



Oracle Cloud Infrastructure Architect Associate: Hands-on Workshop

Student Guide – Volume II
D1111074GC10

Learn more from Oracle University at education.oracle.com



Copyright © 2025, Oracle and/or its affiliates.

Disclaimer

This document contains proprietary information and is protected by copyright and other intellectual property laws. The document may not be modified or altered in any way. Except where your use constitutes "fair use" under copyright law, you may not use, share, download, upload, copy, print, display, perform, reproduce, publish, license, post, transmit, or distribute this document in whole or in part without the express authorization of Oracle.

The information contained in this document is subject to change without notice and is not warranted to be error-free. If you find any errors, please report them to us in writing.

Restricted Rights Notice

If this documentation is delivered to the United States Government or anyone using the documentation on behalf of the United States Government, the following notice is applicable:

U.S. GOVERNMENT END USERS: Oracle programs (including any operating system, integrated software, any programs embedded, installed or activated on delivered hardware, and modifications of such programs) and Oracle computer documentation or other Oracle data delivered to or accessed by U.S. Government end users are "commercial computer software" or "commercial computer software documentation" pursuant to the applicable Federal Acquisition Regulation and agency-specific supplemental regulations. As such, the use, reproduction, duplication, release, display, disclosure, modification, preparation of derivative works, and/or adaptation of i) Oracle programs (including any operating system, integrated software, any programs embedded, installed or activated on delivered hardware, and modifications of such programs), ii) Oracle computer documentation and/or iii) other Oracle data, is subject to the rights and limitations specified in the license contained in the applicable contract. The terms governing the U.S. Government's use of Oracle cloud services are defined by the applicable contract for such services. No other rights are granted to the U.S. Government.

Trademark Notice

Oracle®, Java, MySQL, and NetSuite are registered trademarks of Oracle and/or its affiliates. Other names may be trademarks of their respective owners.

Intel and Intel Inside are trademarks or registered trademarks of Intel Corporation. All SPARC trademarks are used under license and are trademarks or registered trademarks of SPARC International, Inc. AMD, Epyc, and the AMD logo are trademarks or registered trademarks of Advanced Micro Devices. UNIX is a registered trademark of The Open Group.

Third-Party Content, Products, and Services Disclaimer

This documentation may provide access to or information about content, products, and services from third parties. Oracle Corporation and its affiliates are not responsible for and expressly disclaim all warranties of any kind with respect to third-party content, products, and services unless otherwise set forth in an applicable agreement between you and Oracle. Oracle Corporation and its affiliates will not be responsible for any loss, costs, or damages incurred due to your access to or use of third-party content, products, or services, except as set forth in an applicable agreement between you and Oracle.

1002262025

Table of Contents

Module 11: Networking - DNS Management	14
What Is DNS?	15
Domain Name System (DNS)	16
DNS: Introduction	17
OCI DNS Capabilities	20
Benefits of OCI Public DNS	21
DNS Service Components	22
OCI DNS Management	23
Zones	24
Public DNS Zone	27
Demo: Public DNS Zone	29
Private DNS Zone	30
Choices for DNS in VCN	31
Private DNS	32
Demo: Private DNS Zone	33
Private Views	34
HTTP Redirects	36
Traffic Management	39
Traffic Management Components	41
Traffic Management Policy Types	42
Traffic Management Steering Policy Types	43
Use Cases	44
Demo: Failover Policy Type	45
Demo: Load Balancer Policy Type	46
Demo: Geolocation Steering Policy Type	47
Module 12: Networking - Network Command Center	48
Network Command Center Overview	49

Network Command Center	50
Inter-Region Latency	52
OCI Global Locations and Inter-Region Latency	53
Inter-Region Latency (IRL) Dashboard	54
Current Inter-Region Round-Trip Time	55
Inter-Region Round-Trip Time	56
IRL Use Cases	57
Demo: Inter-Region Latency	58
Network Path Analyzer	59
Network Path Analyzer (NPA)	60
Network Path Analyzer: Features	61
Network Path Analyzer: Scenario 1	62
Network Path Analyzer: Scenario 2	63
NPA Use Cases	64
Demo: Network Path Analyzer	65
Network Visualizer	66
Overall Network Architecture in OCI	67
Network Visualizer	68
Network Visualizer: Use Cases	70
Demo: Network Visualizer	71
Capture Filters	72
VTAP Capture Filter Overview	73
Capture Filter Rules	74
Capture Filter Action Criteria	75
Capture Filter Example	76
Demo: Capture Filters	77
Virtual Test Access Points	78
Virtual Test Access Point (VTAP)	79
VTAP Example	80
VTAP Components	81
VTAP Source	82

VTAP Target	83
VTAP Use Cases	84
Demo: Virtual Test Access Points	85
Module 13: Expert Tip	86
Module 14: Compute - Basics	87
Overview of Compute Service	88
OCI Compute Service	89
Platform and Custom Images	91
Instance Images	92
Image Sources	93
Platform Images	94
Custom Images	95
Import/Export and Bring Your Own Image	96
Image Import/Export	97
Replicate Image	98
Bring Your Own Image (BYOI)	99
Compute Shapes	100
Shapes	101
Flexible Shapes	102
GPU Shapes	104
VM GPU Series	106
BMGPU Series	107
Bare Metal versus VM versus Dedicated Hosts	108
Bare Metal Instances	109
Virtual Machine Instances	110
Dedicated Hosts	111
Demo: Generate SSH Keypair	112
Demo: Launch and Connect to an Oracle Linux Instance	113
Demo: Launch and Connect to a Windows Instance	114
Demo: Create a Custom Image	115

Capacity Types: Preemptible Instances	116
Preemptible Instances	117
Demo: Preemptible Instances	120
Capacity Types: Capacity Reservations	121
Capacity Reservations	122
Example Scenarios	124
Support and Limitations	125
Demo: Create a Capacity Reservation and Launch Instances	126
Capacity Types: Dedicated VM Host	127
Dedicated Virtual Machine Hosts	128
Use Cases	129
Dedicated Virtual Machine Host Shapes	130
Limitations	132
Demo: Dedicated VM Host	133
Module 15: Compute - Advanced	134
Burstable Instances	135
Burstable Instances	136
Supported Shapes for Burstable Instances	137
Example Scenarios	138
Burstable Instances Creation	139
Demo: Create a Burstable Instances	140
Compute: Vertical Scaling	141
Vertical Scaling: Considerations	143
Demo: Scale Cores and Memory for an Instance	144
Compute Autoscaling	145
Instance Configuration	146
Instance Pool	147
Instance Configurations and Pools	148
Compute Autoscaling	149
Configuring Autoscaling	150

Autoscaling	151
Demo: Autoscaling	152
Oracle Cloud Agent	153
Oracle OS Management Hub (OSMH)	156
Understanding Challenges of IT Administrator	157
Managing the OS: Challenges	161
Oracle OS Management Hub	162
OSMH Service Architecture	164
OSMH Dashboard	166
OSMH: Simplify and Automate Patch Updates	168
OSMH: Benefits	169
Oracle OS Management Hub (OSMH) Components	170
OSMH Components	171
OSMH: OCI IAM Policies	172
Supported OS Platforms	177
Oracle OS Management Hub (OSMH) for OCI Instances	178
OSMH Example: OCI Instances	179
Oracle OS Management Hub (OSMH) Management Station	190
OSMH: Management Station	191
ManagementStation	192
Oracle OS Management Hub (OSMH) Lifecycle Environments	194
Scenario	195
Lifecycle Environments	196
Lifecycle Environments Benefits	197
Demo: Run Command	198
Run Command	199
Example Scenarios	201
Instance Console Connection	202
Instance Console Connections	203
Instance Console Types	204
Use Cases	205

Demo: Console Connection	206
Infrastructure Maintenance	207
Relocating a VM Instance	208
Live Migration	209
Reboot Migration	210
Manual Migration	211
VM Recovery Due to Infrastructure Failure	212
Shielded Instances	213
Demo: Create a Shielded Instance	218
Confidential Computing	219
Why Confidential Computing?	220
SupportedShapes	222
Benefits	223
Module 16: Object Storage - Basics	224
Overview of Object Storage	225
Oracle Cloud Infrastructure Storage Services	226
OCI Object Storage	227
OCI Object Storage Use Cases	228
Object Storage Resources	229
Object Storage Endpoint	231
Prefixes	232
Object Storage Characteristics	233
Demo: Create a Bucket - Console, Cloudshell, OCI CLI	235
Demo: Upload and Access the Object & Bucket Visibility	236
Multipart Uploads	237
Multipart Uploads (Using Console)	239
Multipart Uploads (Using Multipart Upload AP)	240
Multipart Uploads (Using CLI)	241
Demo: Multipart Uploads	242
Managing Buckets and Objects	243

Object Storage Tiers	246
Auto-Tiering	249
Object Storage Tiers	250
OCI Object Storage Auto-tiering	252
Auto-tiering possible scenarios	253
Demo: Update Storage Tier (Manually, Auto-Tiering)	254
Object Lifecycle Management	255
Lifecycle Policy Rules	256
Object Name Filters	258
Object Name Filters – Rule Precedence	259
Lifecycle Policy Rules	260
Transition Data	261
Demo: Update Storage Tier (Lifecycle Management)	262
Module 17: Expert Tip	263
Module 18: Object Storage - Advanced	264
Object Storage Replication	265
Benefits	268
Replication Policy	269
Limitations	270
Demo: Replication Policy	271
Object Versioning	272
Object Versioning Status	274
Versioning integration with other features	275
Demo: Object Versioning	276
Demo: Replication Policy with Versioning	277
Retention Rules	278
Data Retention	279
Retention Rule Types	280
Retention Rule Lock	281
Retention Duration for Time Bound Rules	282

Use Cases	283
Retention rules integration with other features	284
Demo: Retention Rules - Time Bound and Indefinite	285
Object Copy	286
Demo: Object Copy	289
Object Storage Logging	290
Logging	291
Enabling Logging	292
Demo: Object Storage Logging	293
Securing Object Storage	294
Initial Security Tasks	295
Routine Security Tasks	296
Pre-Authenticated Requests	297
Demo: Create a Pre-authenticated request	300
Demo: Create a Bucket with Customer Managed Key	301
Demo: Re-encrypt an Object	302
Demo: Create automation based on object state changes	303
Module 19: Block Storage - Basics	304
Overview of Block Volume	305
OCI Storage	306
Block Volume Features and Use Cases	307
Block Volume Features	308
Local NVMe SSD Devices	309
Volume Attachment Types	310
iSCSI Versus Paravirtualized	312
Volume Access Types	313
Access Type	314
Read/Write – Shareable	315
Boot Volumes	316
Custom Boot Volumes	318

Troubleshooting	319
Demo: Block Volume Creation	320
Demo: Attach Block Volume to Instance - iSCSI attachment	321
Demo: Attach Block Volume to Instance - Paravirtualized attachment	322
Demo: Configure Multiple Instance Volume Attachments - Part 1	323
Demo: Configure Multiple Instance Volume Attachments - Part 2	324
Block Volume Performance	325
Performance Levels	327
Performance Levels: Lower Cost	328
Performance Levels: Balanced	329
Performance Levels: Higher Performance	330
Performance Levels: Ultra High Performance	331
Dynamic Performance Scaling	332
Dynamic Performance Scaling with Autotuning	333
Performance Based Autotuning	334
Detached Volume Autotuning	335
Module 20: Block Storage - Advanced	336
Resizing a Volume	337
Block and Boot Volume Online Resize	338
Resizing	339
Block and Boot Volume Offline Resize	340
Demo: Volume Resize and Extend Partition	341
Block Volume Backups	342
Backup and Restoration	343
Demo: Create a Block Volume Backup	347
Demo: Create a Backup Policy and define schedule	348
Demo: Restore a Block Volume Backup	349
Demo: Copy Block Volume Backup to another region	350
Block Volume Clones	351
Demo: Create a Block Volume Clone	354

Block Volume Backup Versus Clone Operation	355
Backup Versus Clone	356
Cross Region Replication	358
Use Cases	362
Enabling Volume Replication	363
Demo: Cross Region Replication	364
Volume Groups	365
Demo: Volume Groups	368
Demo: Volume Groups Cross Region Replication	369
Cross Availability Domain Replication	370
Enabling Cross Availability Domain Replication	373
Demo: Cross Availability Domain Replication	374
Demo: Block Volume Encryption	375
Module 21: File Storage - Basics	376
Overview of File Storage	377
Oracle Cloud Infrastructure Storage Services	378
File Storage	379
File Storage Use Cases	380
OCI File Storage Service Features	381
File Storage Concepts	382
Mounting a File System	387
Demo: Create and Mount a File System	388
NFS Export Options	389
Options to control export access	393
Demo: NFS Export Options	394
File System Paths	395
File Storage Service: Paths	396
Export Paths	397
Mount Point Paths	398
File System Paths	399

Module 22: File Storage - Advanced	400
File System Snapshots	401
Demo: Create a Snapshot and Perform Restoration	403
File System Cloning	404
File System Cloning Concepts	407
Demo: Clone a File System	409
Demo: Encrypt using Customer Managed Keys	410
In-Transit Encryption	411
Demo: Set up In-transit encryption	413
File System Replication	414
File System Replication Concepts	416
Replication Process	418
File System Replication: Use Cases	419
Demo: File Storage Replication	420
File Storage Security	421
Security Layers	422
File System Usage and Metering	423
Snapshot Metered Utilization	425
Clone Metered Utilization	426
Module 23: Expert Tip	428



Networking – DNS Management

Oracle Cloud Infrastructure

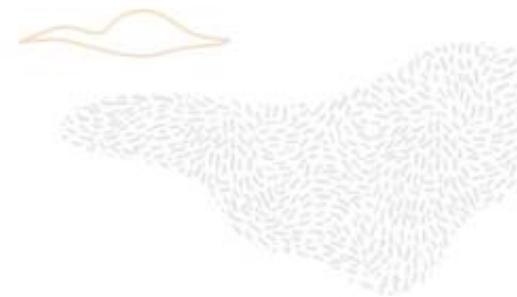
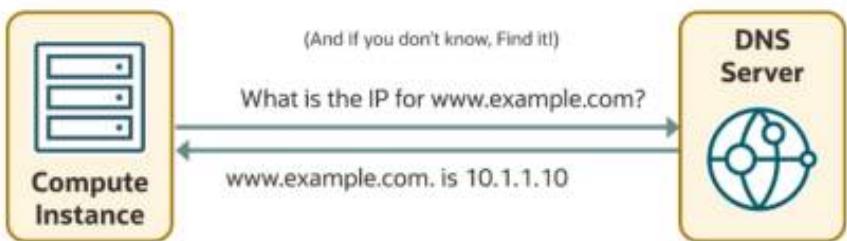
What Is DNS?

