

ExaCS Overview

Level 300

Bal Sharma | May 2019

Safe Harbor Statement

The following is intended to outline our general product direction. It is intended for information purposes only, and may not be incorporated into any contract. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions. The development, release, and timing of any features or functionality described for Oracle's products remains at the sole discretion of Oracle.

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.

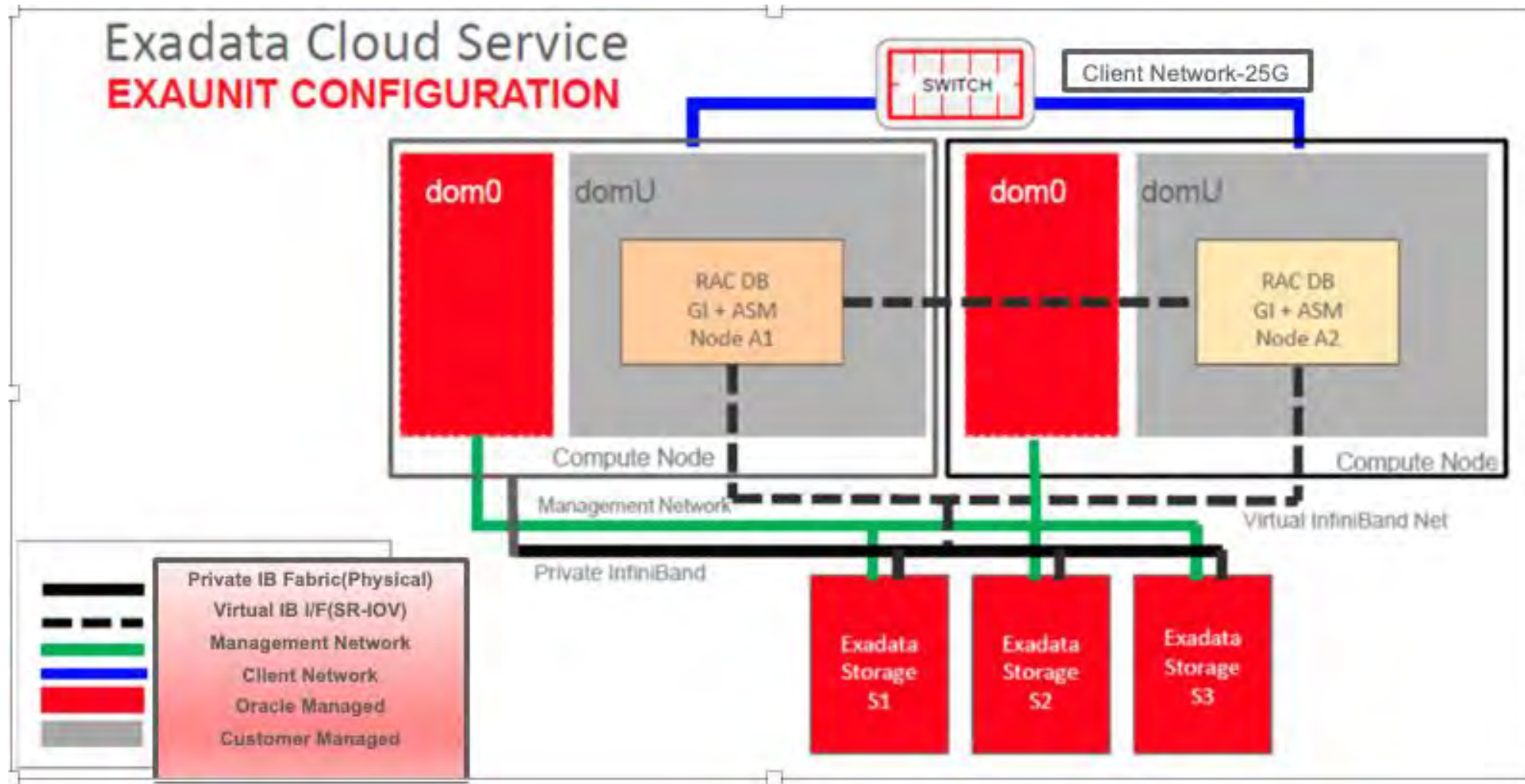
ExaCS Management

- 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

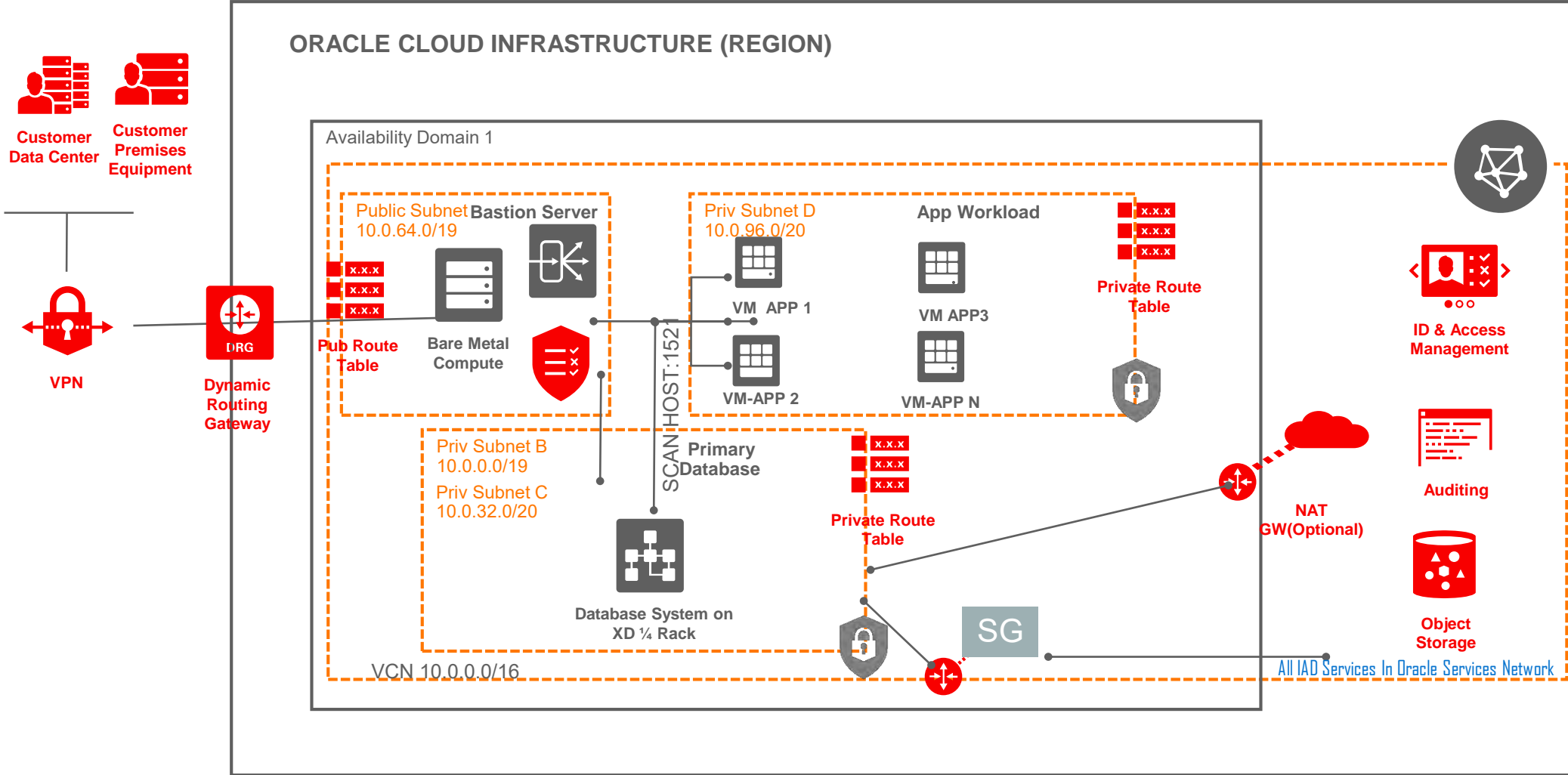
- All Patches pre-staged (OS, GI, DB)
- Patch what you want when you want on your schedule
- Patching automated through cloud tooling
- REST services make scheduling easy

