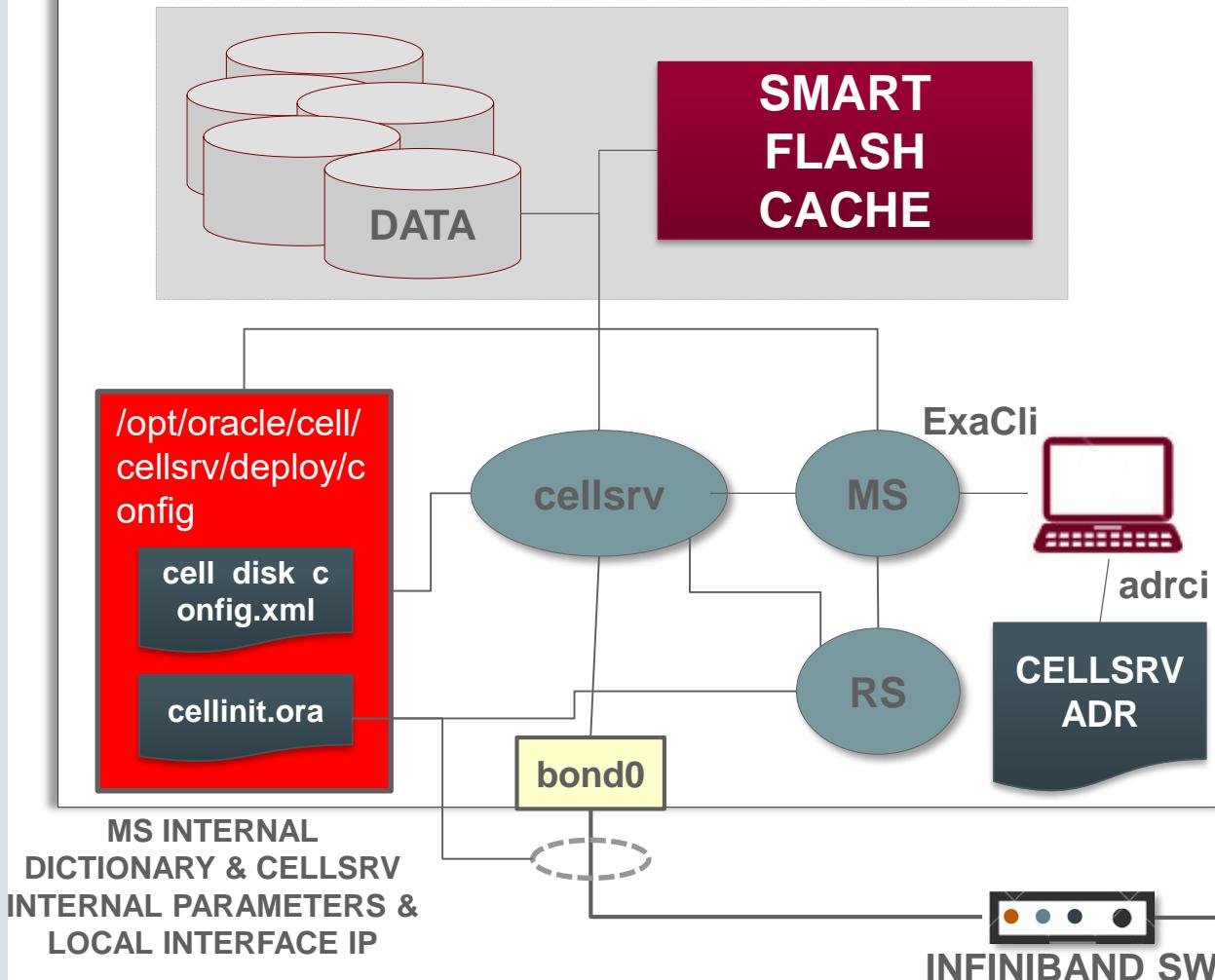
- Optimized (shrunk) set of Operating System packages, Exadata Specific packages, Configuration and Firmware and more, directly usable for the customer to run the Oracle Database best.
- AIDE (Advanced Intrusion Detection Environment)
 - Used to verify the integrity of the files
- STIG Notable changes
 - Password Qualify and ssh client alive interval.
- Chrony replaces NTP
 - Chrony is a different implementation of the network time protocol (NTP) than the network time protocol daemon (ntpd) that is able to synchronize the system clock faster and with better accuracy than ntpd
- Systemd replaces ‘System V Init’ /Upstart
 - Designed to overcome the shortcomings of init. It itself is a background processes which is designed to start processes in parallel, thus reducing the boot time and computational overhead. It has a lot other features as compared to init. It is backwards compatible with SysV init scripts.

ExaCS uses Oracle Linux 7.5 based on UEK4 QU7 (4.1.12-124.20.3) for domU, baremetal and cell.