Networking – DNS Management

Domain Name System (DNS)

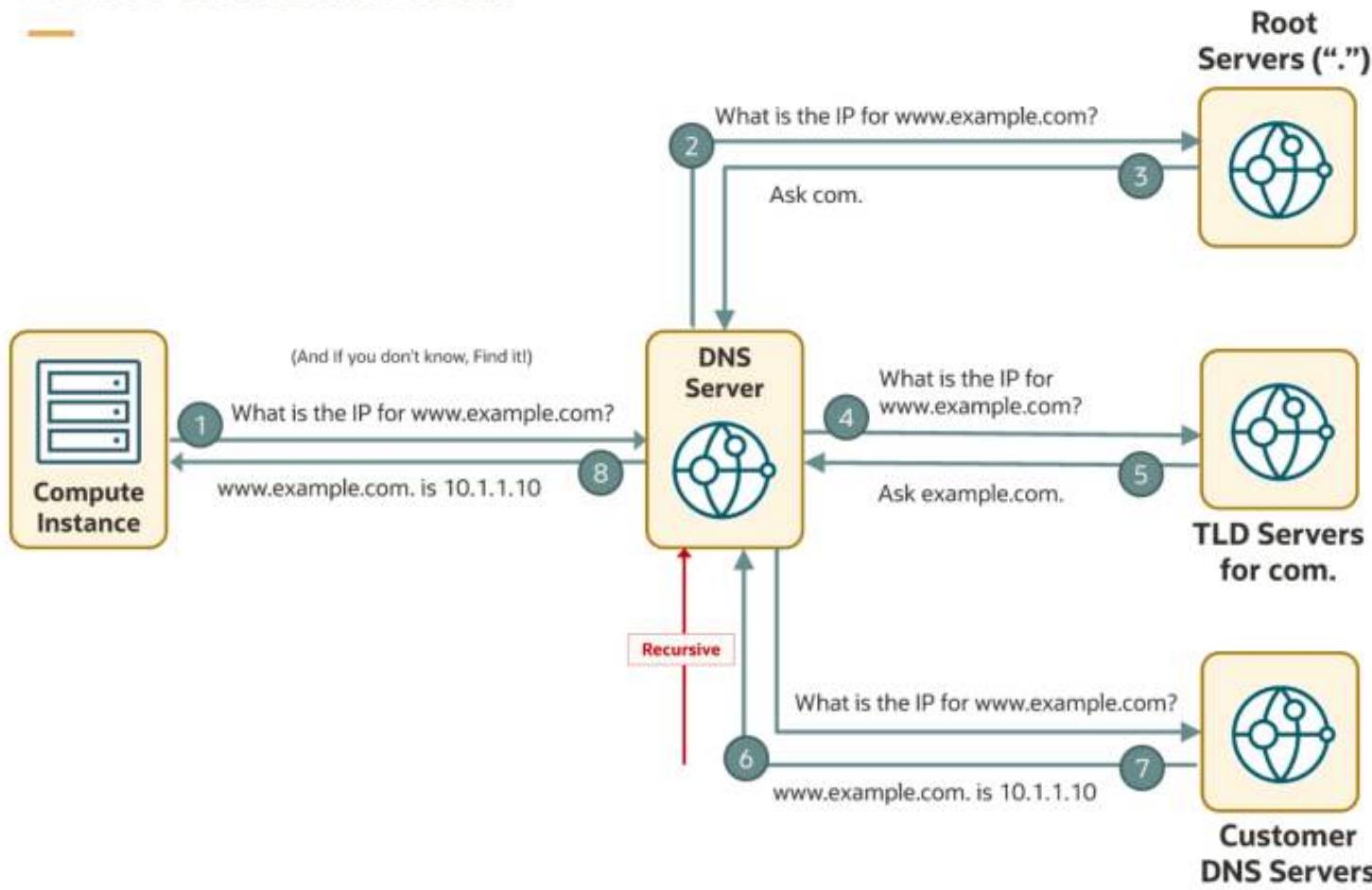
- DNS is:
 - The **hierarchical and decentralized naming system**
 - Used to identify computers, services, and other resources reachable through the Internet or other Internet Protocol (IP) networks
- The resource records contained in the DNS:
 - **Associate domain names with other forms of information**
 - Are most commonly used to map human-friendly domain names to the numerical IP addresses

DNS: Introduction

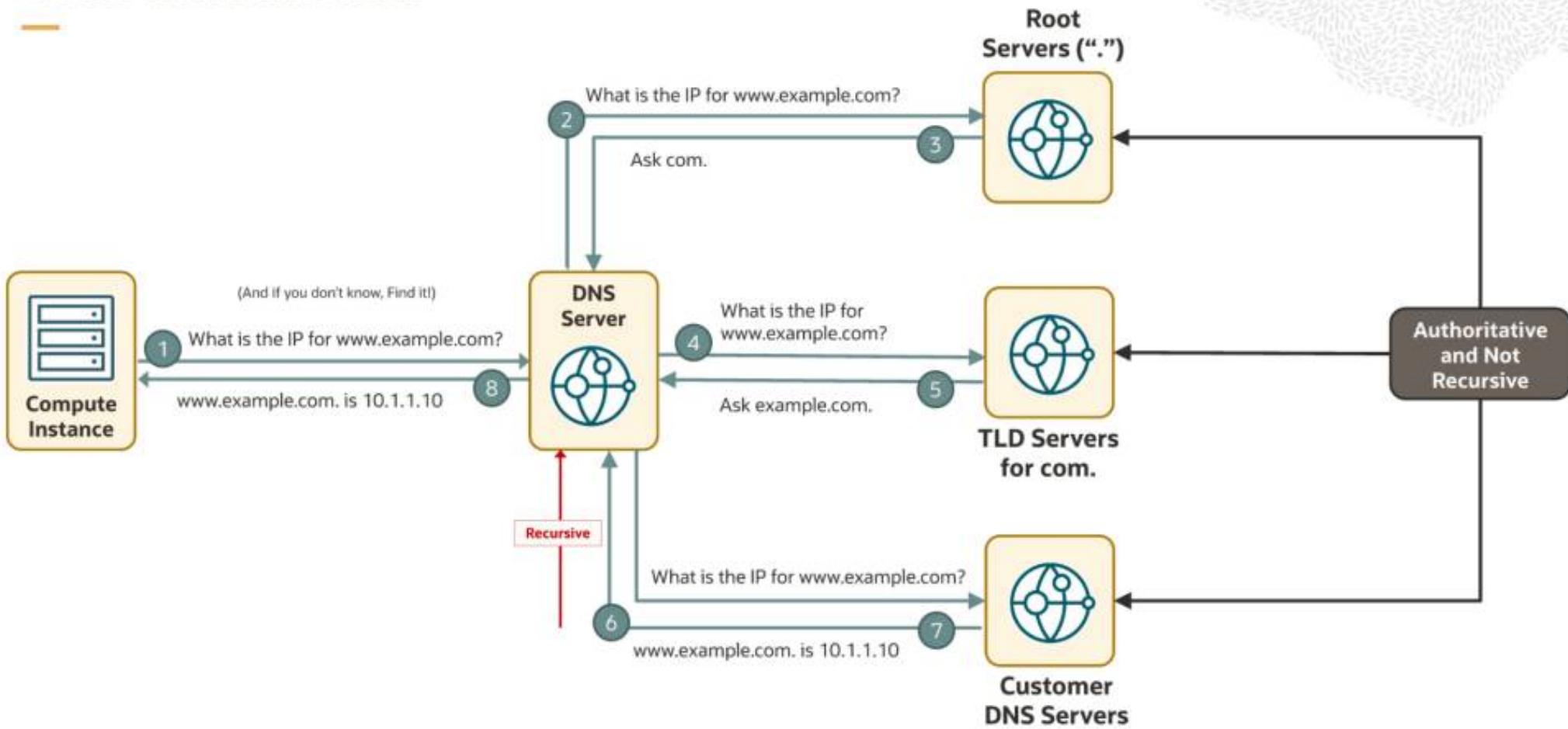




DNS: Introduction



DNS: Introduction



OCI DNS Capabilities

- › Create and manage zones
- › Create and manage records
- › Import zone files

The screenshot shows the OCI DNS Management interface. At the top, there's a green hexagonal icon with a white 'Z' and the word 'ACTIVE'. Below it, the domain name 'oclaademo.com' is displayed. On the right, there are tabs for 'Zone Information' and 'Tags', with 'Zone Information' being the active tab. It shows the zone scope as 'Public', type as 'Primary', and serial number as '1'. The creation date is 'Mon, Oct 30, 2023, 15:12:26 UTC'. The compartment is 'IntroducingOCI (root)'. Under the 'Resources' section, there are filters for 'Records' and 'Downstream services'. The 'Records' section has a 'Manage records' button and a table with columns: Domain, Type, TTL, and RDATA. The table contains two entries:

Domain	Type	TTL	RDATA
oclaademo.com	NS	86400	ns1.p68.dns.oracledns.net ns2.p68.dns.oracledns.net ns3.p68.dns.oracledns.net ns4.p68.dns.oracledns.net
oclaademo.com	SOA	300	ns1.p68.dns.oracledns.net. hostmaster.oclaademo.com. 1360 606 6048...@ns1.p68.dns.oracledns.net.

Benefits of OCI Public DNS



Globally consistent high performance

Optimized transit connectivity

Highly resilient against outage and attacks

DNS propagation time



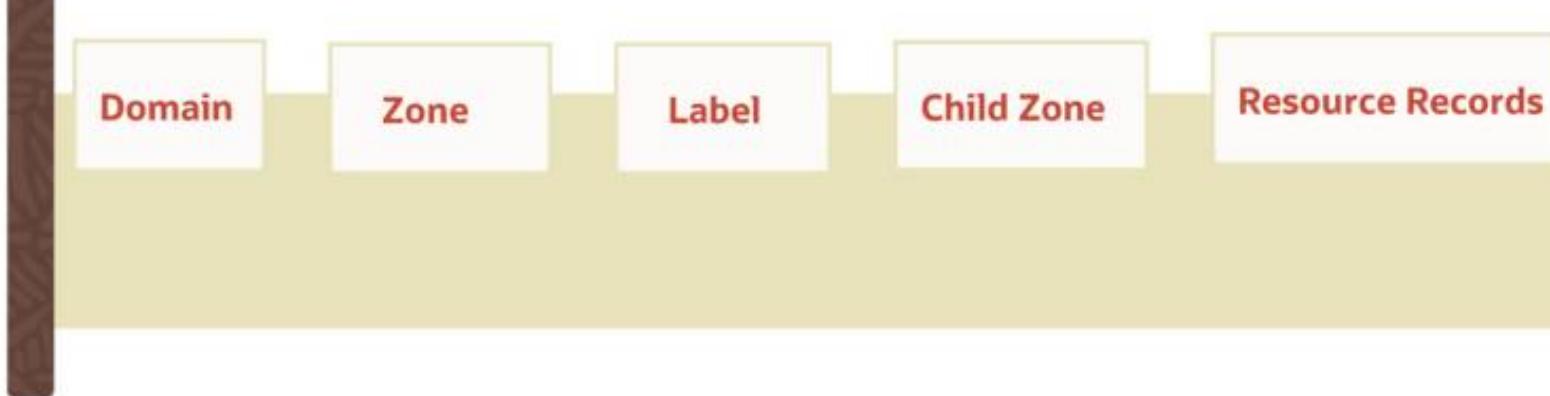
Oracle Cloud Infrastructure

DNS Service Components

Networking – DNS Management

OCI DNS Management

DNS Service components:



Oracle Cloud Infrastructure Zones

Networking – DNS Management

Zones



DNS Zone

Holds trusted DNS records that will reside on OCI Nameservers

A Start of Authority record (SOA) defines a zone.