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

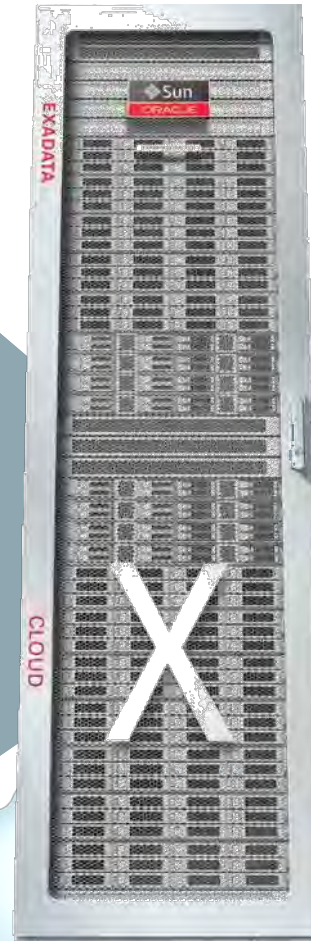


Exadata Basics

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



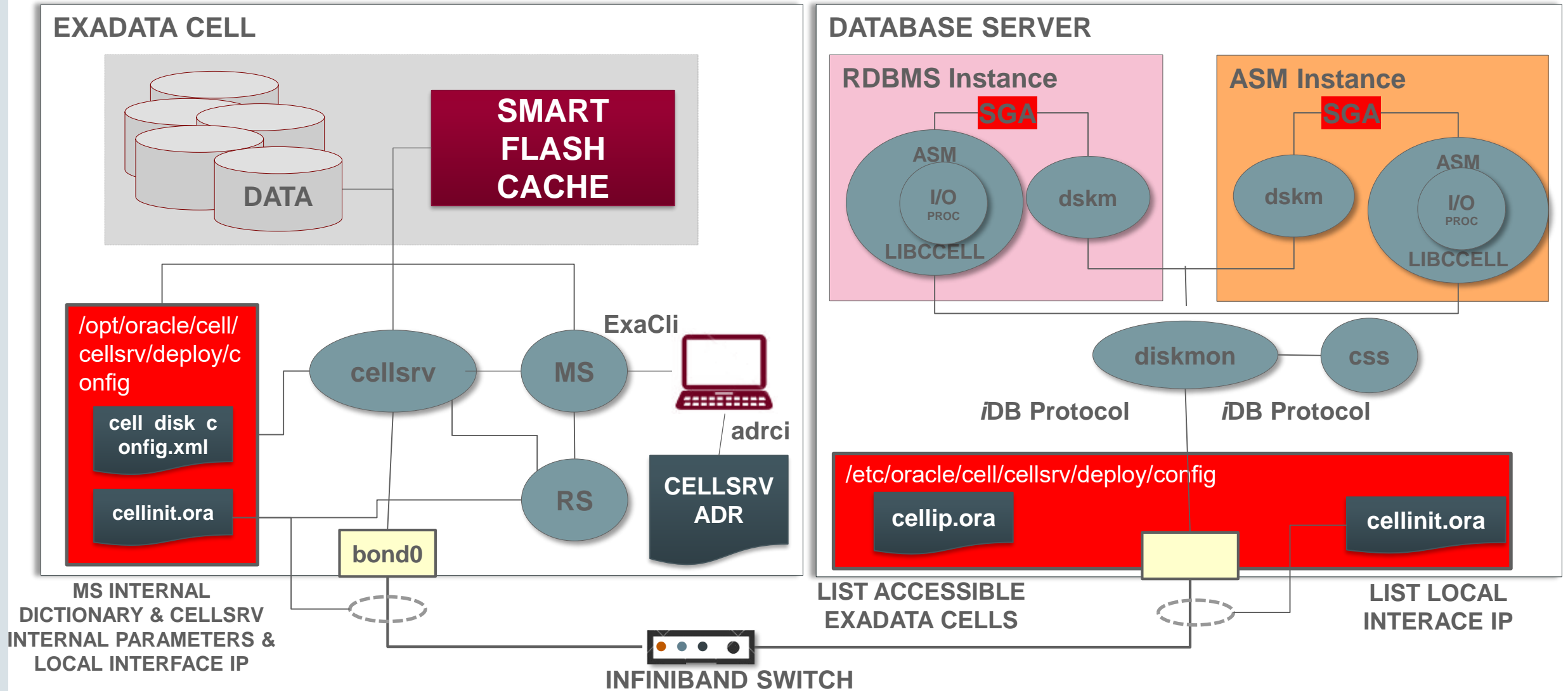
Exadata image contains:

- 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.