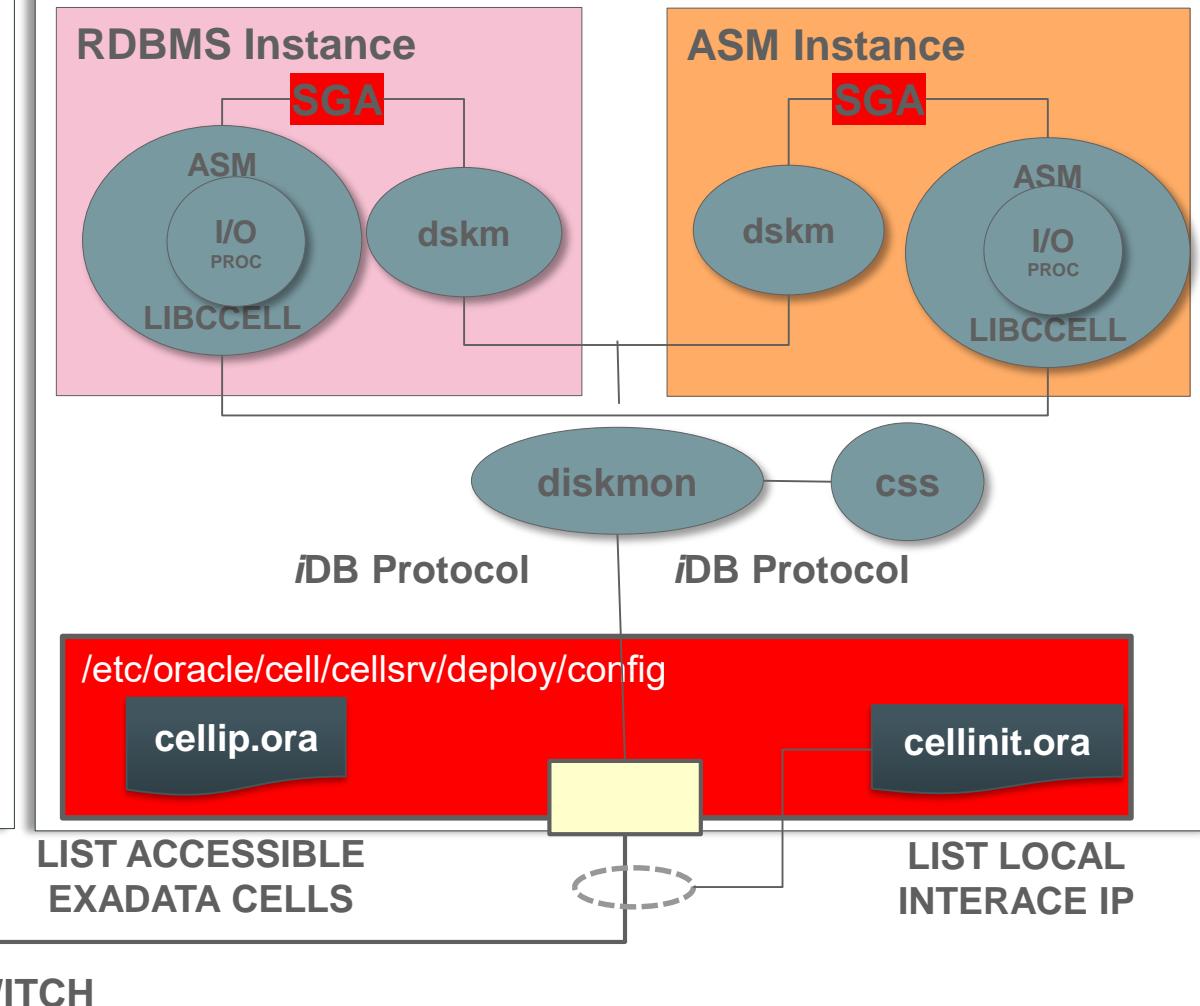


Exadata Software Architecture

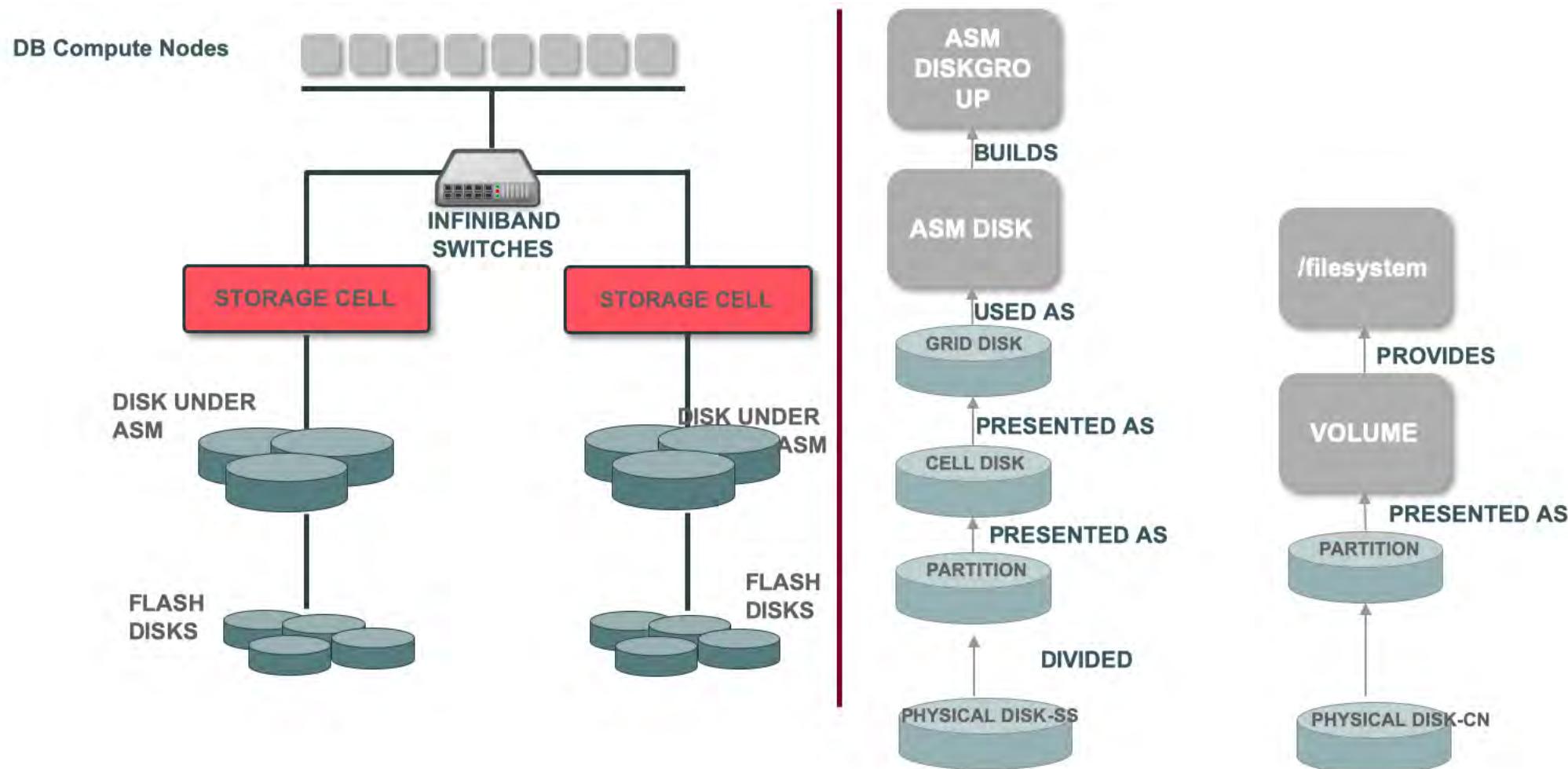
EXADATA CELL



DATABASE SERVER



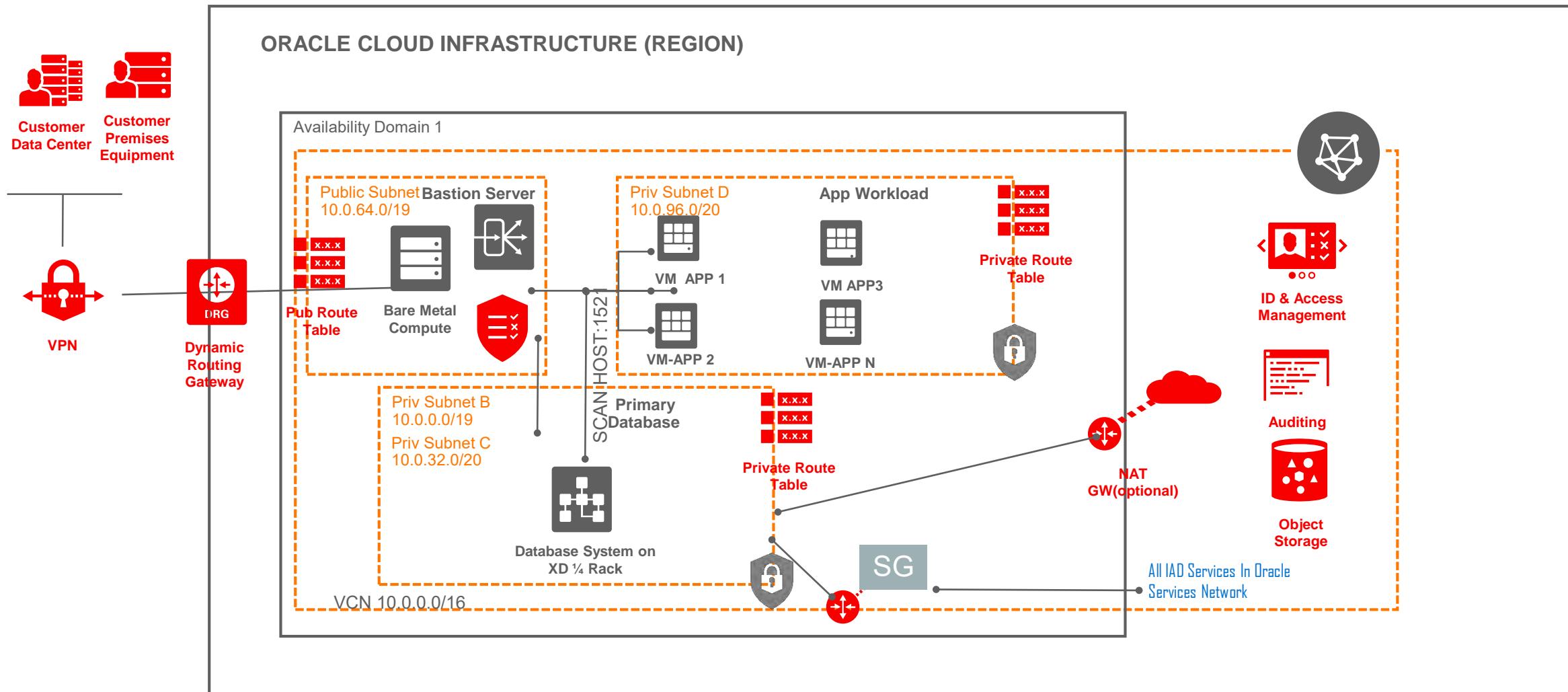
Disk Layout & Physical layout- Exadata





Exadata Cloud Service Provisioning

Exadata typical deployment Architecture



Exadata Cloud Service typical Deployment Flow

- Creating a VCN
- Creating Gateways- NAT/IGW and SG-Note: Service Gateway can handle all internal communication including backups, patching within OCI region.
- Creating Routing Tables
- Creating Security Lists
- Creating DHCP Options
- Creating Subnets
- Modifying Security Rules
- Launching Exadata DB System

Note: For deploying Exadata Cloud Service in OCI you must have IAM policy allowing the operation.
E.g: *Allow group DBAdmins to manage database-family in tenancy*

Prepare Network: Important Points to Consider

We recommend using one of the private IP address ranges specified in RFC 1918 (10.0.0.0/8, 172.16/12, and 192.168/16).