Zones



Types

Public Zones

Private Zones

An administrative space that allows for more granular control of DNS components, such as authoritative nameservers

Oracle Cloud Infrastructure Public DNS Zone

Networking – DNS Management



Public DNS Zone

Holds trusted DNS records
that will reside on OCI
Nameservers

Create public zones with
publicly available domain
names reachable on the
Internet.

Create a public zone

Delegate the zone

Add records to the zone



Oracle Cloud Infrastructure

Demo: Public DNS Zone

— Networking – DNS Management

Oracle Cloud Infrastructure Private DNS Zone

Networking – DNS Management

Choices for DNS in VCN

- Subnet level
- Options:
 - Internet and VCN Resolver (Default)
 - Custom Resolver (Available through Internet, VCN, on-premises network)
 - Private DNS

DNS Type
<p>Internet and VCN Resolver</p> <p>Instance can resolve host names within the VCN and internet host names. No Internet Gateway is required.</p>
<p>Custom Resolver</p> <p>Specify one to three DNS Servers IP addresses below. At least one is required.</p>

Private DNS



- Host name resolution for applications running within and between:
 - VCNs
 - On-premises
 - Other private networks
- Resources
 - Private DNS Zone
 - Private DNS Zone Records
 - Private DNS Views
 - Private DNS Resolver
 - Private DNS Resolver Endpoint

Oracle Cloud Infrastructure

Demo: Private DNS Zone

—
Networking – DNS Management

Oracle Cloud Infrastructure Private Views

Networking – DNS Management

Private Views



Logically group a set of private DNS Zones

A zone can belong to a single view.

Can reference private views from a resolver

A view can be used by a number of resolvers.

Share private DNS data across VCNs

Oracle Cloud Infrastructure HTTP Redirects

Networking – DNS Management

HTTP Redirects

- DNS service lets you redirect HTTP traffic to another URL.
- Use HTTP Redirects to:
 - Redirect all HTTP traffic for an entire zone to another zone
 - Redirect a specific subdomain to an HTTP URL
 - Redirect a subdomain to a URL with a port number
 - Permanently redirect a domain name that has been deprecated by displaying a 301 response code

HTTP Redirects

Create Redirect

Name: Ocloud

Selected zone: Ocloud

oclaademo.com

Domain: test

Target:

Protocol: HTTP Host: http://oclaademo.com/test/test.php Port: 80 Path: / Path Original: / Query: Ocloud Example: http://oclaademo.com/test/test.php

Response code:

301 - Moved permanently
Use if your website was permanently moved to the redirection URL and you want this to be indexed by search engines.

302 - Found
A temporary response code to be used if a certain URL has been changed to a different address for a short amount of time.

Create CNAME record
An associated CNAME record will be created for this redirect in the specified zone.

ALIAS TTL in seconds: 60

Add tags to organize your resources: What can I do with tags? [?](#)

Tag namespace: None (add a free-form tag)

Tag key:

Tag value:

Add tag 

Oracle Cloud Infrastructure Traffic Management

Networking – DNS Management

Traffic Management



Configure routing policies

Serve intelligent responses to DNS queries

Define logic in Steering Policy

Serve different answers (endpoints)

Traffic Management Components

Steering
Policies

Attachments

Rules

Answers

Oracle Cloud Infrastructure

Traffic Management Policy Types

—
Networking – DNS Management

Traffic Management Steering Policy Types

Load Balancer

Distributes traffic over several servers

Failover

Redirects traffic when primary is unavailable

Geolocation

Routes traffic based on geographic conditions

ASN

Routes traffic based on originating ASN number

IP Prefix

Routes traffic based on originating IP prefix

Use Cases

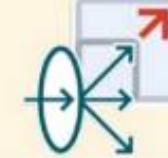
Failover



Cloud Migration



Load Balancing
for Scale



Hybrid
Environments



Worldwide
Geolocation
Steering



IP-Based
Steering



Zero-Rating
Service



Oracle Cloud Infrastructure

Demo: Failover Policy Type

—
Networking – DNS Management

Oracle Cloud Infrastructure

Demo: Load Balancer Policy Type

—
Networking – DNS Management

Oracle Cloud Infrastructure

Demo: Geolocation Steering Policy Type

—
Networking – DNS Management



Networking – Network Command Center

Oracle Cloud Infrastructure

Network Command Center Overview

—
Networking - Network Command Center

Network Command Center

Provides easy access to all the tools from a single place

Offers a unified user experience for all the monitoring capabilities

Visualize, monitor, and troubleshoot

Network Command Center

Network Visualizer

Visualize your networks

Network Path Analyzer

Check your connectivity

VCN flow logs

Capture network traffic information

Inter-region latency dashboard

See Inter-Region latency

Virtual test access points

Monitor network traffic

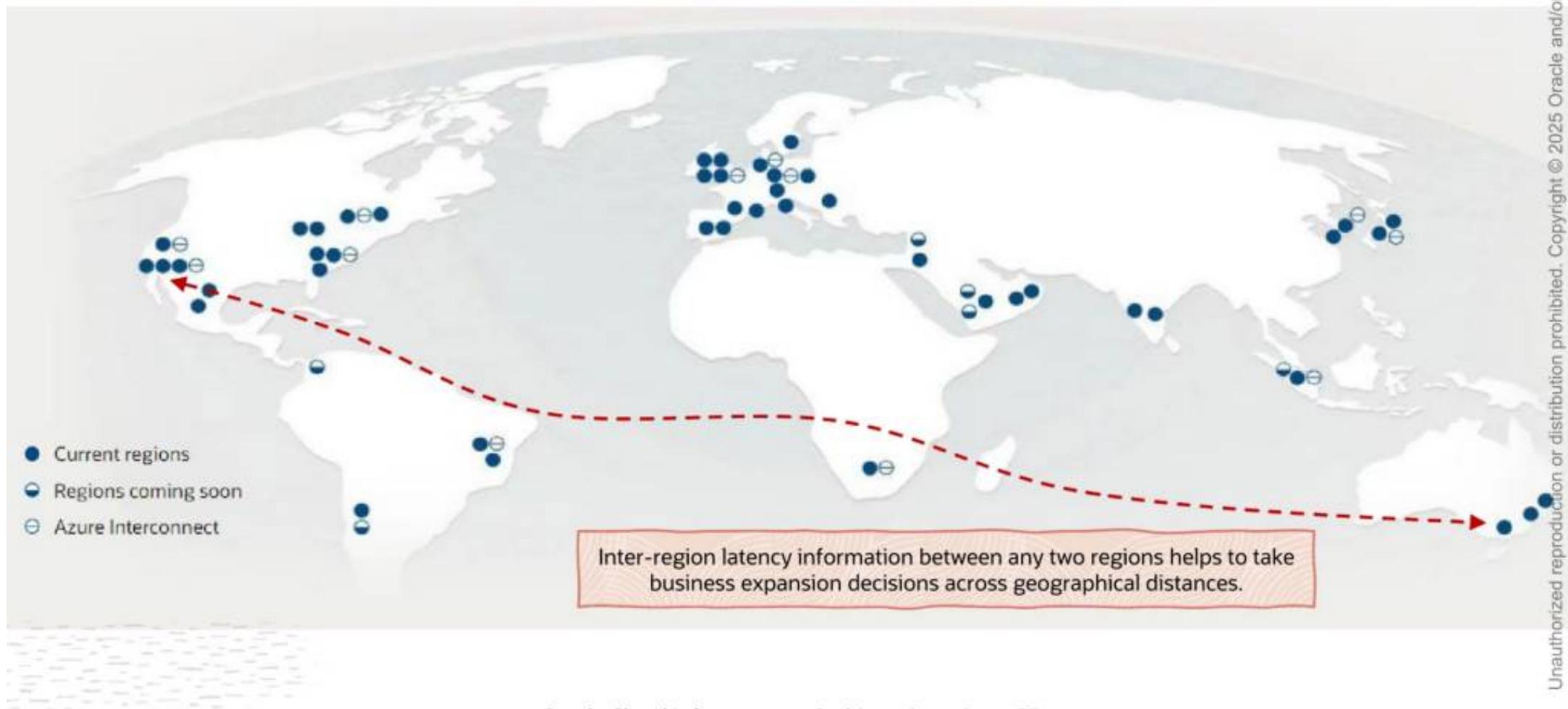
Capture filters

Select what traffic to include in flow logs or VTAPs

Oracle Cloud Infrastructure Inter-Region Latency

Networking - Network Command Center

OCI Global Locations and Inter-Region Latency



Inter-Region Latency (IRL) Dashboard



- ✓ Displays average inter-region round-trip latency for all pairs of regions in an OCI realm

- ✓ Not available in realms with only one region
- ✓ Global latency statistics between all regions

- ✓ Current Inter-Region Round-Trip Time chart
- ✓ Inter-Region Round-Trip Time chart

Current Inter-Region Round-Trip Time



- Current snapshot in milliseconds
- Average of values over the last five minutes
- Updated every minute
- Each cell displays the RTT in milliseconds for the origin/destination pair.

Inter-Region Latency

The Inter-Region Latency Dashboard provides a view of network health and metrics for networking service elements across all regions. These metrics are not specific to your tenancy and are intended for planning purposes only. [Learn more](#)

See a complete list of region codes.

Current Inter-Region Round Trip Time (ms)

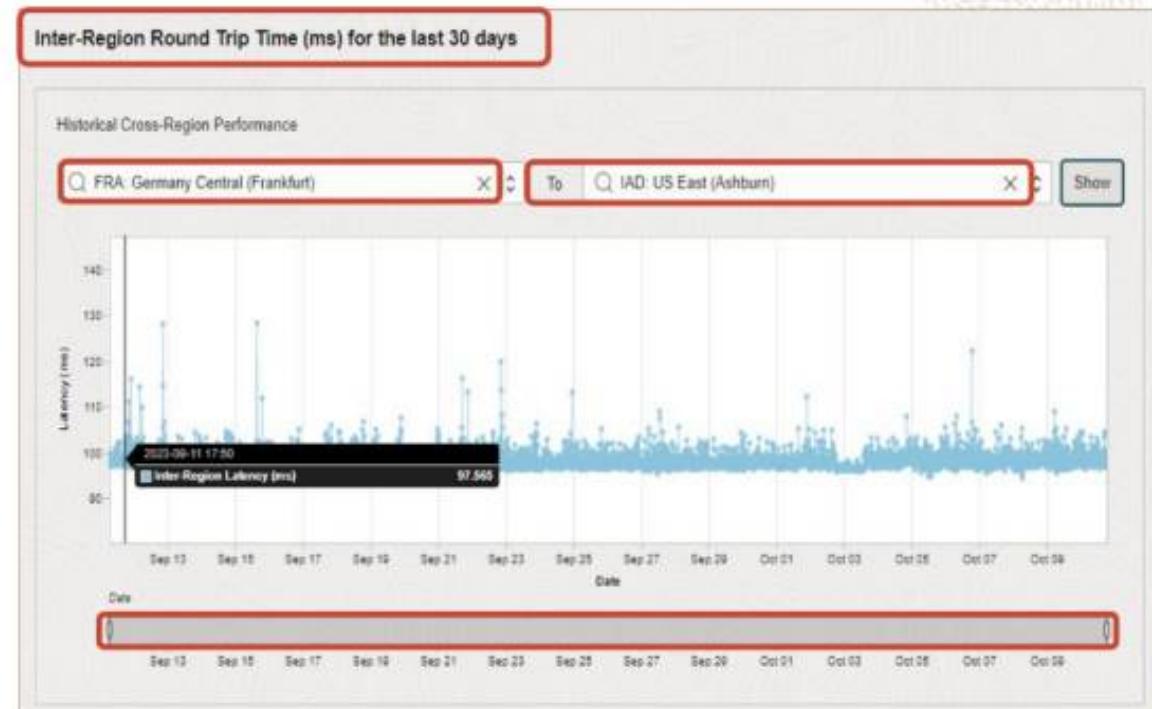
PRA (Germany Central (Frankfurt)) To IAD (US East (Ashburn)) Last Updated: Tue, Oct 10, 2023, 18:45:18 (UTC)

Region	AGA	AMS	ARN	AUS	BOS	BOM	CDD	CWL	DEB	FRA	GRU	HYD	IAD	ICN	JED	JNB	KIX	LHR	LIN	MAD	MEL	MRS	MTY	MTZ	N
AGA	156.73	185.46	274.79	581.57	236.62	133.98	162.77	215.96	178.35	181.53	219.96	58.23	148.55	190.55	320.44	115.54	157.51	150.01	153.01	205.91	144.31	161.73	239.64	166	
AMS	34.74	126.89	381.17	129.72	9.32	9.64	58.55	9.87	162.85	153.64	87.81	252.97	84.89	171.97	257.19	6.68	24.76	28.38	261.33	17.58	161.16	72.69	259		
ARN		188.72	335.34	144.00	36.46	40.69	112.75	56.89	216.71	198.29	121.38	334.85	87.99	205.57	234.14	40.17	47.79	58.51	284.48	45.97	187.46	98.95	271		
AUS			416.46	38.10	84.37	122.73	2.88	134.71	257.33	88.07	261.99	198.13	26.74	294.67	158.19	120.89	91.28	85.98	162.42	76.09	271.62	196.26	147		
BOS				416.20	182.42	289.23	386.78	287.06	119.17	427.02	261.78	412.42	388.71	400.20	418.03	296.11	328.16	123.49	469.42	212.71	286.75	378.99	386		
BOM					113.03	125.95	40.71	121.37	257.92	14.20	160.91	108.58	63.54	254.97	133.29	121.30	101.06	189.35	141.85	94.57	260.64	188.87	126		
CDD						10.37	82.64	6.33	104.85	136.35	78.22	272.38	67.32	172.84	246.41	8.13	17.68	21.17	254.88	16.44	145.94	78.24	238		
CWL							81.36	16.77	175.81	136.02	88.96	297.28	44.87	187.21	203.71	3.82	27.31	30.72	263.90	19.98	161.82	78.39	260		
DWD								96.66	267.27	54.11	160.96	178.85	25.47	255.76	153.98	90.87	51.42	87.68	161.13	73.75	231.86	149.65	146		
FRA									193.22	136.2	62.38	91.53	66.46	135.76	277.49	12.49	12.54	28.68	262.23	17.02	162.95	63.25	247		
GRU										509.94	618.57	317.29	241.39	512.04	287.08	177.81	207.98	284.91	361.90	194.28	181.36	253.95	203		
HYD											262.29	145.44	77.63	298.12	119.35	134.78	194.27	121.91	128.87	107.28	271.71	154.95	111		