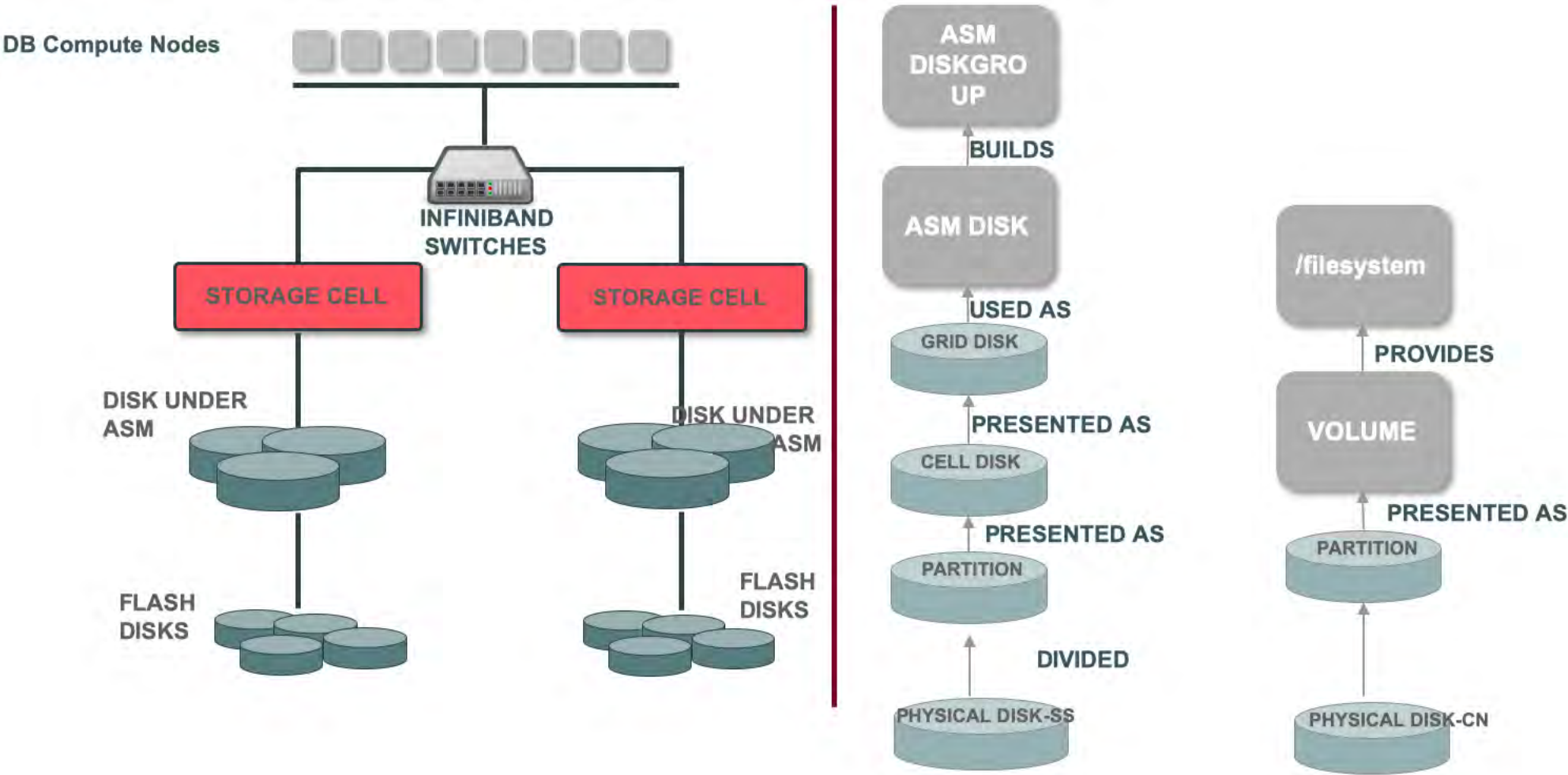


ExaCS uses Oracle Linux 7.5 based on UEK4 QU7 (4.1.12-124.20.3) for domU, baremetal and cell.

Exadata Software Architecture



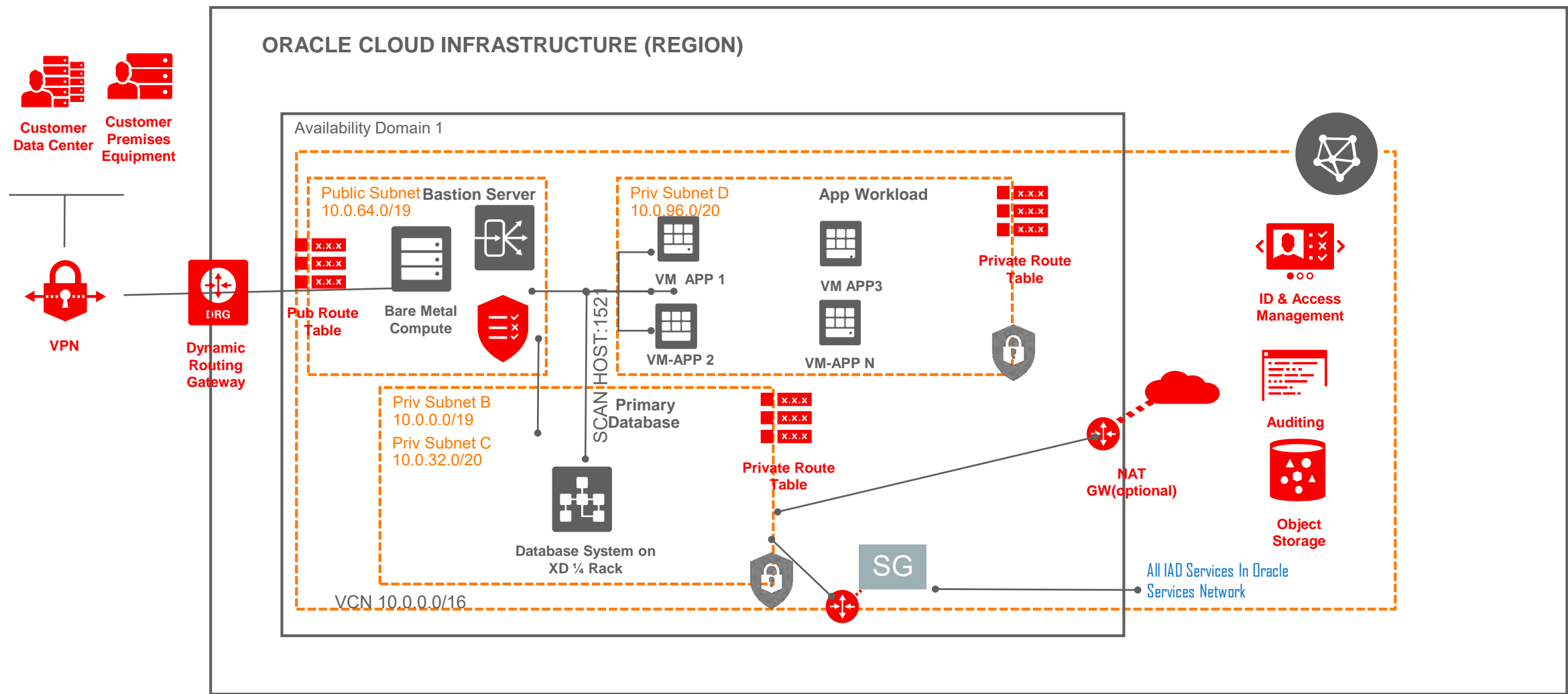
Disk Layout & Physical layout- Exadata





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
 - xdprod-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 'Create Virtual Cloud Network' dialog box. At the top right are 'help' and 'cancel' links. The 'CREATE IN COMPARTMENT' dropdown is set to 'balsharma'. Below it, the 'NAME' field is 'vcn_bal'. There are two radio buttons: 'CREATE VIRTUAL CLOUD NETWORK ONLY' (selected) and 'CREATE VIRTUAL CLOUD NETWORK PLUS RELATED RESOURCES'. A note states: '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.' The 'CIDR BLOCK' field is '10.0.0.0/16'. Under 'DNS RESOLUTION', the 'USE DNS HOSTNAMES IN THIS VCN' checkbox is checked. Below this is a 'DNS LABEL' field with 'vcnbal'. The 'DNS DOMAIN NAME' field is empty. There is a 'TAGS' section with a table for 'TAG NAMESPACE', 'TAG KEY', and 'VALUE'. The 'TAG NAMESPACE' dropdown is set to 'None (apply a free-form tag)'. At the bottom, there is a checkbox for 'VIEW DETAIL PAGE AFTER THIS RESOURCE IS CREATED' and a 'Create Virtual Cloud Network' button.