- Allowable OCI VCN size range is from /16 to /30
- VCN reserves the first two IP addresses and the last one in each subnet's CIDR
- The VCN's CIDR must not overlap with your on-premises network or another VCN you peer with.
- 1 VCN with (at least) 2 subnets (1 Client & 1 Backup)
 - Backup Subnet needs Object Storage Access
 - VCN can be fully private
 - VCN needs VCN resolver
- Create a custom VCN setup-
 - Choose different VCN IP ranges per region
 - Keep VCN name short (Tip: Include Region)
 - Keep Subnet name short (Tip: Include AD)
- Your hostname:
 - <node>-#####.<subnet>.<vcn>.oraclevcn.com
 - xprod-n53zg1.subprivdatabal.vcnbal.oraclevcn.com
 - <max13>-#####.<max24>.<max24>.oraclevcn.com (Max 63)

Step 1: Create a VCN

- Sign in to the Oracle Cloud Infrastructure Console.
- Navigate to Networking-Virtual Cloud Networks-Create a VCN,

For this example, enter the following values in the **Create Virtual Cloud Network** dialog box:

For **Name**, enter **vcn_bal**.

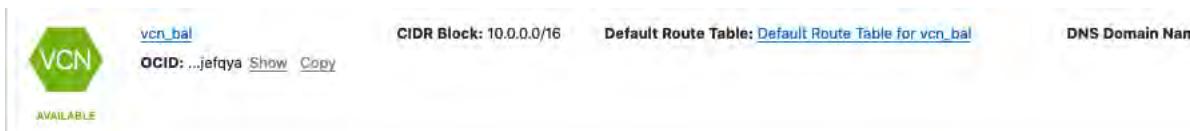
Select **Create Virtual Cloud Network Only**.

For **CIDR Block**, enter **10.0.0.0/16**.

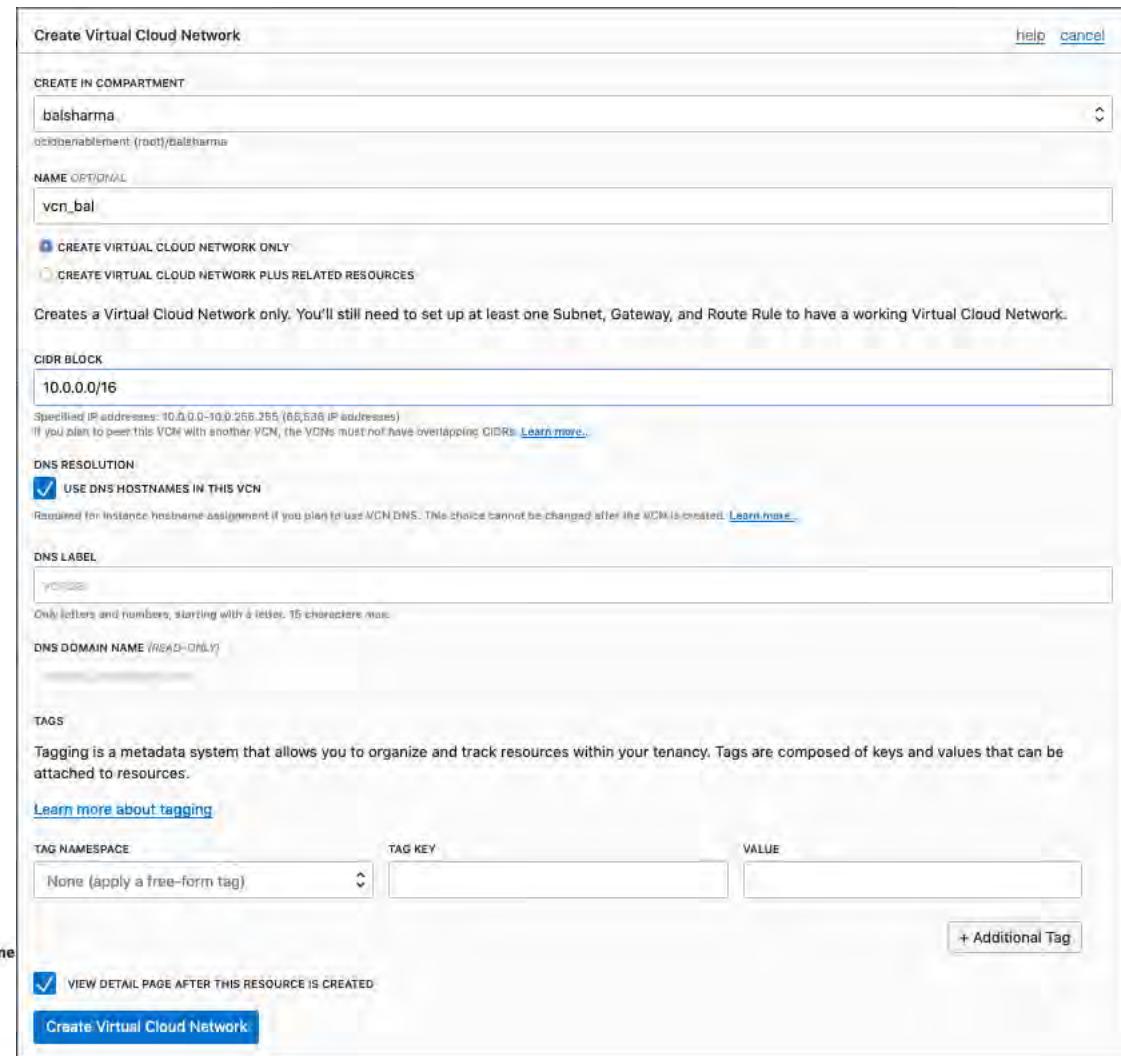
Select the **Use DNS Hostnames in This VCN** check box.

For **DNS Label**, enter **vcnbal**.

Upon creation, VCN appears in the Console.



The screenshot shows the Oracle Cloud Infrastructure console with the VCN 'vcn_bal' listed. The VCN is marked as 'AVAILABLE' and has an OCID. It is associated with a CIDR Block of 10.0.0.0/16 and a Default Route Table. The DNS Domain Name is listed as 'vcnbal'. A 'Create Virtual Cloud Network' button is visible at the bottom of the dialog.



The screenshot shows the 'Create Virtual Cloud Network' dialog box. The 'CREATE IN COMPARTMENT' section shows 'balsharma' and 'ociidentity.ocid1.compartment.oc1..(root)balsharma'. The 'NAME (OPTIONAL)' field contains 'vcn_bal'. The 'CREATE VIRTUAL CLOUD NETWORK ONLY' radio button is selected. The 'CIDR BLOCK' field contains '10.0.0.0/16'. The 'DNS RESOLUTION' section shows 'USE DNS HOSTNAMES IN THIS VCN' checked. The 'DNS LABEL' field contains 'vcnbal'. The 'TAGS' section has a note about tagging and a 'Learn more about tagging' link. The 'TAG NAMESPACE' dropdown is set to 'None (apply a free-form tag)'. The 'Create Virtual Cloud Network' button is at the bottom.

Step 2: Create a NAT Gateway(Optional- Not needed for provisioning)

- Using NAT Gateway- Instances on private subnets can initiate connections to the public internet. Connections initiated from the internet are blocked. Since we want our deployment to be on private subnet and don't want to expose database compute on public Internet, we will create NAT GW to provide access outside.