Inter-Region Round-Trip Time

- Historical view of the last 30 days
- Source and destination regions to be selected



IRL Use Cases



Network
Planning

Intelligent region selection
based on performance

Troubleshooting

Current and historical network
performance validation

Monitoring &
Alarms

Latency metrics comparison and
threshold breach notifications

Oracle Cloud Infrastructure

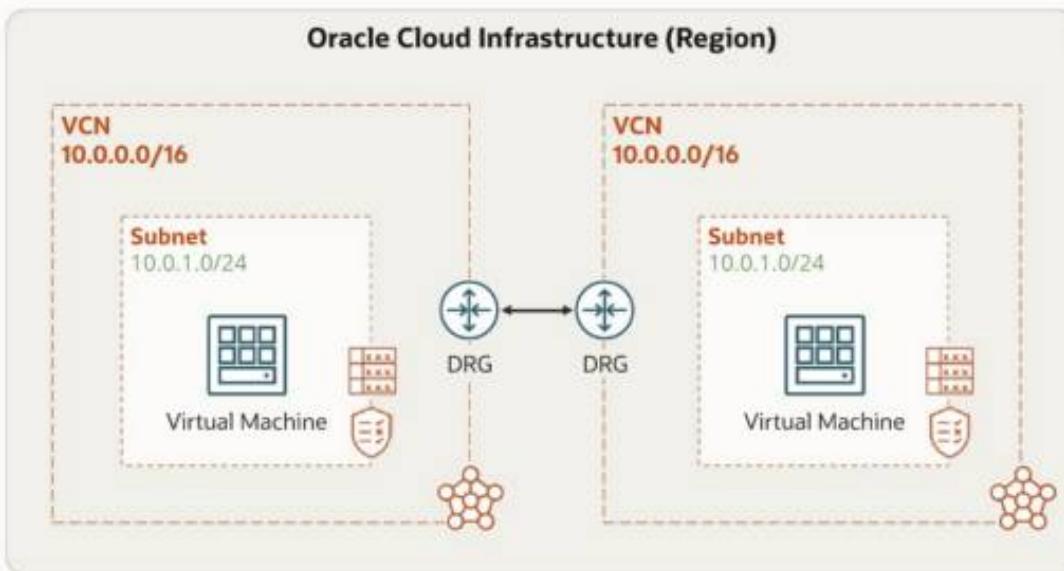
Demo: Inter-Region Latency

—
Networking - Network Command Center

Oracle Cloud Infrastructure Network Path Analyzer

Networking- Network Command Center

Network Path Analyzer (NPA)



Is a Network Command Center service that identifies connectivity problems

Facilitates troubleshooting, security analysis, and data monitoring

Queries the networking constructs for the configuration that checks reachability

Provides hop-by-hop path visualization

Network Path Analyzer: Features

- Points out routing and security configuration issues
- Supports connectivity checks to Oracle Services Network
- Does not use real traffic
- Is a free service

Supported scenarios

OCI <-> OCI

On-premises <-> OCI

OCI <-> On-premises

OCI <-> Internet

Network Path Analyzer: Scenario 1

OCI <-> OCI

Forward traffic from DRG and compute via VCN-2 attachment is denied, making the compute instance in VCN-2 unreachable.



Network Path Analyzer: Scenario 2

OCI <-> Internet

- No route is defined.
- Egress rule is not configured in the security list.



NPA Use Cases



Troubleshoot routing and security misconfigurations.

Reduces MTTR for cases of outage

Validate network paths on demand.

Matches the intent

Verify connectivity setup will work as expected.

Avoids delays in actual deployment

Oracle Cloud Infrastructure

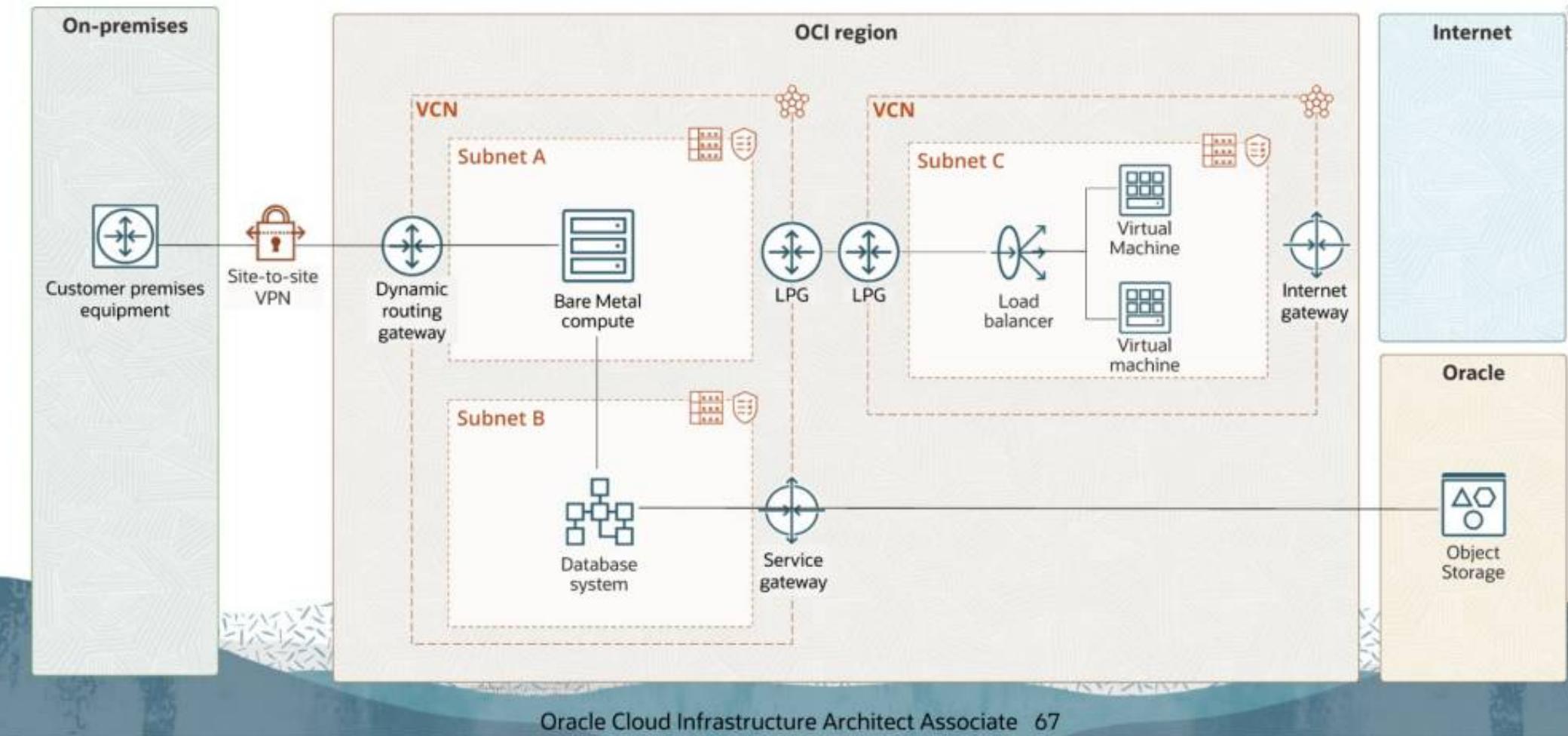
Demo: Network Path Analyzer

—
Networking - Network Command Center

Oracle Cloud Infrastructure Network Visualizer

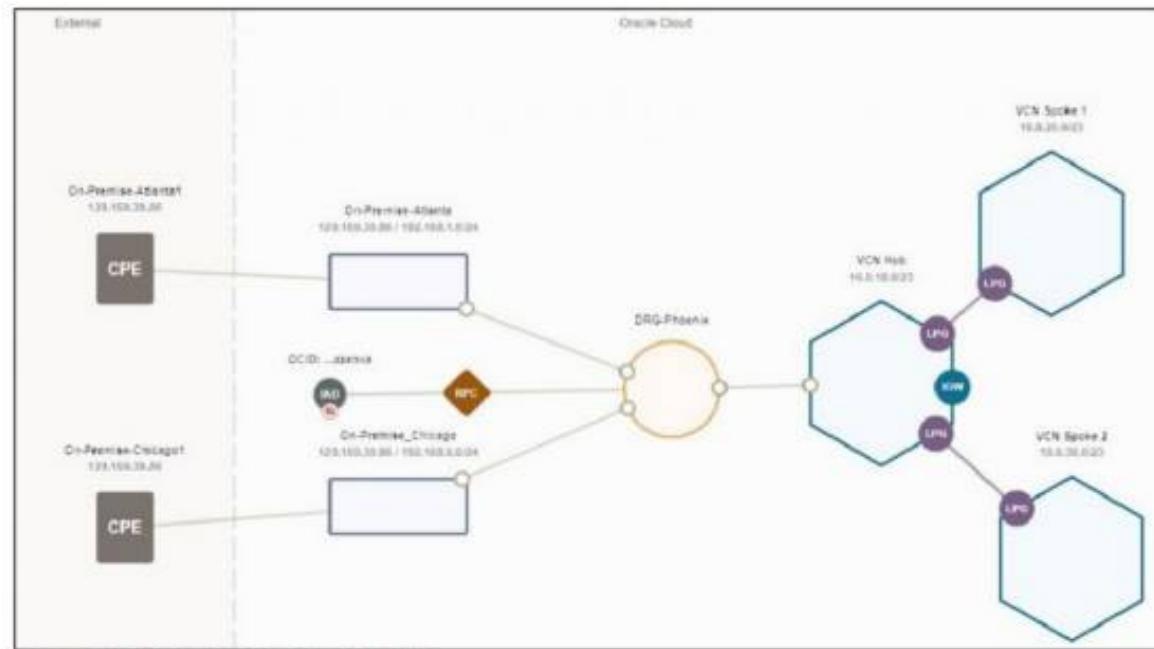
Networking - Network Command Center

Overall Network Architecture in OCI



Network Visualizer

Provides a diagram of implemented topology of all VCNs in a selected region and tenancy



Allows quick navigation between its core components

Network Visualizer



Provides a diagram of the implemented topology of all VCNs

Regional Topology map

DRGs, VCNs, CPEs, and various types of gateways

VCN Topology map

Subnets, VLANs, and gateways to other resources

Subnet Topology map

Instances, load balancers, FSS, and OKE clusters

Network Visualizer: Use Cases



Visualize and troubleshoot network security configuration issues.

Security configuration helps to visualize port and protocol-based security

Aid with network planning and network changes.

It is easier to visualize network changes.

Troubleshoot any transit routing configuration issues.

See different types of attachments.



Oracle Cloud Infrastructure

Demo: Network Visualizer

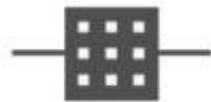
—
Networking - Network Command Center

Oracle Cloud Infrastructure

Capture Filters

Networking - Network Command Center

VTAP Capture Filter Overview



Capture Filters

Create capture filter

Rules

Capture filter rules are examined in order and executed when matched. When the first match is found, remaining rules are not examined or executed. If you reorder the rules the Capture filter behavior will change. [Learn more about capture filters.](#)

Sequence number 1

Traffic direction: Ingress

Include/Exclude: Include

Source IPv4 CIDR or IPv6 prefix: Optional 0.0.0.0/0

Destination IPv4 CIDR or IPv6 prefix: Optional 10.0.0.0/24

IP protocol: TCP

Source port range: Optional 80-80

Destination port range: Optional 80-80

Defines what type of traffic to capture

Must have a capture filter associated with it

Must have at least one rule and can have up to 10 rules

Capture Filter Rules

You can create multiple rules inside a capture filter with include or exclude actions, such as:

- ✓ Source and destination CIDRs
- ✓ Protocol (TCP, UDP, and ICMP)
- ✓ Source, and destination port

Traffic direction setting captures all traffic or traffic based on Ingress or Egress criteria.