**VCN**
AVAILABLE

[vcn_bal](#)
OCID: ...jefqya [Show](#) [Copy](#)

CIDR Block: 10.0.0.0/16

Default Route Table: [Default Route Table for vcn_bal](#)

DNS Domain Name

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,

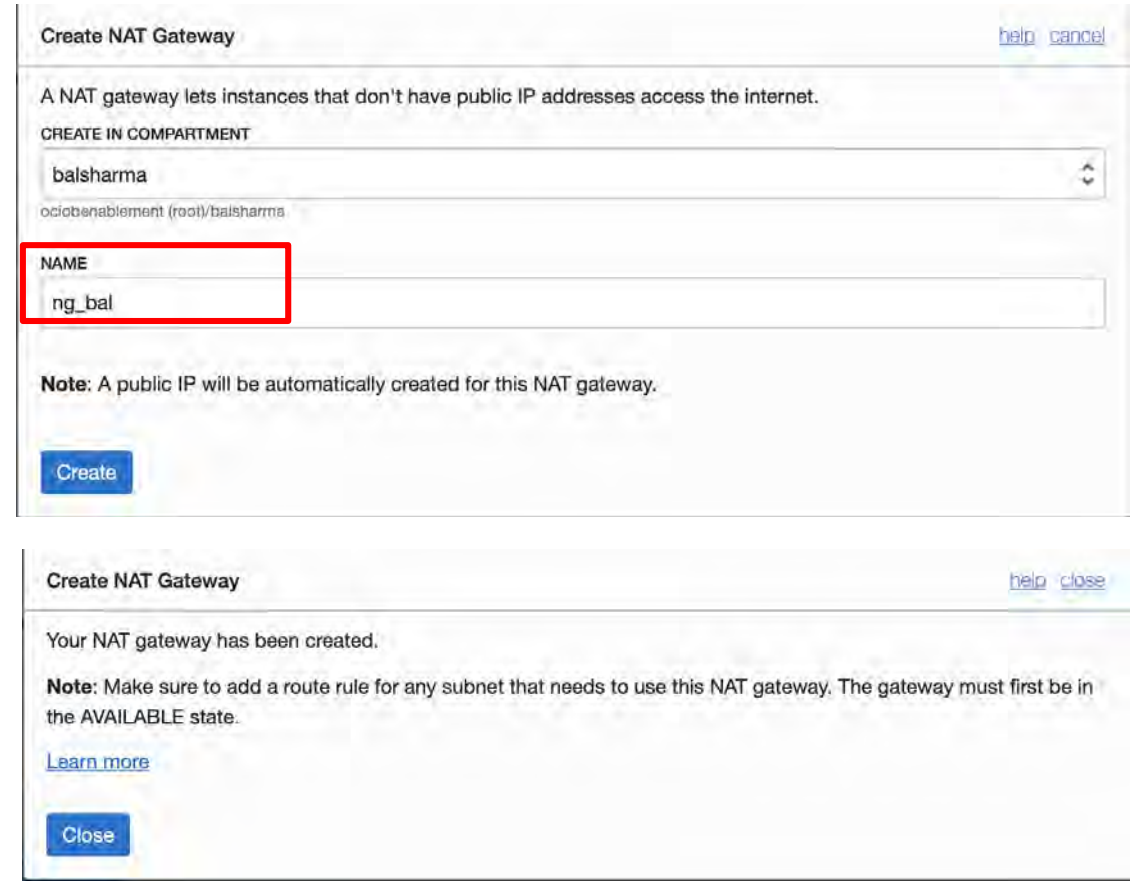
For this example, enter the following values in the **Create NAT Gateway** dialog box:

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.



Create NAT Gateway [help](#) [cancel](#)

A NAT gateway lets instances that don't have public IP addresses access the internet.

CREATE IN COMPARTMENT

balsharma
ociotenabement (root)/balsharma

NAME
ng_bal

Note: A public IP will be automatically created for this NAT gateway.

Create

Create NAT Gateway [help](#) [close](#)

Your NAT gateway has been created.

Note: Make sure to add a route rule for any subnet that needs to use this NAT gateway. The gateway must first be in the AVAILABLE state.

[Learn more](#)

Close

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.