- Navigate to Networking-Virtual Cloud Networks-Create a NAT Gateway,

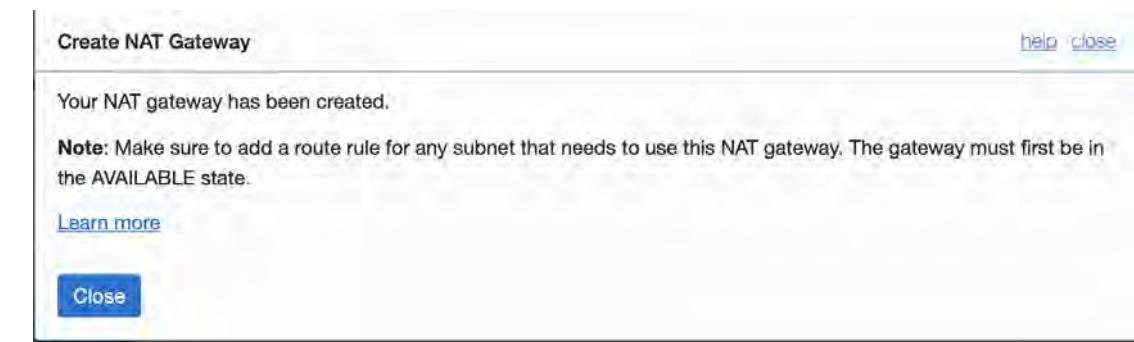
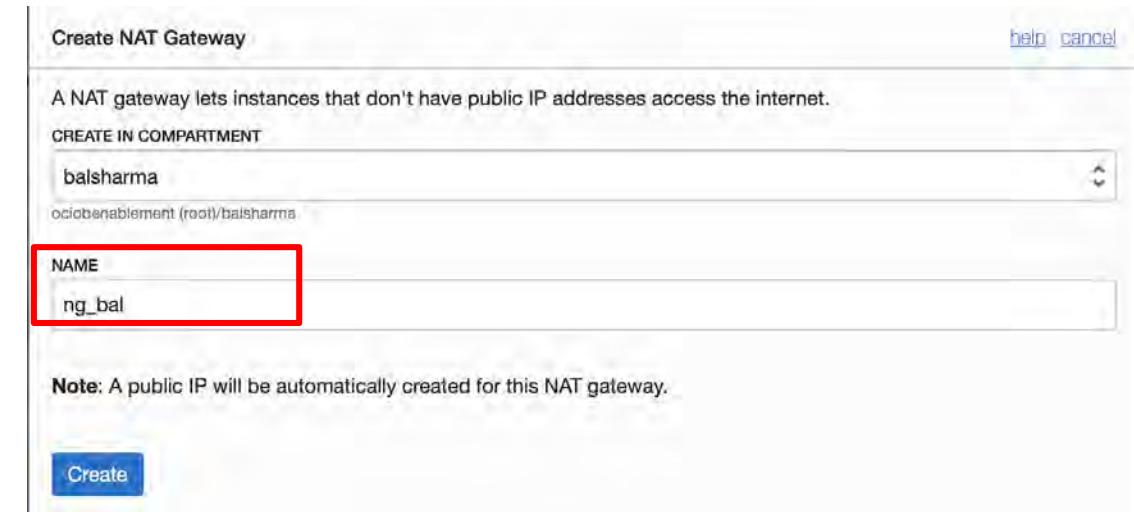
For this example, enter the following values in the **Create NAT Gateway** dialog box:

For **Name**, enter **ng_bal**.

Click Create.

Upon creation, a confirmation appears and you will see the same in the Console.

Note: You might want to have a NAT GW configured, One of use case would be to upload diagnostic logs to Oracle Support portal directly from ExaCS node.



Step 3: Create a Service Gateway

A service gateway allows access to Object Storage. Later you configure your backup route table so that Exadata backup can travel to Object Storage within Oracle Cloud Infrastructure network fabric without traversing through public internet.

- Navigate to Networking-Virtual Cloud Networks-Select VCN-Create a Service Gateway,

For this example, enter the following values in the **Create Service Gateway** dialog box:

For **Name**, enter **ng_bal**.

For **Services**, Select **All IAD Services in Oracle Cloud Service Network**

Click **Create**.

Upon creation, a confirmation appears and you will see the same in the Console.



Step 4: Create Route Tables

Virtual cloud network uses virtual route tables to send traffic out of the VCN

Each rule specifies a destination CIDR block and the target (the next hop) for any traffic that matches that CIDR. For Exadata, you create two route tables, for client traffic and backup traffic.

Select VCN you created earlier

For this example, enter the following values in the **Create Route Table** dialog box: For **Name**, enter **priv**, you can provide any name.

For Route Rules section

Define Target type as Service Gateway, you can additionally add NAT GW in case needed.

You need to select compartment.

Select the NAT Gateway(if Chosen) and Service Gateway you created earlier in corresponding rules

You can create these individually, In this example I have combined them. Please note Service GW can securely talk with all services in OCI region.

Create Route Table

NAME
priv

CREATE IN COMPARTMENT
balsharma
ociobenblement.root/balsharma

Route Rules

Important: For a route rule that targets a Private IP, you must first enable "Skip Source/Destination Check" on the VNIC that the Private IP is assigned to.

TARGET TYPE: Service Gateway DESTINATION SERVICE: All IAD Services In Oracle Services Network

COMPARTMENT: balsharma TARGET SERVICE GATEWAY: sg_bal

+ Additional Route Rule

TAGS
Tagging is a metadata system that allows you to organize and track resources within your tenancy. Tags are composed of keys and values which can be attached to resources.
[Learn more about tagging](#)

TAG NAMESPACE: No namespace (Free-Form tag) KEY: VALUE: OPTIONAL

+ Additional Tag

Create Route Table **Cancel**

Route Tables in VCN

priv

Add Tag(s) Terminate

Route Table Information

Tags

OCID: ...3jganq Show Copy

Created: Mon, Jan 14, 2019, 11:14:51 PM UTC

Compartment: balsharma

Route Rules

Add Route Rules

Destination

0.0.0.0/0

All IAD Services In Oracle Services Network

Target Type

NAT Gateway

Service Gateway

Target

ng_bal

sg_bal

Default Route Table for vcn_bal

Apply Tag(s)

Route Table Information

Tags

OCID: ...tpd4va Show Copy

Created: Tue, 08 Jan 2019 21:28:56 GMT

Compartment: oclobenablement (root)/balsharma

Route Rules

Edit Route Rules

Destination CIDR Block: 0.0.0.0/0

Target Type: Internet Gateway

Target: ig_bal ...ohd27q Show Copy

Route Tables in balsharma Compartment

Create Route Table



RT

AVAILABLE

Default Route Table for vcn_bal
OCID: ...tpd4va Show Copy

1

Compartment: balsharma



RT

AVAILABLE

priv
OCID: ...3jganq Show Copy

2

Compartment: balsharma

Route Table

ROUTE TABLE COMPARTMENT

balsharma

oclobenablement (root)/balsharma

ROUTE TABLE

Default Route Table for vcn_bal

Security Lists

SECURITY LIST COMPARTMENT

balsharma

oclobenablement (root)/balsharma

SECURITY LIST

bas

SECURITY LIST COMPARTMENT

balsharma

oclobenablement (root)/balsharma

SECURITY LIST

Default Security List for vcn_bal

SECURITY LIST COMPARTMENT

balsharma

oclobenablement (root)/balsharma

SECURITY LIST

fsaccess

+ Add Security List

Update

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Step 4: Create Security Lists

- A security list controls ingress and egress rules that specify the types of traffic allowed in and out. You configure your security lists at the subnet level, which means that all instances in a given subnet are subject to the same set of rules.
- Select VCN you created earlier to create SL.
- In this deployment I have 3 Security Lists: Default Security List which is defining data Ingress and egress rules,
- Another security list for Bastion Server.
- A separate security list for OCI File Service.