Create capture filter

Rules

Capture filter rules are examined in order and executed when matched. When the first match is found, remaining rules are not examined or executed. If you reorder the rules the capture filter behavior will change. [Learn more about capture filters](#)

Sequence number 1

Reorder ▾

Traffic direction

Ingress

Include/Exclude

Include

Source IPv4 CIDR or IPv6 prefix Optional ⓘ

0.0.0.0/0

Destination IPv4 CIDR or IPv6 prefix Optional ⓘ

10.0.0.0/24

IP protocol

TCP

Destination port range Optional

80-80

Capture Filter Action Criteria



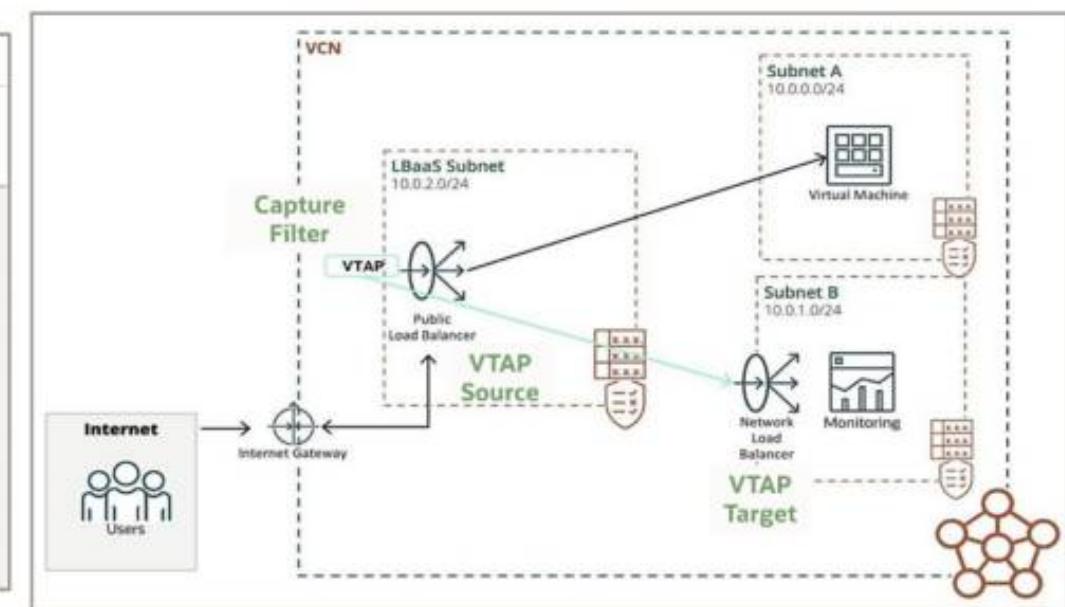
Create capture filter

Rules

Capture filter rules are examined in order and executed when matched. When the first match is found, remaining rules are not examined or executed. If you reorder the rules the capture filter behavior will change. [Learn more about capture filters](#).

Sequence number 1

Traffic direction	Include/Exclude
Ingress	Include
Source IPv4 CIDR or IPv6 prefix (Optional)	Destination IPv4 CIDR or IPv6 prefix (Optional)
0.0.0.0	10.0.0.0/24
Example: 10.10.1.0/24 or 2001:db8::/64	Example: 10.10.1.0/24 or 2001:db8::/64
IP protocol	
TCP	
Source port range (Optional)	Destination port range (Optional)
80-80	80-80
Example: 1-49355	Example: 1-49355



Capture Filter Example

Intent : To include all traffic from 10.1.0.0/16 except 10.1.1.1

1. Source CIDR: 10.1.1.1/32, Exclude
2. Source CIDR: 10.1.0.0/16, Include
3. Source CIDR: 10.1.1.0/24, Include



Traffic from 10.1.1.1 is excluded by Rule 1.

1. Source CIDR: 10.1.0.0/16, Include
2. Source CIDR: 10.1.1.0/24, Include
3. Source CIDR: 10.1.1.1/32, Exclude



Traffic from 10.1.1.1 is included by Rule 1
because of change in position of Exclude Rule.

Oracle Cloud Infrastructure

Demo: Capture Filters

—
Networking - Network Command Center

Oracle Cloud Infrastructure

Virtual Test Access Points

—
Networking - Network Command Center

Virtual Test Access Point (VTAP)

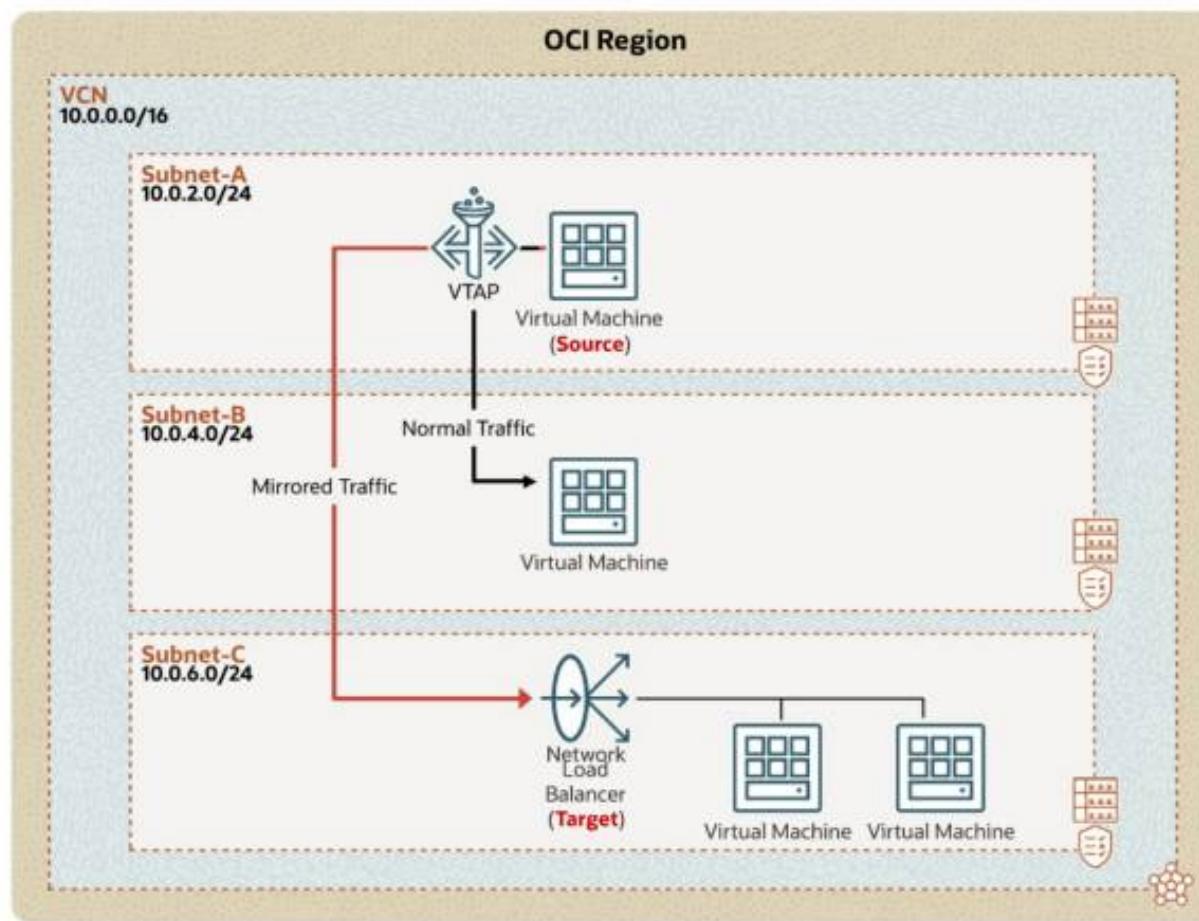
Mirror traffic from source to target for troubleshooting, security analysis, and data monitoring.

Traffic from the VTAP with the more specific source will be mirrored.

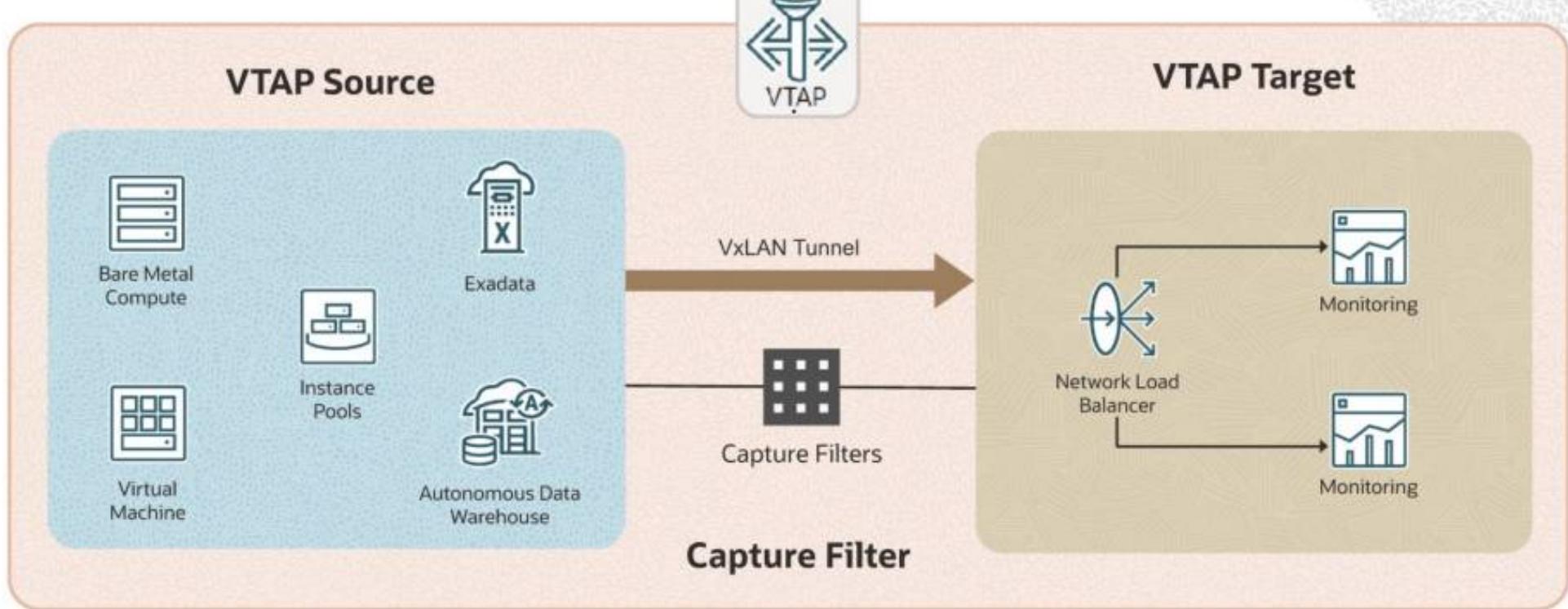
- ✓ Source and Target must be hosted in the same VCN
- ✓ Has important components such as:
 - VTAP source
 - VTAP target
 - Capture Filter



VTAP Example

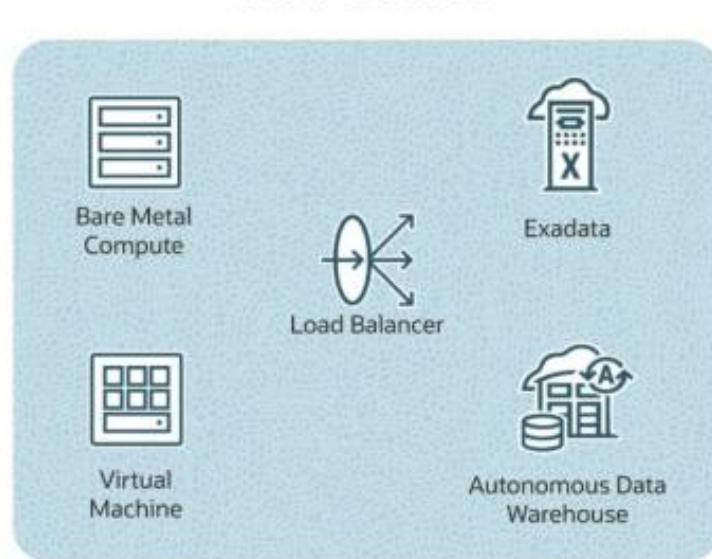


VTAP Components



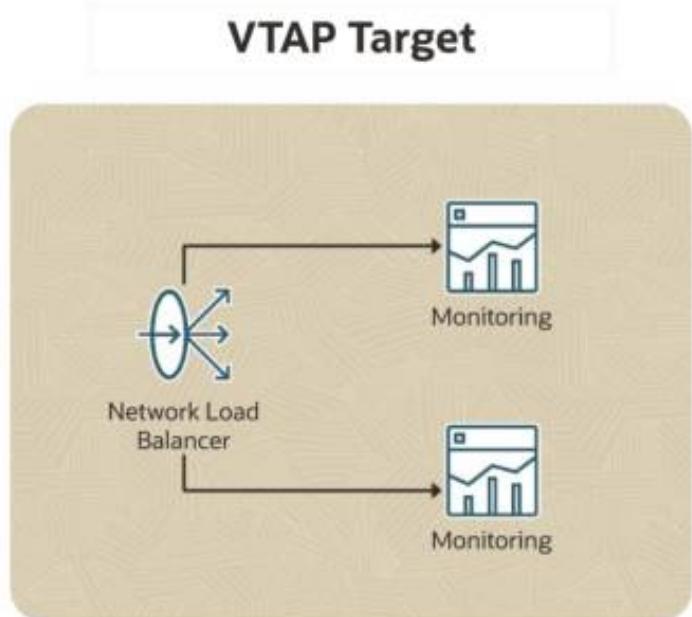
Traffic is encapsulated in VXLAN and then sent to VTAP target (Network Load Balancer) via UDP port 4789.