Create Service Gateway [help](#) [cancel](#)

Note: Make sure to add a route rule and security list rule for any subnet that needs to use the service gateway. [Learn more.](#)

NAME
sg_bal

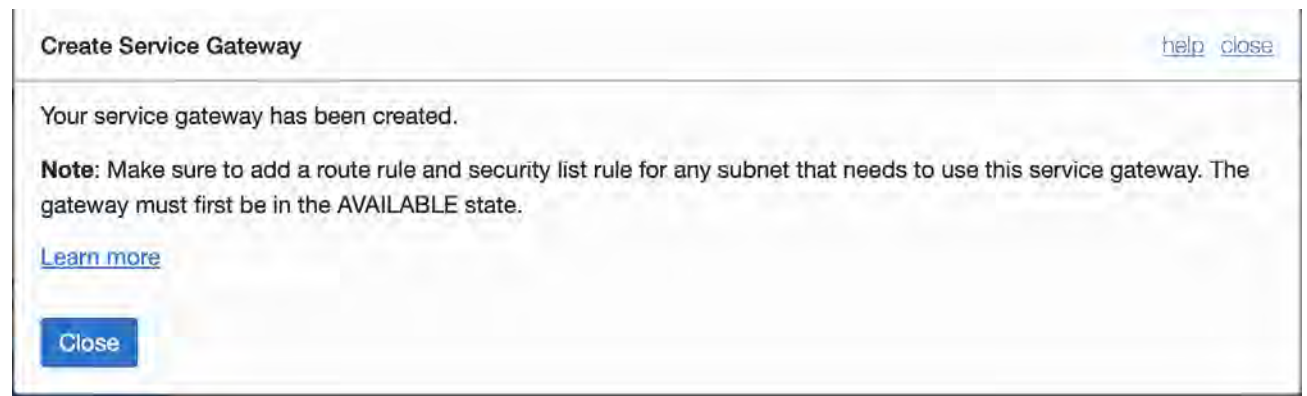
CREATE IN COMPARTMENT
balsharma
ocioanabment/(root)/balsharma

SERVICES
All IAD Services In Oracle Services Network

Warning: Your workloads may need access to public endpoints not supported by the service gateway (for example, to get updates or patches). Ensure you have a NAT gateway or other access to the internet if necessary. [Learn more.](#)

[Show Additional Options](#)

[Create Service Gateway](#) [Cancel](#)



Create Service Gateway [help](#) [close](#)

Your service gateway has been created.

Note: Make sure to add a route rule and security list rule for any subnet that needs to use this service gateway. The gateway must first be in the AVAILABLE state.

[Learn more](#)

[Close](#)

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
oci:tenancy:ocid1tenancy: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	DESTINATION SERVICE
Service Gateway	All IAD Services In Oracle Services Network
Service Gateway	sg_bal

COMPARTMENT
balsharma
oci:tenancy:ocid1tenancy:root/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	KEY	VALUE	OPTIONAL
No namespace (Free-Form tag)			

+ 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	Target Type	Target
0.0.0.0/0	NAT Gateway	ng_bal
All IAD Services In Oracle Services Network	Service Gateway	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: ociobenablement (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](#)



AVAILABLE

[Default Route Table for vcn_bal](#)

OCID: ...tpd4va [Show](#) [Copy](#)

1

RULE

Compartment: balsharma



AVAILABLE

[priv](#)

OCID: ...3jganq [Show](#) [Copy](#)

2

RULES

Compartment: balsharma

Route Table

ROUTE TABLE COMPARTMENT

balsharma

ROUTE TABLE

Default Route Table for vcn_bal

Security Lists

SECURITY LIST COMPARTMENT

balsharma

SECURITY LIST COMPARTMENT

balsharma

SECURITY LIST COMPARTMENT

balsharma

SECURITY LIST

bas

SECURITY LIST

Default Security List for vcn_bal

SECURITY LIST

fsaccess

[+ Add Security List](#)

[Update](#)

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) [Remove\(s\)](#)

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: ...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

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
-------------------	------------------	------------------------	----------------------------	---

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.

Default DHCP Options for vcn_bal

[Terminology](#) [Apply Tag\(s\)](#)

DHCP Option Information [Tags](#)

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

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

DHCP Options

[Edit DHCP Options](#)

DNS Type: Internet and VCN Resolver

Search Domain: vcnbal.oraclevcn.com

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**.

ORACLE®

Edit Subnet
[help](#)
[cancel](#)

NAME

sub_priv_bkp_bal

DHCP Options

DHCP OPTIONS COMPARTMENT

balsharma

ociobenablement (root)/balsharma

DHCP OPTIONS

Default DHCP Options for vcn_bal

Route Table

ROUTE TABLE COMPARTMENT

balsharma

ociobenablement (root)/balsharma

ROUTE TABLE

priv

Security Lists

SECURITY LIST COMPARTMENT

balsharma

ociobenablement (root)/balsharma

SECURITY LIST

Default Security List for vcn_bal

x

SECURITY LIST COMPARTMENT

balsharma

ociobenablement (root)/balsharma

SECURITY LIST

fsaccess

x

+ 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
[help](#)
[cancel](#)

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

None (apply a free-form tag)

TAG KEY

VALUE

+ 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 [help](#) [cancel](#)

SECURITY LIST NAME

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

Examples: 80, 20-22 or All

[\(more information\)](#)

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

Examples: 0, 3, 5 or All

[\(more information\)](#)

+ 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

Examples: 80, 20-22 or All

[\(more information\)](#)

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

Examples: 0, 3, 5 or All

[\(more information\)](#)

+ Another Egress Rule

Save Security List Rules

ORACLE

Copyright © 2019, Oracle and/or its affiliates. All rights reserved.