Default Security List for vcn_bal

Instance traffic is controlled by firewall rules on each Instance in addition to this Security List

Add Tag(s) Tags

Security List Information Tags

OCID: ..6wvtoq Show Copy
Created: Tue, Jan 8, 2019, 9:28:56 PM UTC

Ingress Rules

Add Ingress Rules						
Stateless	Source	IP Protocol	Source Port Range	Destination Port Range	Type and Code	Allows
No	10.0.0.0/16	TCP	All	All		TCP traffic for ports: All
No	10.0.0.0/16	ICMP		All		ICMP traffic for: All
No	0.0.0.0/0	TCP	All	3389		TCP traffic for ports: 3389
No	10.0.0.0/16	TCP	All	7803		TCP traffic for ports: 7803
No	10.0.0.0/16	TCP	All	4903		TCP traffic for ports: 4903
No	10.0.0.0/16	TCP	All	7301		TCP traffic for ports: 7301
No	All IAD Services In Oracle Services Network	TCP	All	1521		TCP traffic for ports: 1521
No	10.0.0.0/19	TCP	All	1521		TCP traffic for ports: 1521
No	10.0.128.0/24	TCP	All	All		TCP traffic for ports: All

Stateful Rules

Source: 10.0.0.0/16	IP Protocol: TCP	Source Port Range: All	Destination Port Range: All	Allows: TCP traffic for ports: all
Source: 10.0.0.0/16	IP Protocol: ICMP	Type and Code: All		Allows: ICMP traffic for: all types and codes
Source: 0.0.0.0/0	IP Protocol: TCP	Source Port Range: All	Destination Port Range: 3389	Allows: TCP traffic for ports: 3389

Security Lists

Security List to use File Service

fsaccess

[Edit All Rules](#) [Terminate](#) [Apply Tag\(s\)](#)

[Security List Information](#) [Tags](#)

OCID: ...psowza [Show](#) [Copy](#)

Created: Thu, 24 Jan 2019 22:07:01 GMT

Instance traffic is controlled by firewall rules on each instance in addition to this Security List

Ingress Rules

[Stateless Rules](#)

No Ingress Rules

There are no stateless ingress Rules for this Security List

[Stateful Rules](#)

Source: 0.0.0.0/0	IP Protocol: TCP	Source Port Range: All	Destination Port Range: 111	Allows: TCP traffic for ports: 111
Source: 0.0.0.0/0	IP Protocol: TCP	Source Port Range: All	Destination Port Range: 2048-2050	Allows: TCP traffic for ports: 2048-2050
Source: 0.0.0.0/0	IP Protocol: UDP	Source Port Range: All	Destination Port Range: 111	Allows: UDP traffic for ports: 111
Source: 0.0.0.0/0	IP Protocol: UDP	Source Port Range: All	Destination Port Range: 2048	Allows: UDP traffic for ports: 2048

bas

Security List for Bastion host

[Edit All Rules](#) [Terminate](#) [Apply Tag\(s\)](#)

[Security List Information](#) [Tags](#)

OCID: ...uhyt7a [Show](#) [Copy](#)

Created: Mon, 14 Jan 2019 23:11:13 GMT

Instance traffic is controlled by firewall rules on each instance in addition to this Security List

Ingress Rules

[Stateless Rules](#)

No Ingress Rules

There are no stateless ingress Rules for this Security List

[Stateful Rules](#)

Source: 0.0.0.0/0 IP Protocol: TCP Source Port Range: All Destination Port Range: 22 Allows: TCP traffic for ports: 22 SSH Remote Login Protocol

Allows: TCP traffic for ports: 22 SSH Remote Login Protocol

Step 5: Create DHCP Options

VCN uses DHCP options to automatically provide configuration information to the instances when they boot up. Each VCN comes with a default set of DHCP options with initial values that you can change or keep.

In this example, I will be using default DHCP option for Exadata and recommend for ExaCS provisioning.

The image shows two screenshots of the Oracle Cloud Infrastructure (OCI) console. The top screenshot is titled 'Default DHCP Options for vcn_bal' and displays basic information: 'Edit' and 'Apply Tag(s)' buttons, a 'DHCP Option Information' tab (selected), and a 'Tags' tab. Under 'DHCP Option Information', it shows 'OCID: ...nqifca' with 'Show' and 'Copy' links, and 'Created: Tue, 08 Jan 2019 21:28:56 GMT'. The bottom screenshot is titled 'DHCP Options' and shows an 'Edit DHCP Options' button. It lists two entries: 'DNS Type: Internet and VCN Resolver' and 'Search Domain: vcnbal.oraclevcn.com', which are both highlighted with a red rectangular box.

Step 6: Create Subnets

A subnet is a subdivision of a VCN. Each subnet in a VCN exists in a single availability domain and consists of a contiguous range of IP addresses that do not overlap with other subnets in the cloud network.

In this example, I will be creating 4 different subnets- Two of these will be required by ExaCS-data & Backup, One for Bastion Host, Last one for Applications

You can select **Regional Subnets** which is recommended over AD specific subnets. Regional subnets allows you to create instances in availability domain within region, so better high availability.

Follow same steps to create all other subnets except for bastion host you will be creating a public subnet.

Follow these steps to create the client and backup subnet.

- In the Console, click the name of the VCN that you created-in this example **bal_vcn**.
- In the **Resources** section, click **Subnets**.
- Click **Create Subnet**.
- In the **Create Subnet** dialog box, enter the following values to create the client subnet:
 - Enter a name for the subnet (in this example, **sub_priv_data_bal**).
 - Choose the availability domain where you plan to launch the Exadata DB system.
 - Enter the CIDR block for the subnet (in this example, **10.0.0.0/19**).
 - Choose the route table that you created for the client traffic (in this example, **priv**).
 - For **Subnet Access** , select **Private Subnet**.
- Ensure that the **DNS Resolution** check box is selected.
- Leave the default value for **DNS Label**.

Create Subnet

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

NAME (OPTIONAL)

AVAILABILITY DOMAIN

CIDR BLOCK

Specified IP addresses: 10.0.0.0-10.0.31.255 (6,192 IP addresses)

ROUTE TABLE

SUBNET ACCESS

- PRIVATE SUBNET
Prohibit public IP addresses for Instances in this Subnet
- PUBLIC SUBNET
Allow public IP addresses for Instances in this Subnet

DNS RESOLUTION
 USE DNS HOSTNAMES IN THIS SUBNET
Allows assignment of DNS hostname when launching an Instance

DNS LABEL

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

DNS DOMAIN NAME (READ ONLY)

DHCP OPTIONS

Security Lists
 Default Security List for vcn_bal

TAGS

Tagging is a metadata system that allows you to organize and track resources within your tenancy. Tags are composed of keys and values that can be attached to resources.

[Learn more about tagging](#)

TAG NAMESPACE	TAG KEY	VALUE
<input type="text" value="None (apply a free-form tag)"/>	<input type="text"/>	<input type="text"/>

Create Subnet

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

NAME (OPTIONAL)

AVAILABILITY DOMAIN

CIDR BLOCK

Specified IP addresses: 10.0.32.0-10.0.47.255 (4,096 IP addresses)

ROUTE TABLE

SUBNET ACCESS

- PRIVATE SUBNET
Prohibit public IP addresses for Instances in this Subnet
- PUBLIC SUBNET
Allow public IP addresses for Instances in this Subnet

DNS RESOLUTION
 USE DNS HOSTNAMES IN THIS SUBNET
Allows assignment of DNS hostname when launching an Instance

SUBNET TYPE

- REGIONAL (RECOMMENDED)
Instances in the subnet can be created in any availability domain in the region. Useful for Non-availability domain specific traffic.
- AVAILABILITY DOMAIN-SPECIFIC
Instances in the subnet can only be created in one availability domain in the region.

DHCP OPTIONS

Security Lists
 Default Security List for vcn_bal

TAGS

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[Learn more about tagging](#)

TAG NAMESPACE	TAG KEY	VALUE
<input type="text" value="None (apply a free-form tag)"/>	<input type="text"/>	<input type="text"/>

Create Subnet

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

NAME (OPTIONAL)

AVAILABILITY DOMAIN

CIDR BLOCK

Specified IP addresses: 10.0.64.0-10.0.95.255 (6,192 IP addresses)

ROUTE TABLE

SUBNET ACCESS

- PRIVATE SUBNET
Prohibit public IP addresses for Instances in this Subnet
- PUBLIC SUBNET
Allow public IP addresses for Instances in this Subnet

DNS RESOLUTION
 USE DNS HOSTNAMES IN THIS SUBNET
Allows assignment of DNS hostname when launching an Instance

SUBNET TYPE

- REGIONAL (RECOMMENDED)
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Instances in the subnet can only be created in one availability domain in the region.