VTAP Source



- A single compute instance VNIC
- A Load Balancer
- A Database System
- An Exadata VM cluster
- An Autonomous Database

VTAP Target



- Receives the mirrored traffic from the selected VTAP source
- Network load balancer with a UDP listener on port 4789
- Backend configured with network analytics and monitoring tool

VTAP Use Cases

Threat monitoring and forensic analysis

Performs deep packet inspection and helps to investigate anomalous behavior

Adhere to compliance requirements

Adheres to the mandate to log and monitor traffic

Troubleshooting Network issues

Helps to identify issues impacting performance of applications

Oracle Cloud Infrastructure

Demo: Virtual Test Access Points

—
Networking - Network Command Center

Expert Tip

Compute - Basics

Oracle Cloud Infrastructure

Overview of Compute Service

Compute

OCI Compute Service

Provisions compute resources in the cloud

Foundation for other OCI services

Based on shapes



CPU

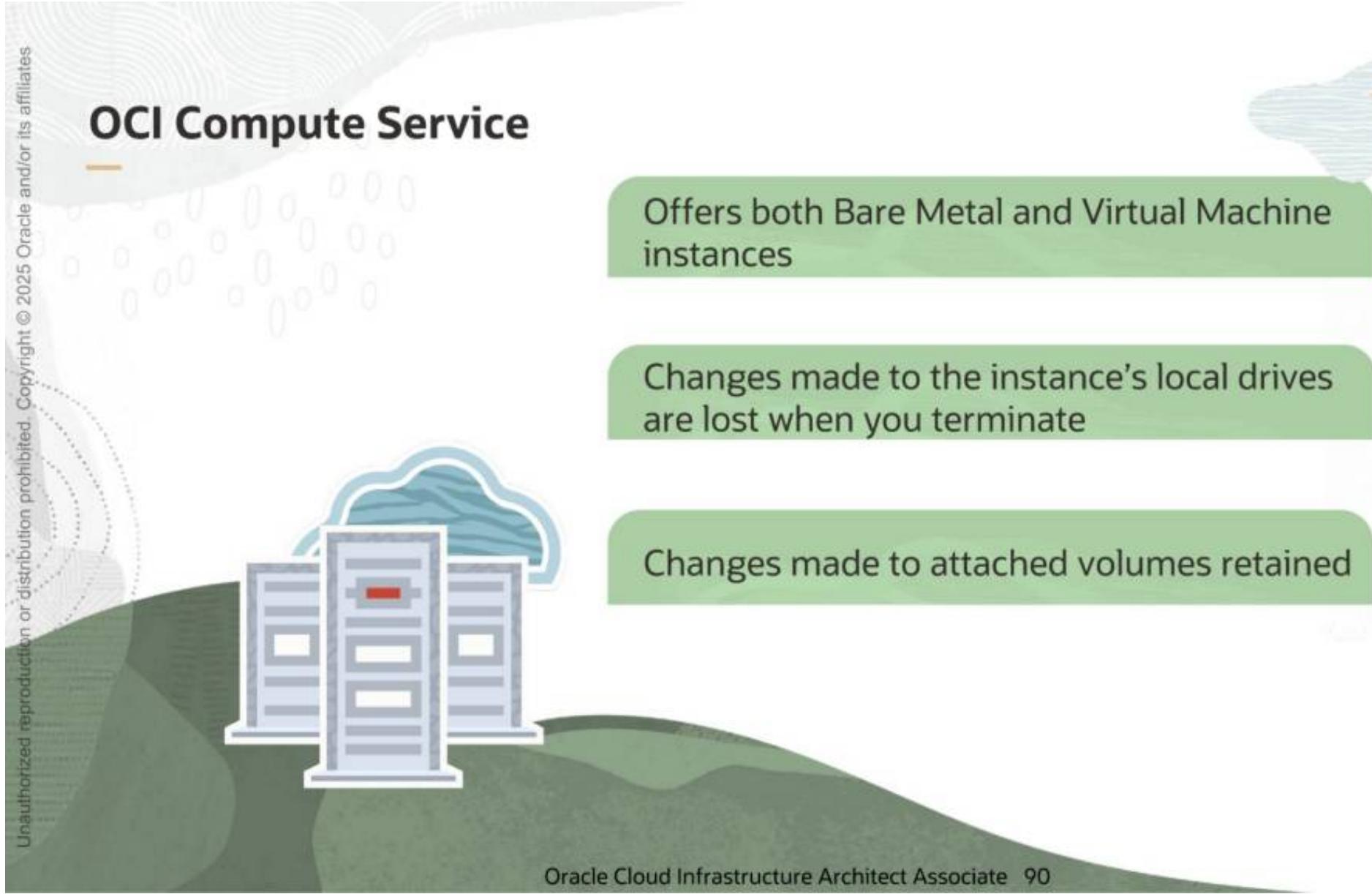


Memory



Storage

OCI Compute Service



Offers both Bare Metal and Virtual Machine instances

Changes made to the instance's local drives are lost when you terminate

Changes made to attached volumes retained

Oracle Cloud Infrastructure

Platform and Custom Images

— Compute

Instance Images



Compute instances built using images

An image

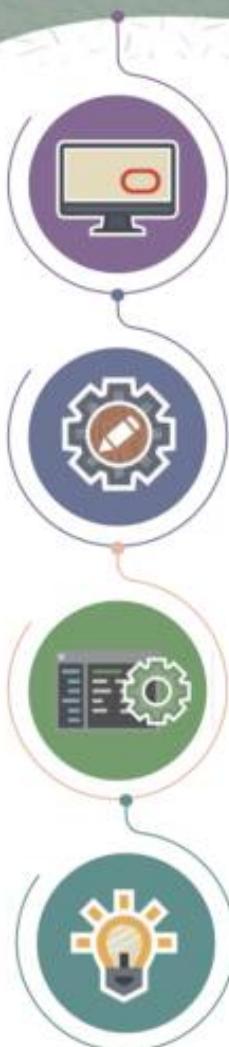
Template of a virtual hard drive

Contains

Operating System (OS)

Software (optional)

Image Sources



Platform

Linux

Windows

Custom images

Created from existing instances (in OCI)

Marketplace

Prebuilt application images from Oracle and third parties

Bring Your Own Image

Platform Images

Oracle provides several prebuilt images for:



Oracle Linux

Ubuntu

CentOS

Microsoft Windows

The current list of images provided can be found here:

<https://docs.cloud.oracle.com/en-us/iaas/Content/Compute/References/images.htm>



Custom Images

Create a custom image of an instance.

Maximum size for importing a custom image is 400 GB.

Windows supports two kinds of images: generalized and specialized.

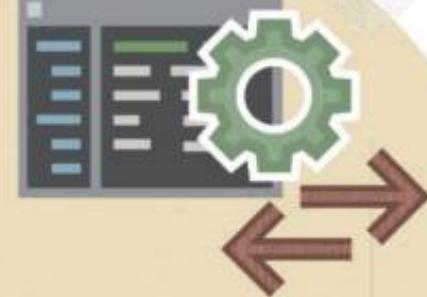
Oracle Cloud Infrastructure

Import/Export and Bring Your Own Image

— Compute

Image Import/Export

- Compute service enables you to share custom images.
- Image import/export uses the OCI Object Storage service.
- Supports:
 - Emulation Mode
 - Paravirtualized
 - Native Mode



Replicate Image

Replicate an image across regions.

- Export image to object storage bucket in the same region.
- Copy image to bucket in the destination region.
- Obtain the URL path to the image object.
- Import the image in the destination region.

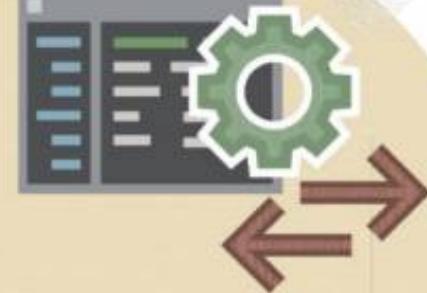


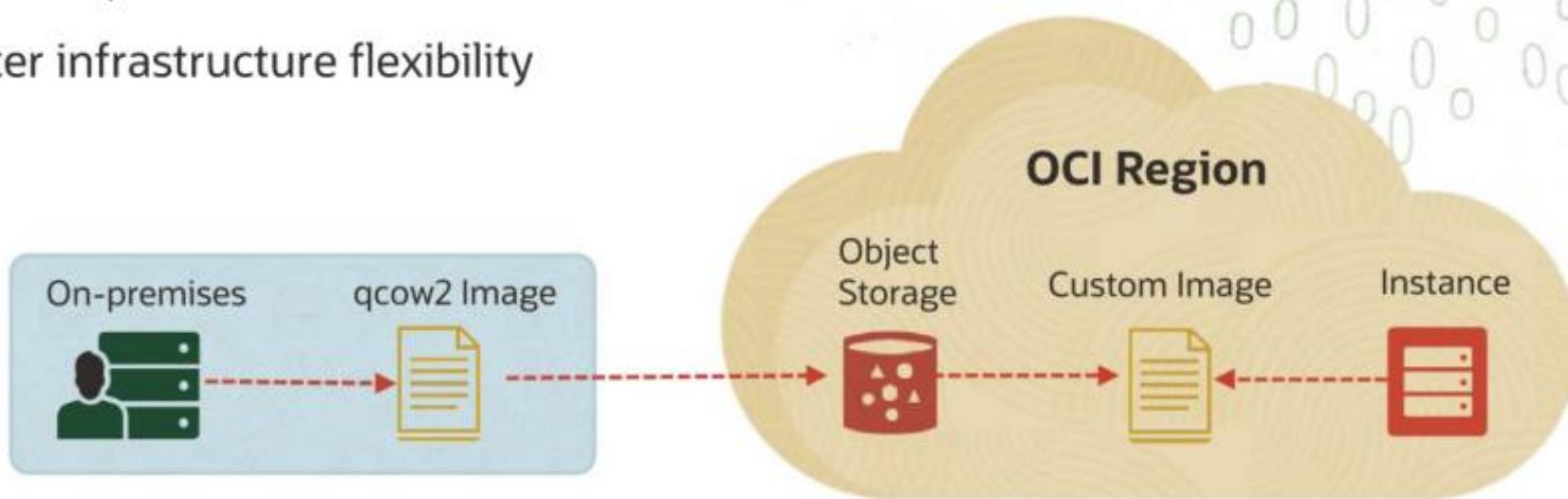
Image
Import/Export

Bring Your Own Image (BYOI)



Helps with:

- Lift-and-shift cloud migration projects
- Old and new operating systems
- Experimentation
- Better infrastructure flexibility



Note: You must comply with all licensing requirements when you upload and start instances based on the OS images that you supply.

Oracle Cloud Infrastructure Compute Shapes

Compute

Shapes

A template that determines the resources allocated to an instance

Available with AMD, Intel, and Arm-based processors

Fixed shapes

Cannot be customized

Bare Metal or Virtual Machine

Flexible Shapes

Can be customized

1 to 64 OCPUs AMD/1 to 32 OCPUs Intel/ 1 to 80 OCPUs Ampere

1 to 64 GB memory/OCPU (1024 GB Max AMD/512 GB Max Intel/ 512 GB Max Ampere)

Virtual Machine only

Flexible Shapes

VM.Standard.E3.Flex (AMD)

VM.Standard.E4.Flex (AMD)

VM.Standard3.Flex (Intel)

VM.Optimized3.Flex (Intel)

VM.Standard.A1.Flex (Arm processor from Ampere)

Flexible Shapes

Shape name	OCPUs	Memory (GB)	Network bandwidth (Gbps)	Max. total VNICs <small>i</small>
<input checked="" type="checkbox"/> VM.Standard3.Flex	4	64	4	4

You can customize the number of OCPUs and the amount of memory allocated to a flexible shape. The other resources scale proportionately. [Learn more about flexible shapes.](#)

Number of OCPUs

1 4 8 16 24 32

Burstable i

Amount of memory (GB) i

1 64 128 256 384 512

Oracle Cloud Infrastructure GPU Shapes

Compute

GPU Shapes

**Designed for
hardware-accelerated workloads**

Powered by A100, A10, V100, and P100 NVIDIA GPUs

Mainstream graphics and videos

AI training and HPC workloads

High performance cluster networking

VM GPU Series



- **VM.GPU2:** X7-based GPU compute.
 - GPU: NVIDIA Tesla P100 16 GB
 - CPU: Intel Xeon Platinum 8167M. Base frequency 2.0 GHz, max turbo frequency 2.4 GHz.
- **VM.GPU3:** X7-based GPU compute.
 - GPU: NVIDIA Tesla V100 16 GB
 - CPU: Intel Xeon Platinum 8167M. Base frequency 2.0 GHz, max turbo frequency 2.4 GHz.
- **VM.GPU.A10:** X9-based GPU compute.
 - GPU: NVIDIA A10 24 GB
 - CPU: Intel Xeon Platinum 8358. Base frequency 2.6 GHz, max turbo frequency 3.4 GHz.