33

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) [View](#)

Security List Information [Tags](#)

OCID: oc6wvt0q [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 access 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
xdprod

AVAILABILITY DOMAIN
GrCh:US-ASHBURN-AD-1

SHAPE TYPE
☐ VIRTUAL MACHINE ☐ BARE METAL ☒ EXADATA

SHAPE
Exadata.Quarter2.92

TOTAL NODE COUNT
1

ORACLE DATABASE SOFTWARE EDITION
Enter the Edition ID or select a license from the list.

CLUSTER NAME (Optional)
xdpcluster

CPU CORE COUNT
6

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.

CLUSTER NAME (Optional)
xdpcluster

CPU CORE COUNT
6

The number of CPU cores to enable on the DB System. Specify a multiple of 2, up to 96.

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:

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 shapes.

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

⌵

POB 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 `!@#%&*~`, `^_<>|`, 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.

[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) 	<input type="text"/>	<input type="text"/>

[+ 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

[View Advanced Options](#)

DISK REDUNDANCY

100%

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

The screenshot displays the Oracle Cloud Infrastructure (OCI) console interface. At the top, there's a navigation bar with the OCI logo, a menu icon, a search bar, and user information. The main header area shows "Bare Metal, VM, and Exadata" on the left and "DB Systems in balsharma Compartment" in the center, with a note "Displaying 1 DB Systems". On the left sidebar, under "DB Systems", there are links for "Standalone Backups" and "List Scope". Below this, a dropdown menu shows the selected compartment as "balsharma". The main content area features a "Launch DB System" button at the top. Below it, a single DB System card is shown with details:

- ID:** ocid1.db.system...6xk44a
- Availability Domain:** GrCh:US-ASHBURN-AD-1
- Database Software Edition:** Enterprise Edition Extreme Performance
- CPU Core Count:** 6
- Shape:** Exadata.Quarter2.92
- Virtual Cloud Network:** vcn_bal
- Client Subnet:** sub_priv_data_bal
- Backup Subnet:** sub_priv_bkp_bal
- Private IP:** Loading...
- Public IP:** Loading...
- Launched:** Fri, 11 Jan 2019 21:36:08 GMT

At the bottom left, there's a search prompt: "Don't see what you're looking for?".

Screenshot: Launching an Exadata DB System from OCI Console

Database » DB Systems » DB System Details » Nodes

xdprod



DB System Information **Tags**

Availability Domain: GrCh:US-ASHBURN-AD-1
Shape: Exadata.Quarter2.92
Compartment: ociobenablement (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

OCID: ...6xk44a [Show](#) [Copy](#)
Created: Fri, 11 Jan 2019 21:36:08 GMT
Oracle Database Software Edition: Enterprise Edition Extreme Performance
Virtual Cloud Network: [vcn_bal](#)
Client Subnet: sub_priv_data_bal
Backup Subnet: sub_priv_bkp_bal
Hostname Prefix: xdpnod-n53zg
Scan DNS Name: Unavailable
License type: License included

Nodes

Displaying 2 Nodes

 PROVISIONING...	Host Name: xdpnod-n53zg2 OCID: ...uulwyq Show Copy	Private IP Address & DNS Name: Unavailable in this state. Public IP Address: Unavailable in this state. Backup Private IP Address & DNS Name: Unavailable in this state. Backup Public IP Address: Unavailable in this state.	Floating IP Address: Unavailable in this state.
 PROVISIONING...	Host Name: xdpnod-n53zg1 OCID: ...3uur7q Show Copy	Private IP Address & DNS Name: Unavailable in this state. Public IP Address: Unavailable in this state. Backup Private IP Address & DNS Name: Unavailable in this state. Backup Public IP Address: Unavailable in this state.	Floating IP Address: Unavailable in this state.