DHCP OPTIONS

Security Lists
 Default Security List for vcn_bal

TAGS

Tagging is a metadata system that allows you to organize and track resources within your tenancy. Tags are composed of keys and values that can be attached to resources.

[Learn more about tagging](#)

TAG KEY	VALUE
<input type="text"/>	<input type="text"/>

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Edit Subnet

NAME
sub_priv_bkp_bal

DHCP Options

DHCP OPTIONS COMPARTMENT
balsharma
oclobenablelement (root/balsharma)

DHCP OPTIONS
Default DHCP Options for vcn_bal

Route Table

ROUTE TABLE COMPARTMENT
balsharma
oclobenablelement (root/balsharma)

ROUTE TABLE
priv

Security Lists

SECURITY LIST COMPARTMENT
balsharma
oclobenablelement (root/balsharma)

SECURITY LIST
Default Security List for vcn_bal

SECURITY LIST COMPARTMENT
balsharma
oclobenablelement (root/balsharma)

SECURITY LIST
fsaccess

+ Add Security List

Update

ExaCS new UI might provide Automated Backup through console, Create a bucket in object storage –For Backup Configuration-Can be used later for configuration in case You want to use bkup_api for configuring backup.

Create Bucket

Specify the storage tier for this bucket. Storage tier for a bucket can only be specified during creation.

BUCKET NAME
balxdbucket

STORAGE TIER
 STANDARD
 ARCHIVE

TAGS

Tagging is a metadata system that allows you to organize and track resources within your tenancy. Tags are composed of keys and values that can be attached to resources.

[Learn more about tagging](#)

TAG NAMESPACE	TAG KEY	VALUE
None (apply a free-form tag)		
+ Additional Tag		

ENCRYPT USING KEY MANAGEMENT

Create Bucket

Step 7: Add Rules to Security Lists

Update your security lists and add appropriate ingress and egress rules to allow traffic.

In the Console, click the name of the VCN that you created. In the **Resources** section, click **Security Lists**. Click the **Default security list for vcn_bal**. and add following to allow TCP and ICMP traffic between both subnets-data and backup.

Edit Security List Rules

Allow Rules for Ingress

Ingress Rule 1

Allows TCP traffic for ports: all

STATELESS [\(more information\)](#)

SOURCE TYPE: CIDR SOURCE CIDR: 10.0.0.0/16 IP PROTOCOL: TCP

SOURCE PORT RANGE (OPTIONAL): All DESTINATION PORT RANGE (OPTIONAL): All

Ingress Rule 2

Allows ICMP traffic for all types and codes

STATELESS [\(more information\)](#)

SOURCE TYPE: CIDR SOURCE CIDR: 10.0.0.0/16 IP PROTOCOL: ICMP

TYPE AND CODE (OPTIONAL): All

[+ Another Ingress Rule](#)

Allow Rules for Egress

Egress Rule 1

Allows TCP traffic for ports: all

STATELESS [\(more information\)](#)

DESTINATION TYPE: CIDR DESTINATION CIDR: 10.0.0.0/16 IP PROTOCOL: TCP

SOURCE PORT RANGE (OPTIONAL): All DESTINATION PORT RANGE (OPTIONAL): All

Egress Rule 2

Allows ICMP traffic for all types and codes

STATELESS [\(more information\)](#)

DESTINATION TYPE: CIDR DESTINATION CIDR: 10.0.0.0/16 IP PROTOCOL: ICMP

TYPE AND CODE (OPTIONAL): All

[+ Another Egress Rule](#)

Save Security List Rules



Default Security List for vcn_bal

Instance traffic is controlled by firewall rules on each instance in addition to this Security List

[Add Tag\(s\)](#)

[Remove](#)

[Security List Information](#)

[Tags](#)

OCID: ..6wvtoq [Show](#) [Copy](#)

Created: Tue, Jan 8, 2019, 9:28:56 PM UTC

Ingress Rules

Add Ingress Rules						
Stateless	Source	IP Protocol	Source Port Range	Destination Port Range	Type and Code	Allows
No	10.0.0.0/16	TCP	All	All	TCP traffic for ports: All	⋮
No	10.0.0.0/16	ICMP		All	ICMP traffic for: All	⋮
No	0.0.0.0/0	TCP	All	3389	TCP traffic for ports: 3389	⋮
No	10.0.0.0/16	TCP	All	7803	TCP traffic for ports: 7803	⋮
No	10.0.0.0/16	TCP	All	4903	TCP traffic for ports: 4903	⋮
No	10.0.0.0/16	TCP	All	7301	TCP traffic for ports: 7301	⋮
No	All IAD Services in Oracle Services Network	TCP	All	1521	TCP traffic for ports: 1521	⋮
No	10.0.0.0/19	TCP	All	1521	TCP traffic for ports: 1521	⋮
No	10.0.128.0/24	TCP	All	All	TCP traffic for ports: All	⋮

Note: These examples use 0.0.0.0/0 for demo purposes only. You can add ingress and egress security rules as allowed by your company's security policies. Also note that All IAD Service in Oracle Service Network can be accessed with service Gateway.

Step 9: Launch an Exadata DB System from OCI Console

Now that you have created all the networking components that are required to launch an Exadata DB system, launch the system.

- In the Console, open the navigation menu. Under **Database**, click **Bare Metal, VM, and Exadata**.
- Choose your compartment.
- Click **Launch DB System**.
- In the Launch DB System dialog box, enter the following values.
- Enter a display name for the Exadata DB system (for example, **xdprod**).
- Choose the availability domain where the Exadata DB system will reside.
- For **Shape Type**, select **Bare Metal Machine**.
- Select the shape (for example, **Exadata.Quarter2.92**).
- Enter a cluster name (for example, **xdpcluster**).
- Enter a CPU core count (for example, **6**).
- Select a license type.
- Select to upload or paste SSH keys (public keys).
- Select a data storage percentage (for example, **35%**).

- For **Virtual Cloud Network**, select the VCN that you created (for example, **ExaVCN**).
- For **Client Subnet**, select the client subnet that you created (for example, **sub_priv_data_bal**).
- For **Backup Subnet**, select the backup subnet that you created (for example, **sub_priv_bkp_bal**).
- Enter a hostname prefix (for example, **xdprod**).
- Enter a database name (for example, **bmsprod**).
- Select a database version (for example, **12.1.0.2**).
- If you selected Oracle Database version 12 or later, enter a PDB name (for example, **bmspdb**).
- Enter and then confirm a database admin password.
- Select a database workload (OLTP or DSS).
- Click **Launch DB System**.

Note: Please select Database version as 18.X for getting GRID version 18 to be installed so that you can create database version 11.X till 18 later.

Screenshot: Launching an Exadata DB System from OCI Console

Launch DB System [help](#) [cancel](#)

If the Virtual Cloud Network or Subnet is in a different Compartment than the DB System, enable Compartment selection for those resources: [Click here](#).