BM GPU Series

- **BM.GPU2:** X7-based GPU compute.
 - GPU: NVIDIA Tesla P100 16 GB
 - CPU: Intel Xeon Platinum 8167M. Base frequency 2.0 GHz, max turbo frequency 2.4 GHz.
- **BM.GPU3:** X7-based GPU compute.
 - GPU: NVIDIA Tesla V100 16 GB
 - CPU: Intel Xeon Platinum 8167M. Base frequency 2.0 GHz, max turbo frequency 2.4 GHz.
- **BM.GPU4:** E3-based GPU compute.
 - GPU: NVIDIA A100 40 GB
 - CPU: AMD EPYC 7542. Base frequency 2.9 GHz, max boost frequency 3.4 GHz.
- **BM.GPU.A10:** X9-based GPU compute.
 - GPU: NVIDIA A10 24 GB
 - CPU: Intel Xeon Platinum 8358. Base frequency 2.6 GHz, max turbo frequency 3.4 GHz.
- **BM.GPU.A100:** E4-based GPU compute.
 - GPU: NVIDIA A100 80 GB
 - CPU: AMD EPYC 7J13. Base frequency 2.55 GHz, max boost frequency 3.7 GHz.

Oracle Cloud Infrastructure

Bare Metal versus VM versus Dedicated Hosts

Compute

Bare Metal Instances

Bare Metal (BM)
(single-tenant model)



Bare Metal Server



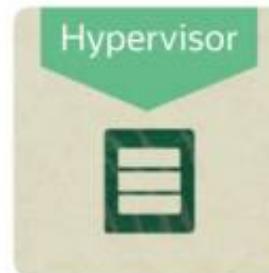
Workloads that are
not virtualized



Performance-intensive
workloads



Workloads that
require BYOL



Workloads that require
a specific hypervisor

Virtual Machine Instances

Virtual Machine (VM)

(multitenant model)

VMs



Hypervisor



Bare Metal Server

Runs on top of Bare Metal hardware

Hypervisor on top of Bare Metal server

Dedicated Hosts

Dedicated VM Hosts (DVH)

(single-tenant, not shared)



Bare Metal Server

Combination of Bare Metal and Virtual Machines

Multiple VMs running on Bare Metal

Whole server dedicated to a single host

Oracle Cloud Infrastructure

Demo: Generate SSH Keypair



Oracle Cloud Infrastructure

Demo: Launch and Connect to an Oracle Linux Instance

Oracle Cloud Infrastructure

Demo: Launch and Connect to a Windows Instance

Oracle Cloud Infrastructure

Demo: Create a Custom Image

Oracle Cloud Infrastructure

Capacity Types: Preemptible Instances

—
Compute

Use excess compute capacity

Designed for short-term usage

Shapes cannot be changed after creation

Cannot be converted to an on-demand instance

50% cheaper than on-demand instances



Preemptible Instances

Capacity can be reclaimed
when needed

Does not support Bare
Metal instances

Cannot be used in instance
pools

Use the Events service to
receive notifications when
preemptible capacity is
reclaimed



Preemptible Instances

Preemptible Instances Creation

Follow the same process as an on-demand instance.

Expand advanced placement options.

Select Preemptible.



Placement

Availability Domain: AD-1

Fault Domain: Let Oracle choose the best fault domain

Edit

Capacity type: On-demand capacity

Placement

The [availability domain](#) helps determine which shapes are available.

Collapse

Availability domain

AD 1

dKVS-SA-SAOPAULO-1-AD-1



[Hide advanced options](#)

Capacity type

On-demand capacity

Place the instance on a shared host using on-demand capacity.

Preemptible capacity

Place the instance on a shared host using [preemptible capacity](#). This instance can be preempted at any time.

Capacity reservation

Place the instance on a shared host, and have it count against a [capacity reservations](#).

Dedicated host

Place the instance on a [dedicated virtual machine host](#).

When reclaimed, permanently delete the attached boot volume.

Fault Domain

Let Oracle choose the best fault domain

[What should I select a fault domain?](#)

Oracle Cloud Infrastructure

Demo: Preemptible Instances

Oracle Cloud Infrastructure

Capacity Types: Capacity Reservations

—
Compute

Capacity Reservations



- Reserve compute capacity in advance.
- Create instances against the reservation.
- Capacity is available for workloads when needed.
- No size or time commitments
- Delete reservation at any time.
- Unused reserved capacity is metered differently than used reserved capacity.



Capacity Reservations



Compute » Capacity reservations » Capacity reservation details

reservation-20220423-1743

ACTIVE

CR

Edit Add Tags Move Resource Delete

Capacity reservation information Tags

OCID: ssogna Show Copy
Compartment: inforaclerohit (root)/samvit/ArchAssociateDemoComp
Default reservation: false

Created: Sat, Apr 23, 2022, 12:13:40 UTC
Availability domain: AD-1

Resources Capacity configurations

Add capacity configuration

Instance type	Reserved capacity ⓘ	Used capacity
VM Standard.E3 Flex (1 OCPU, 16 GB memory)	1	0

Capacity reservations can have up to 30 capacity configurations.

Example Scenarios



Reservations tied to a specific availability domain

Cannot be moved from one availability domain to another

Shapes of instances limited to the shape defined in the configuration of the capacity

Do not apply to dedicated VM Hosts

Capacity allocated upon creation. If capacity is not available, capacity creation will fail.

Support and Limitations

Oracle Cloud Infrastructure

Demo: Create a Capacity Reservation and Launch Instances

Oracle Cloud Infrastructure

Capacity Types: Dedicated VM Host

—
Compute

Dedicated VM Hosts (DVH)



Bare Metal Server

- Run Virtual Machine (VM) instances on dedicated servers
- Single tenant
- Not shared with other customers
- Not billed for individual VM instances placed on the host
- Host shape determines capacity and types of instances launched
- Some OCPUs are reserved for VM management but are billed

Dedicated Virtual Machine Hosts

Use Cases



Compliance and
regulatory isolation
requirements



Node-based
requirements

Dedicated Virtual Machine Host Shapes



DVH.Standard2.52 - VM.Standard2 series



DVH.Standard3.64 - VM.Standard3 series



DVH.Standard.E2.64 - VM.Standard.E2 series



DVH.Standard.E3.128 - VM.Standard.E3 series

Dedicated Virtual Machine Host Shapes



DVH.DenseIO2.52 - VM.DenseIO2 series



DVH.Optimized3.36 – VM.Optimized3 series



DVH.Standard.E4.128 - VM.Standard.E4 series



Limitations

Features not supported

Autoscaling

Capacity reservations

Instance configurations

Instance pools

Burstable instances

Reboot migration



Oracle Cloud Infrastructure

Demo: Dedicated VM Host



Compute - Advanced

Oracle Cloud Infrastructure

Burstable Instances

Compute

Burstable Instances



Guaranteed baseline CPU performance

Able to burst to a higher level for occasional spikes

The instance is charged for the set baseline.

Baseline utilization is a fraction of each CPU core:
12.5% or 50%.

Bursting is contingent on available capacity.

If the instance's average CPU utilization over the past
24 hours is below the baseline, the system will allow
it to burst.

Memory does not burst.



Supported Shapes for Burstable Instances

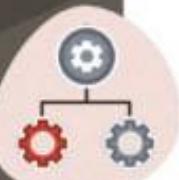


VM.Standard3.Flex

VM.Standard.E3.Flex

VM.Standard.E4.Flex

Example Scenarios



Microservices



Development and test environments



Continuous integration and continuous delivery (CI/CD) tools



Static websites



Monitoring systems

Burstable Instances Creation

- Follow the same process as an on-demand instance.
- Change the shape type to supported shapes.
- Set Maximum OCPU.
- Set Burstable.
- Set the Baseline.

Shape name	OCPUs	Memory (GB)	Network bandwidth (Gbps)	Max. total VNICs
<input checked="" type="checkbox"/> VM.Standard.E4 Flex	4	16	2	4

You can customize the number of OCPUs and the amount of memory allocated to a flexible shape. The other resources scale proportionately. [Learn more about flexible shapes](#).

Number of OCPUs

1 4 22 43 64 4

Burstable

Baseline utilization per OCPU

12.5%

Charge for a burstable instance is the same regardless of whether the actual CPU utilization is at the baseline, below the baseline, or bursts above the baseline.

Oracle Cloud Infrastructure

Demo: Create a Burstable Instances

Oracle Cloud Infrastructure

Compute: Vertical Scaling

—
Compute

Compute: Vertical Scaling

- Change the shape of a VM instance
- No need to rebuild your instances
- Scale up compute resources to increase performance
- Scale down to reduce costs



Vertical Scaling: Considerations

- Public and private address, volume and VNIC attachments remain the same.
- Shape series and image of original shape determines which shapes can be selected.
- Image used to launch the instance must be compatible with the new shape.
- The operation requires a reboot if the instance is running while changing a shape.
- Changing shape of an instance affects:
 - Number of OCPUs
 - Amount of memory
 - Network bandwidth
 - Maximum number of VNICs



Oracle Cloud Infrastructure

Demo: Scale Cores and Memory for an Instance

Oracle Cloud Infrastructure

Compute Autoscaling

Compute

Instance Configuration



To create one or more instances
in an instance pool

A template for launching individual
instances that are not part of a pool

Does not include the contents of any block
volumes that are attached to the instance

Compute > Instance configurations > Instance configuration details

instance-config-20220425-1403

Launch instance **Create instance pool** **Edit** **Delete** **More Actions**

Instance configuration information **Tags**

Instance configuration information
OCID: kvrona Show Copy

The screenshot shows the 'Compute' section of the Oracle Cloud interface. A specific instance configuration named 'instance-config-20220425-1403' is selected. At the top, there are several buttons: 'Launch instance' (highlighted with a red box), 'Create instance pool', 'Edit', 'Delete', and 'More Actions'. Below these buttons, there are two tabs: 'Instance configuration information' and 'Tags'. Under the 'Instance configuration information' tab, the OCID 'kvrona' is listed along with 'Show' and 'Copy' options.

Instance Pool



Set of instances managed as a group

Can be associated with only one instance configuration

Attach or detach load balancers

Adjust the number of instances based on performance metrics or schedule

instance-pool-20220425-1407

P
RUNNING

General information

OCID: ...hvm7a Show Copy
Instance configuration: [instance-config-20220425-1403](#) (View details)
Created: Mon, Apr 25, 2022, 08:43:54 UTC
Target instance count: 2

Attached instances

Name	State	Availability domain	Fault domain
inst-minv1-instance-pool-20220425-1407	Running	AD-1	FD-3
inst-iwcfg1-instance-pool-20220425-1407	Running	AD-1	FD-2

Instance Configurations and Pools

Instance Configurations



Running Instance



Config

OS image, metadata, shape

VNICs, storage, subnets

Pools



Config



Multiple Instances

Different availability domains

Manage all together (stop, start, terminate)

Attach to a load balancer

Compute Autoscaling

Autoscaling

**Metric-based
autoscaling**



**Schedule-based
autoscaling**

Configuring Autoscaling

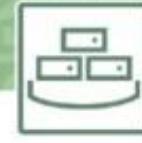
1

Create an instance configuration from an instance.



2

Create an instance pool using the instance configuration.



3

Configure the instance pool.



4

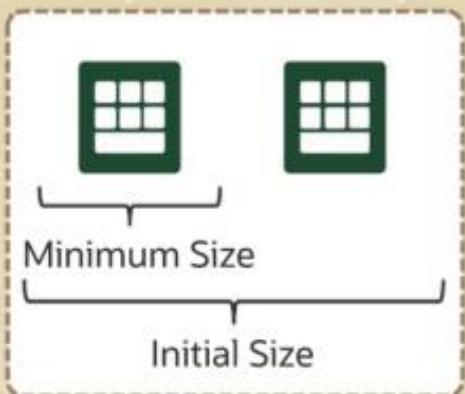
Create an autoscaling configuration.



Autoscaling

Unauthorized reproduction or distribution prohibited. Copyright © 2025 Oracle and/or its affiliates.

Instance Pool Before Scale

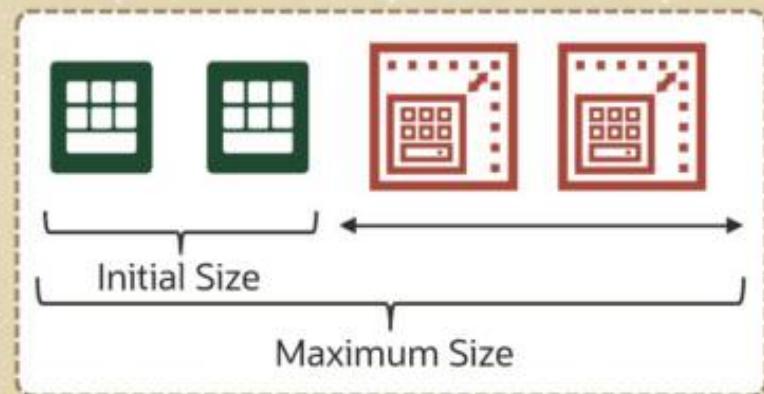


Scaling Rule



If CPU or memory > 70%, add two instances.
If CPU or memory < 70%, remove two instances.