Secure Access via Bastion Server

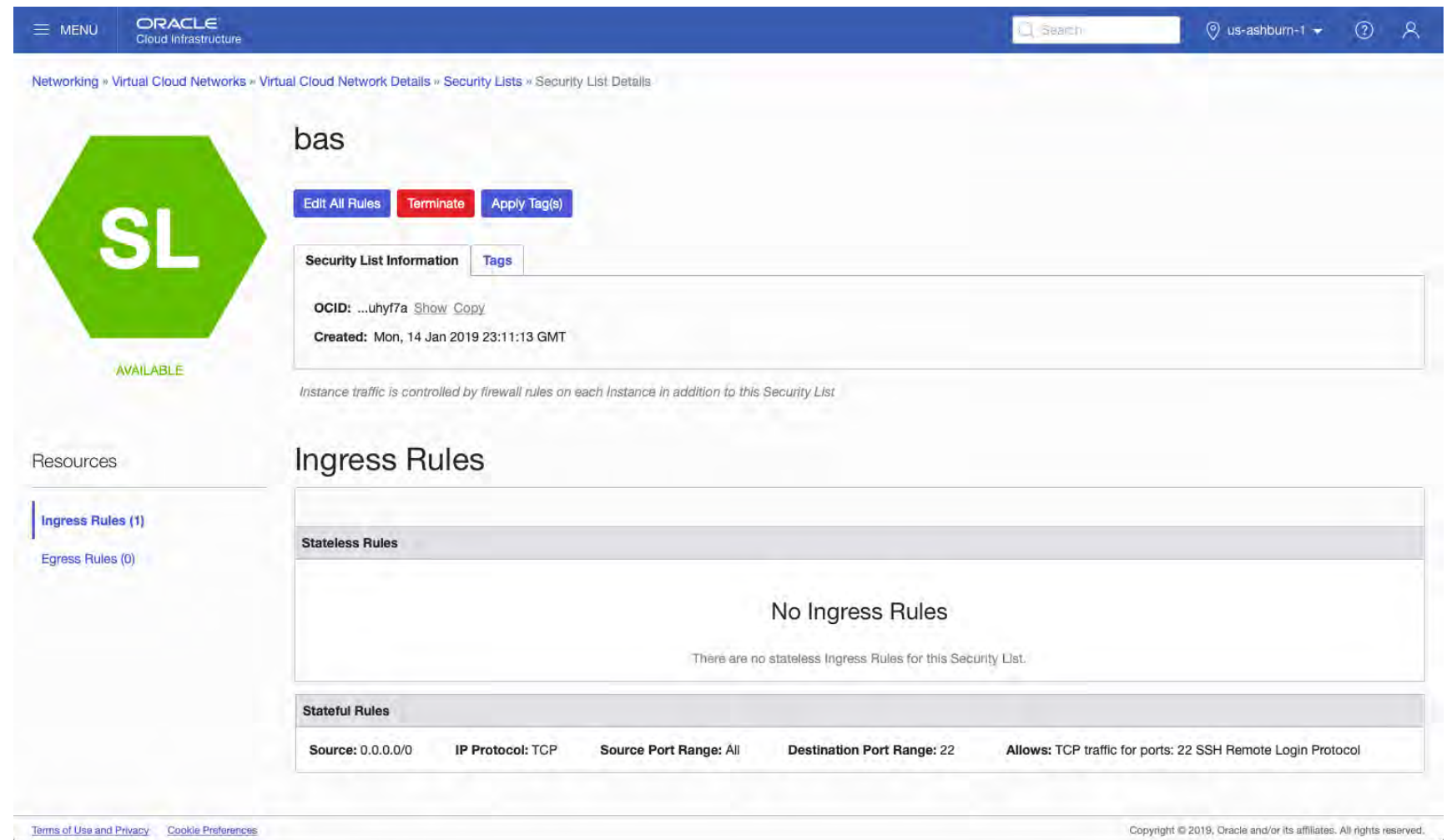
Since the ExaCS system is on private subnet, you need to connect it using bastion host. Create a config file for ssh on Your client host to access The deployment of ExaCS on private Subnet using Proxy host. E.g

```
dhcp-10-135-189-14:.ssh 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:.ssh balsharma$ pwd
/Users/balsharma/.ssh
dhcp-10-135-189-14:.ssh balsharma$
```



The screenshot displays the Oracle Cloud Infrastructure console interface for a Security List named 'bas'. The top navigation bar includes the Oracle logo, 'Cloud Infrastructure', a search bar, and the region 'us-ashburn-1'. The breadcrumb trail indicates the path: Networking » Virtual Cloud Networks » Virtual Cloud Network Details » Security Lists » Security List Details.

The main content area features a large green hexagonal icon with 'SL' and the status 'AVAILABLE'. To the right of the icon are buttons for 'Edit All Rules', 'Terminate', and 'Apply Tag(s)'. Below these is the 'Security List Information' tab, which shows the OCID as '...uhyt7a' (with a 'Show Copy' link) and the creation time as 'Mon, 14 Jan 2019 23:11:13 GMT'. A note states: 'Instance traffic is controlled by firewall rules on each Instance in addition to this Security List'.

The 'Resources' section on the left lists 'Ingress Rules (1)' and 'Egress Rules (0)'. The 'Ingress Rules' section on the right is titled 'No Ingress Rules' and contains the text: 'There are no stateless Ingress Rules for this Security List.' Below this, the 'Stateful Rules' section shows a single rule with the following details: Source: 0.0.0.0/0, IP Protocol: TCP, Source Port Range: All, Destination Port Range: 22, and Allows: TCP traffic for ports: 22 SSH Remote Login Protocol.

At the bottom of the console, there are links for 'Terms of Use and Privacy' and 'Cookie Preferences', and a copyright notice: 'Copyright © 2019, Oracle and/or its affiliates. All rights reserved.'

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/oraInventory/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.vcnbal.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

Copyright (c) 1982, 2016, Oracle. All rights reserved.

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(*)
-----
IAD300633EXDCL01                         36
IAD300633EXDCL02                         36
IAD300633EXDCL03                         36
XDPROD_N53ZG1                             1
XDPROD_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 117787008 115017408 6539264 36159325
Y DATA1/
MOUNTED HIGH N 512 512 4096 4194304 168136704 167965296 9340928 52874789
N RECOC1/
MOUNTED HIGH N 512 512 4096 4194304 63037440 63036180 3502080 19644700
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-LVDbOra1
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 DYAMIC –  
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

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

ORACLE®
Cloud Infrastructure

cloud.oracle.com/iaas

cloud.oracle.com/tryit