DB System Information

DISPLAY NAME

AVAILABILITY DOMAIN

SHAPE TYPE
 VIRTUAL MACHINE BARE METAL EXADATA

SHAPE
 Exadata. Quarter2.92 Exadata. Standard2.92 Exadata. Standard2.92

TOTAL NODE COUNT

ORACLE DATABASE SOFTWARE EDITION

CLUSTER NAME (Optional)

CPU CORE COUNT
 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100 102 104 106 108 110 112 114 116 118 120 122 124 126 128 130 132 134 136 138 140 142 144 146 148 150 152 154 156 158 160 162 164 166 168 170 172 174 176 178 180 182 184 186 188 190 192 194 196 198 200 202 204 206 208 210 212 214 216 218 220 222 224 226 228 230 232 234 236 238 240 242 244 246 248 250 252 254 256 258 260 262 264 266 268 270 272 274 276 278 280 282 284 286 288 290 292 294 296 298 300 302 304 306 308 310 312 314 316 318 320 322 324 326 328 330 332 334 336 338 340 342 344 346 348 350 352 354 356 358 360 362 364 366 368 370 372 374 376 378 380 382 384 386 388 390 392 394 396 398 400 402 404 406 408 410 412 414 416 418 420 422 424 426 428 430 432 434 436 438 440 442 444 446 448 450 452 454 456 458 460 462 464 466 468 470 472 474 476 478 480 482 484 486 488 490 492 494 496 498 500 502 504 506 508 510 512 514 516 518 520 522 524 526 528 530 532 534 536 538 540 542 544 546 548 550 552 554 556 558 560 562 564 566 568 570 572 574 576 578 580 582 584 586 588 590 592 594 596 598 600 602 604 606 608 610 612 614 616 618 620 622 624 626 628 630 632 634 636 638 640 642 644 646 648 <span style="border: 1px solid #ccc; padding: 2px 5px; font-size: 0.9

CLUSTER NAME

CPU CORE COUNT ▼ ▲

The number of CPU cores to enable on the DB System. Specify a multiple of 2, up to 32.

LICENSE TYPE ?

LICENSE INCLUDED
Includes the cost of Oracle Cloud Infrastructure and Oracle Database licenses.

BRING YOUR OWN LICENSE (BYOL)
Includes the cost of Oracle Cloud Infrastructure but excludes Oracle Database licenses. You purchased your Database licenses directly from Oracle.

SSH PUBLIC KEY ?

CHOOSE SSH KEY FILES
 PASTE SSH KEYS

Choose SSH Key files (.pub) from your computer:

(1)

STORAGE ALLOCATION ?

DATABASE BACKUPS ON EXADATA STORAGE
 CREATE SPARSE DISK GROUP

Percentage: 35% DATA, 50% RECO, 15% SPARSE

[Hide Advanced Options](#)

DISK REDUNDANCY ?

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

TIME ZONE ?

UTC
 AMERICA/CHICAGO (BROWSER-DETECTED)
 SELECT ANOTHER TIME ZONE



Screenshot: Launching an Exadata DB System from OCI Console

Database Information

Database Name
bmsprod

Database Version
 DISPLAY ALL AVAILABLE VERSIONS ⓘ
12.1.0.2

PDB Name (Optional)
bmspdb

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 , , !, @, #, %.

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.

[Show Advanced Options](#)

TAGS
Tagging is a metadata system that allows you to organize and track resources within your tenancy. Tags are composed of keys and values that can be attached to resources.

[Learn more about tagging](#)

TAG NAMESPACE TAG KEY VALUE
None (apply a free-form tag) + Additional Tag

Launch DB System

Network Information

VIRTUAL CLOUD NETWORK
vcn_bal

CLIENT SUBNET
sub_priv_data_bal

BACKUP SUBNET
sub_priv_bkp_bal

HOSTNAME PREFIX
xdprod

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

HOST AND DOMAIN URL

Storage Allocation ⓘ

DATABASE BACKUPS ON EXADATA STORAGE

CREATE SPARSE DISK GROUP

Percentage: 35% DATA, 50% RECO, 15% SPARSE

[Edit Advanced Options](#)

DISK REDUNDANCY
High

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

DB Systems in balsharma Compartments Displaying 1 DB Systems

DB System	Availability Domain	Oracle Database Software Edition	Virtual Cloud Network	Launched
xdprod	GrCh:US-ASHBURN-AD-1	Enterprise Edition Extreme Performance	vcn_bal	Fri, 11 Jan 2019 21:36:08 GMT
	OCID: ...6xk44a	Show Copy		

DB Systems

Standalone Backups

List Scope

COMPARTMENT
balsharma

PROVISIONING

DBS

xdprod

Availability Domain: GrCh:US-ASHBURN-AD-1

Oracle Database Software Edition: Enterprise Edition Extreme Performance

CPU Core Count: 6

Virtual Cloud Network: vcn_bal

Launched: Fri, 11 Jan 2019 21:36:08 GMT

Client Subnet: sub_priv_data_bal

Backup Subnet: sub_priv_bkp_bal

Private IP: Loading...

Public IP: Loading...



Screenshot: Launching an Exadata DB System from OCI Console

The screenshot displays the OCI Console interface for launching an Exadata DB System. The top navigation bar shows the Oracle Cloud Infrastructure logo and a search bar. The main content area is divided into two main sections: 'DB Systems' and 'Nodes'.

DB Systems Section:

- Left Panel:** Shows two Exadata DB Systems: 'xdprod' and 'bmsprod'. Both are in a 'PROVISIONING...' state. The 'xdprod' card includes buttons for 'Suspend/Undock', 'Add SBI | View', and 'Tags'.
- Right Panel:** Shows detailed information for the 'xdprod' DB System. The 'DB System Information' tab is selected, displaying the following details:
 - Availability Domain:** GrCh:US-ASHBURN-AD-1
 - Shape:** Exadata.Quarter2.92
 - Compartment:** oclobenablement (root)/balsharma
 - CPU Core Count:** 6
 - Disk Redundancy:** High
 - Cluster Name:** xdpcluster
 - Port:** 1521
 - Host Domain Name:** subprivdatabal.vcnbal.oraclevcn.com
 - Scan IP Addresses:** Unavailable
- Client Subnet:** sub_priv_data_bal
- Backup Subnet:** sub_priv_bkp_bal
- Hostname Prefix:** xdp-n53zg
- Scan DNS Name:** Unavailable

A red box highlights the 'Client Subnet' and 'Backup Subnet' fields.

Nodes Section:

- Resources:** Shows 'Nodes (2)' and 'Databases (1)'. The 'Nodes' section is selected, showing two nodes: 'xdprod-n53zg2' and 'xdprod-n53zg1', both in a 'PROVISIONING...' state.
- Nodes Table:** Displays the following information for each node:

Host Name	Private IP Address & DNS Name	Floating IP Address
xdprod-n53zg2	Unavailable in this state.	Unavailable in this state.
xdprod-n53zg1	Unavailable in this state.	Unavailable in this state.

Page Footer:

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Secure Access via Bastion Server

Since the ExaCS system is on private subnet, you need to connect it using bastion host. Create a config file for ssh on Your client host to access The deployment of ExaCS on private Subnet using Proxy host. E.g

```
dhcp-10-135-189-14:~ balsharma$ cat config
HOST bastion
  IdentityFile /Users/balsharma/keys/new/balskey
  User opc
  Hostname 129.213.124.178

HOST 10.0.96.2
  User opc
  IdentityFile /Users/balsharma/keys/new/balskey
  ProxyCommand ssh bastion -W %h:%p

HOST 10.0.0.3
  User opc
  IdentityFile /Users/balsharma/keys/new/xdkey
  ProxyCommand ssh bastion -W %h:%p

HOST 10.0.0.2
  User opc
  IdentityFile /Users/balsharma/keys/new/xdkey
  ProxyCommand ssh bastion -W %h:%p
dhcp-10-135-189-14:~ balsharma$ pwd
/Users/balsharma/.ssh
dhcp-10-135-189-14:~ balsharma$
```

Networking » Virtual Cloud Networks » Virtual Cloud Network Details » Security Lists » Security List Details

bas

SL AVAILABLE

Edit All Rules Terminate Apply Tag(s)

Security List Information Tags

OCID: ...uhyf7a Show Copy

Created: Mon, 14 Jan 2019 23:11:13 GMT

Instance traffic is controlled by firewall rules on each Instance in addition to this Security List

Ingress Rules

No Ingress Rules

Stateless Rules

Stateful Rules

Source: 0.0.0.0/0 IP Protocol: TCP Source Port Range: All Destination Port Range: 22 Allows: TCP traffic for ports: 22 SSH Remote Login Protocol

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ExaCS: Verifying Database and system information

```
[opc@xdprod-n53zg1 ~]$ sudo -s
[root@xdprod-n53zg1 opc]# dbaascli dbhome info
DBAAS CLI version 18.2.3.1.0
Executing command dbhome info
Location of inventory.xml is set to /u01/app/oralInventory/ContentsXML/inventory.xml
Enter a homename or just press enter if you want details of all homes
1.HOME_NAME=OraHome100_12102_dbbp180417_0
  HOME_LOC=/u02/app/oracle/product/12.1.0/dbhome_2
  PATCH_LEVEL=12102_dbbp180417
  DBs installed= bmsprod
```

```
[root@xdprod-n53zg1 opc]# dbaascli database status --dbname bmsprod
DBAAS CLI version 18.2.3.1.0
Executing command database status
Database Status:
Instance bmsprod1 is running on node xdprod-n53zg1. Instance status: Open,HOME=/u02/app/oracle/product/12.1.0/dbhome_2.
Instance bmsprod2 is running on node xdprod-n53zg2. Instance status: Open,HOME=/u02/app/oracle/product/12.1.0/dbhome_2.
```

```
Bals-MacBook-Pro:~ balsharma$ ssh 10.0.0.2
Last login: Sun Jan 27 06:29:48 2019 from bast13.subpubbasbal.venbal.oraclevcn.com
[opc@xdprod-n53zg1 ~]$ grep -i MACHINETYPES /opt/oracle.SupportTools/onecommand/databasemachine.xml
  <MACHINETYPES>X7-2 Elastic Rack HC 10TB</MACHINETYPES>
[opc@xdprod-n53zg1 ~]$
```

ExaCS: Verifying ASM information

```
[opc@xdprod-n53zg1 ~]$ sudo su - grid
[grid@xdprod-n53zg1 ~]$
[grid@xdprod-n53zg1 ~]$
[grid@xdprod-n53zg1 ~]$ sqlplus

SQL*Plus: Release 12.2.0.1.0 Production on Sun Jan 27 19:34:52 2019

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Enter user-name: sys as sysasm
Enter password:

Connected to:
Oracle Database 12c Enterprise Edition Release 12.2.0.1.0 - 64bit Production

SQL> select failgroup , count(*) from v$asm_disk group by failgroup ;

FAILGROUP          COUNT(*)
-----  -----
TAD300633EXDCL01      36
TAD300633EXDCL02      36
TAD300633EXDCL03      36
XDPROM_N53ZG1          1
XDPROM_N53ZG2          1

SQL> ■

[grid@xdprod-n53zg1 ~]$ asmcmd
ASMCMD> lsdg
State  Type  Rebal  Sector  Logical_Sector  Block  AU  Total_MB  Free_MB  Req_mir_free_MB  Usable_file_MB  Offline_
es  Name
MOUNTED  HIGH  N      512      512  4096  4194304  117707808  115017408  6539264  36159325
Y  DATA1/
MOUNTED  HIGH  N      512      512  4096  4194304  168136784  167965296  9340928  52874789
N  RECO1/
MOUNTED  HIGH  N      512      512  4096  4194304  63037440  63036180  3502080  19544700
N  SPRC1/
ASMCMD> ■

[[root@xdprod-n53zg1 ~]# df -h
Filesystem      Size  Used  Avail Use% Mounted on
/dev/mapper/VGExaDb-LVDbSys1
                  24G   5.6G   17G  26% /
tmpfs           709G  616M  708G   1% /dev/shm
/dev/xvda1       488M   32M  431M   7% /boot
/dev/mapper/VGExaDb-LVDb0ra1
                  20G   266M   19G   2% /u01
/dev/xvdb         50G   14G   33G  30% /u01/app/12.2.0.1/grid
/dev/xvdc         50G   9.0G   38G  20% /u01/app/oracle/product/12.2.0.1/dbhome_1
/dev/xvdd         50G   8.6G   39G  19% /u01/app/oracle/product/12.1.0.2/dbhome_1
/dev/xvde         50G   5.4G   42G  12% /u01/app/oracle/product/11.2.0.4/dbhome_1
/dev/xvdg        1.1T   12G  1017G   2% /u02
/dev/asm/acfsvol01-258
                  800G   31G  770G   4% /acfs01
[root@xdprod-n53zg1 ~]# ■
```

ExaCS –Deployment: Things to consider:

Deployment Time:

	Quarter	Half	Full
Launch	4h	6h	8h
Secure Erase	6h	6h	6h
Termination	Minutes	Minutes	Minutes

- Passwords: Don't use SYS/SYSTEM/Oracle
- SSH Key: Only use 1 with no spaces in the “comment” field
- Adjust Huge Pages depending on DB and Memory requirements as per MOS Note

Connecting to the Database: Use an application service !

```
srvctl modify service -db ORCL -service APPCON -failovertype TRANSACTION -replay_init_time 300  
-failoverretry 30 -failoverdelay 3 -notification TRUE -commit_outcome TRUE -session_state DYNAMIC -  
drain_timeout 30 –failover_restore LEVEL1
```

Setting Up Exadata (OCI Controlplane)

- Methods
 - Console
 - OCI CLI
 - Terraform
 - SDK
- Functions
 - Created/Terminated
 - Scale Up/Down
 - Create/Delete DB/DBHome

```
oci db system launch

--availability-domain, --compartment-id, --cpu-core-count, --
hostname, --shape, --subnet-id, --backup-subnet-id, --cluster-
name, --display-name, --domain, --sparse-diskgroup, --database-
edition, --admin-password, --db-name, --db-version, --ssh-
authorized-keys-file ...
```

oci db system launch [OPTIONS]

Ref: https://docs.cloud.oracle.com/iaas/tools/oci-cli/latest/oci_cli_docs/cmdref/db/system/launch.html

ExaCS - Sizing and Consolidation Best practices on

- X7 introduced a new pricing model
 - OCPUs and Infrastructure have been separated
 - Upon creation, infrastructure is charged 744 hours
 - Not designed to do a “quick” test
 - No OCPU minimums
 - 0 OCPUs will shutdown the VMs
 - Only infrastructure is charged
 - Don’t use less than 4 OCPU per node
 - No imparity allowed (today)
 - Size for Storage capacity and IOP/s and Grow CPU by demand
 - ExaCS Shape change not possible => Data Guard for Migration



Consolidation on ExaCS

- Use CPU_COUNT to distribute workload
 - Production Workload
 - Partitioning Approach
 - Enabled Cores > SUM(CPU_COUNT)

Test/Development

- Overprovisioning Approach
- Enabled Cores > 3x SUM(CPU_COUNT)
- Use Resource Manager for IntraDB Workload
- Enable IORM for IO Distribution

Demo

ExaCS Network Preparation & Provisioning

Demo Flow

Prepare Network

Create VCN

Create Service GW

Create Route Table

Create Security List

Create Subnets

ORACLE

Compartment: ExaCS_PROD_COMP

VCN Name: ExaCS_VCN_PROD
Compartment: ExaCS_PROD_COMP
CIDR Block: 10.0.0.0/19
Create with Option **Virtual Cloud Network Only**

SGW Name: ExaCS_NW_SGW
Compartment: EXACS_PROD_COMP
Services: All IAD Services in Oracle Service Network

RT Name: ExaCS_RT_DATA, ExaCS_RT_BKP
Route Rule: Target Type Service GW: ExaCS_NW_SGW

Security List: Two new- for Data and for Backup Subnet
ExaCS_SEC_DATA, ExaCS_SEC_BKP , Default Rule

Subnet Name: ExaCS_SUB_DATA, ExaCS_SUB_BKP:
Regional/Private, CIDR:
CIDR: 10.0.2.0/24, 10.0.3.0/24
Security Rules: ExaCS_SEC_DATA, ExaCS_SEC_BKP , Default Rule

Provision ExaCS

Db System Information

Network Information

Database Information

Launch Db System

UI operations

Exadata Cloud Service – Summary

You should now be able to

- Describe the features of Exadata Cloud Service
- Understand Exadata and its core architecture.
- Understand Exadata Cloud Service Deployment best practices.
- Describe the aspects of service management in Exadata Cloud service
- Provision Exadata Cloud service using console
- Architecture best practices for database workload
- Consolidation best practices and sizing

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