Instance Pool After Scale



Oracle Cloud Infrastructure

Demo: Autoscaling

Oracle Cloud Infrastructure

Oracle Cloud Agent

Compute

Oracle Cloud Agent

Lightweight process

Manages plugins running
on compute instances

To use plugins:

- › Oracle Cloud Agent software must be installed
- › Plugins must be enabled

Examples:

Bastion: Allows SSH connections to an instance without public IP address

OSMS Agent: Manages patches and updates for the OS environment

Oracle Cloud Agent

Instance information	Shielded instance	Oracle Cloud Agent	Tags																																																		
<p>Oracle Cloud Agent is a lightweight process that manages plugins running on the instance. Plugins collect performance metrics, install OS updates, and perform other instance management tasks.</p>																																																					
<p>Stop plugins</p>																																																					
<table><thead><tr><th>Plugin name</th><th>Status</th><th>Message</th><th>Last updated</th><th>Enable plugin</th></tr></thead><tbody><tr><td>Vulnerability Scanning</td><td>-</td><td>-</td><td>Mon, Apr 25, 2022, 09:57:38 UTC</td><td><input type="checkbox"/> Disabled</td></tr><tr><td>Oracle Java Management Service</td><td>-</td><td>-</td><td>Mon, Apr 25, 2022, 09:57:38 UTC</td><td><input type="checkbox"/> Disabled</td></tr><tr><td>OS Management Service Agent</td><td>Running</td><td>-</td><td>Mon, Apr 25, 2022, 09:57:38 UTC</td><td><input checked="" type="checkbox"/> Enabled</td></tr><tr><td>Management Agent</td><td>-</td><td>-</td><td>Mon, Apr 25, 2022, 09:57:38 UTC</td><td><input type="checkbox"/> Disabled</td></tr><tr><td>Custom Logs Monitoring</td><td>Running</td><td>finish installing and running VM agent</td><td>Mon, Apr 25, 2022, 09:57:38 UTC</td><td><input checked="" type="checkbox"/> Enabled</td></tr><tr><td>Compute Instance Run Command</td><td>Running</td><td>-</td><td>Mon, Apr 25, 2022, 09:57:38 UTC</td><td><input checked="" type="checkbox"/> Enabled</td></tr><tr><td>Compute Instance Monitoring</td><td>Running</td><td>-</td><td>Mon, Apr 25, 2022, 09:57:38 UTC</td><td><input checked="" type="checkbox"/> Enabled</td></tr><tr><td>Block Volume Management</td><td>-</td><td>-</td><td>Mon, Apr 25, 2022, 09:57:38 UTC</td><td><input type="checkbox"/> Disabled</td></tr><tr><td>Bastion</td><td>Stopped</td><td>-</td><td>Mon, Apr 25, 2022, 09:57:38 UTC</td><td><input checked="" type="checkbox"/> Enabled</td></tr></tbody></table>				Plugin name	Status	Message	Last updated	Enable plugin	Vulnerability Scanning	-	-	Mon, Apr 25, 2022, 09:57:38 UTC	<input type="checkbox"/> Disabled	Oracle Java Management Service	-	-	Mon, Apr 25, 2022, 09:57:38 UTC	<input type="checkbox"/> Disabled	OS Management Service Agent	Running	-	Mon, Apr 25, 2022, 09:57:38 UTC	<input checked="" type="checkbox"/> Enabled	Management Agent	-	-	Mon, Apr 25, 2022, 09:57:38 UTC	<input type="checkbox"/> Disabled	Custom Logs Monitoring	Running	finish installing and running VM agent	Mon, Apr 25, 2022, 09:57:38 UTC	<input checked="" type="checkbox"/> Enabled	Compute Instance Run Command	Running	-	Mon, Apr 25, 2022, 09:57:38 UTC	<input checked="" type="checkbox"/> Enabled	Compute Instance Monitoring	Running	-	Mon, Apr 25, 2022, 09:57:38 UTC	<input checked="" type="checkbox"/> Enabled	Block Volume Management	-	-	Mon, Apr 25, 2022, 09:57:38 UTC	<input type="checkbox"/> Disabled	Bastion	Stopped	-	Mon, Apr 25, 2022, 09:57:38 UTC	<input checked="" type="checkbox"/> Enabled
Plugin name	Status	Message	Last updated	Enable plugin																																																	
Vulnerability Scanning	-	-	Mon, Apr 25, 2022, 09:57:38 UTC	<input type="checkbox"/> Disabled																																																	
Oracle Java Management Service	-	-	Mon, Apr 25, 2022, 09:57:38 UTC	<input type="checkbox"/> Disabled																																																	
OS Management Service Agent	Running	-	Mon, Apr 25, 2022, 09:57:38 UTC	<input checked="" type="checkbox"/> Enabled																																																	
Management Agent	-	-	Mon, Apr 25, 2022, 09:57:38 UTC	<input type="checkbox"/> Disabled																																																	
Custom Logs Monitoring	Running	finish installing and running VM agent	Mon, Apr 25, 2022, 09:57:38 UTC	<input checked="" type="checkbox"/> Enabled																																																	
Compute Instance Run Command	Running	-	Mon, Apr 25, 2022, 09:57:38 UTC	<input checked="" type="checkbox"/> Enabled																																																	
Compute Instance Monitoring	Running	-	Mon, Apr 25, 2022, 09:57:38 UTC	<input checked="" type="checkbox"/> Enabled																																																	
Block Volume Management	-	-	Mon, Apr 25, 2022, 09:57:38 UTC	<input type="checkbox"/> Disabled																																																	
Bastion	Stopped	-	Mon, Apr 25, 2022, 09:57:38 UTC	<input checked="" type="checkbox"/> Enabled																																																	
Showing 9 items																																																					

Oracle Cloud Infrastructure

Oracle OS Management Hub (OSMH)

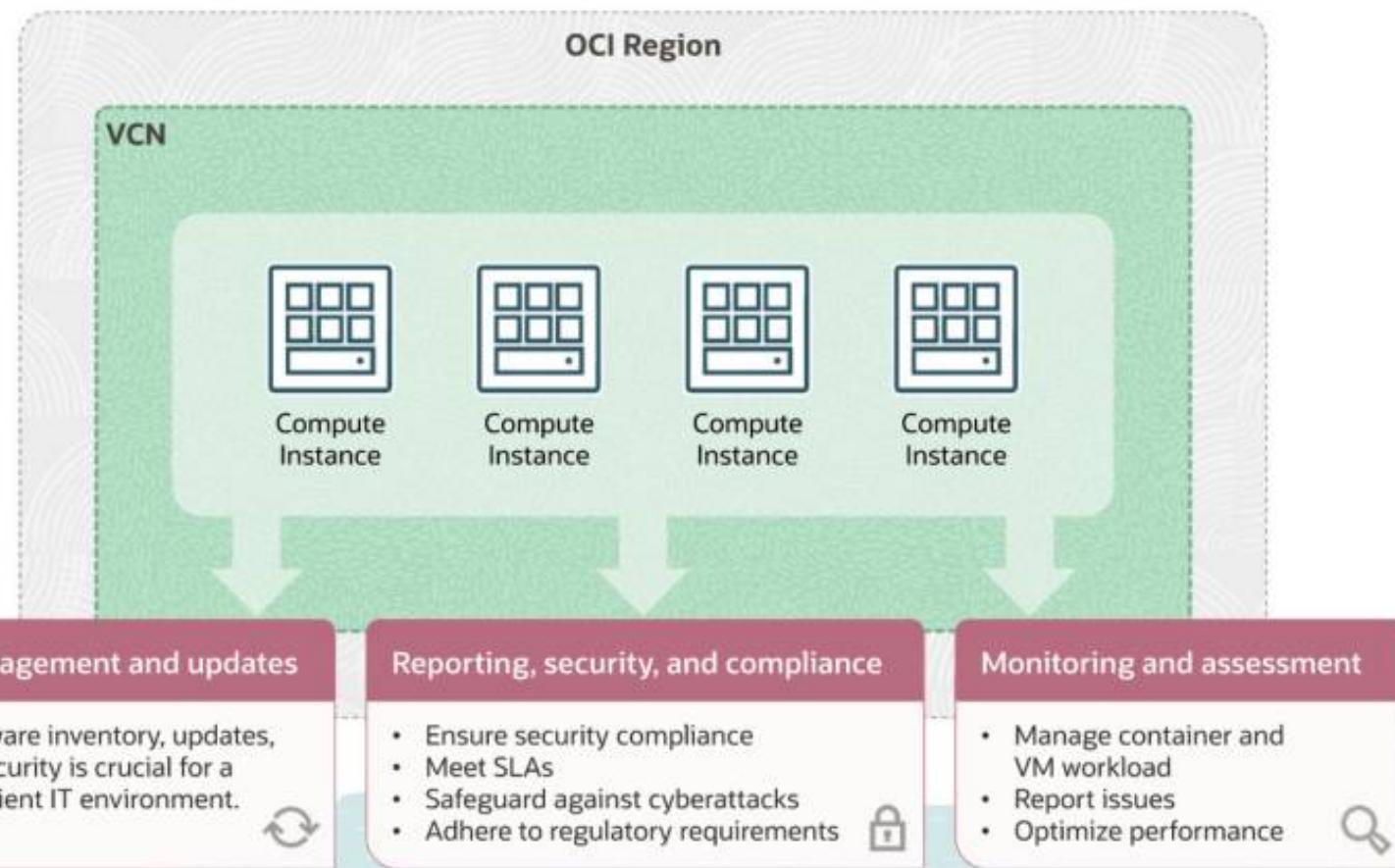


Understanding **Challenges** of IT Administrator

Understanding **Challenges** of IT Administrator



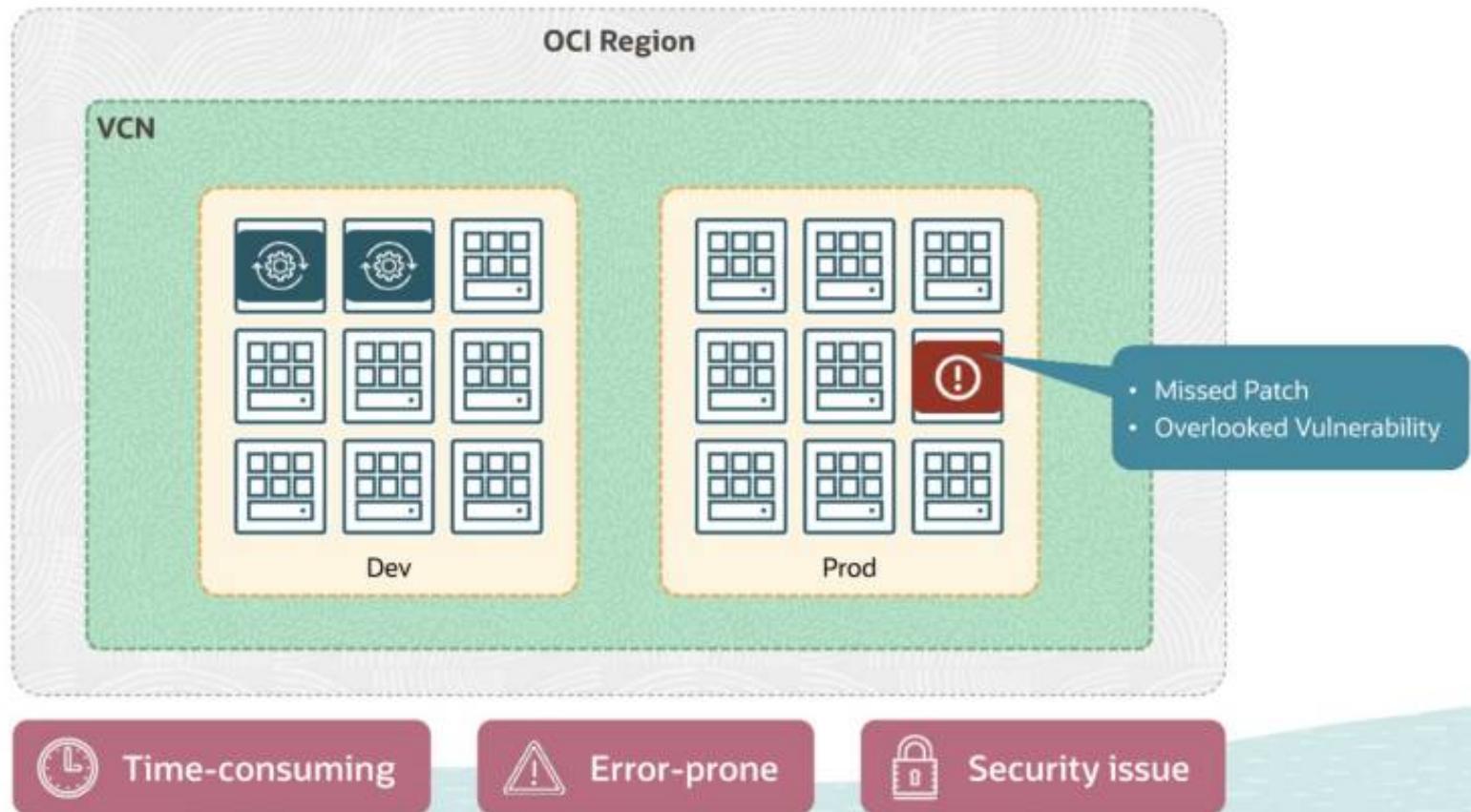
IT Administrator



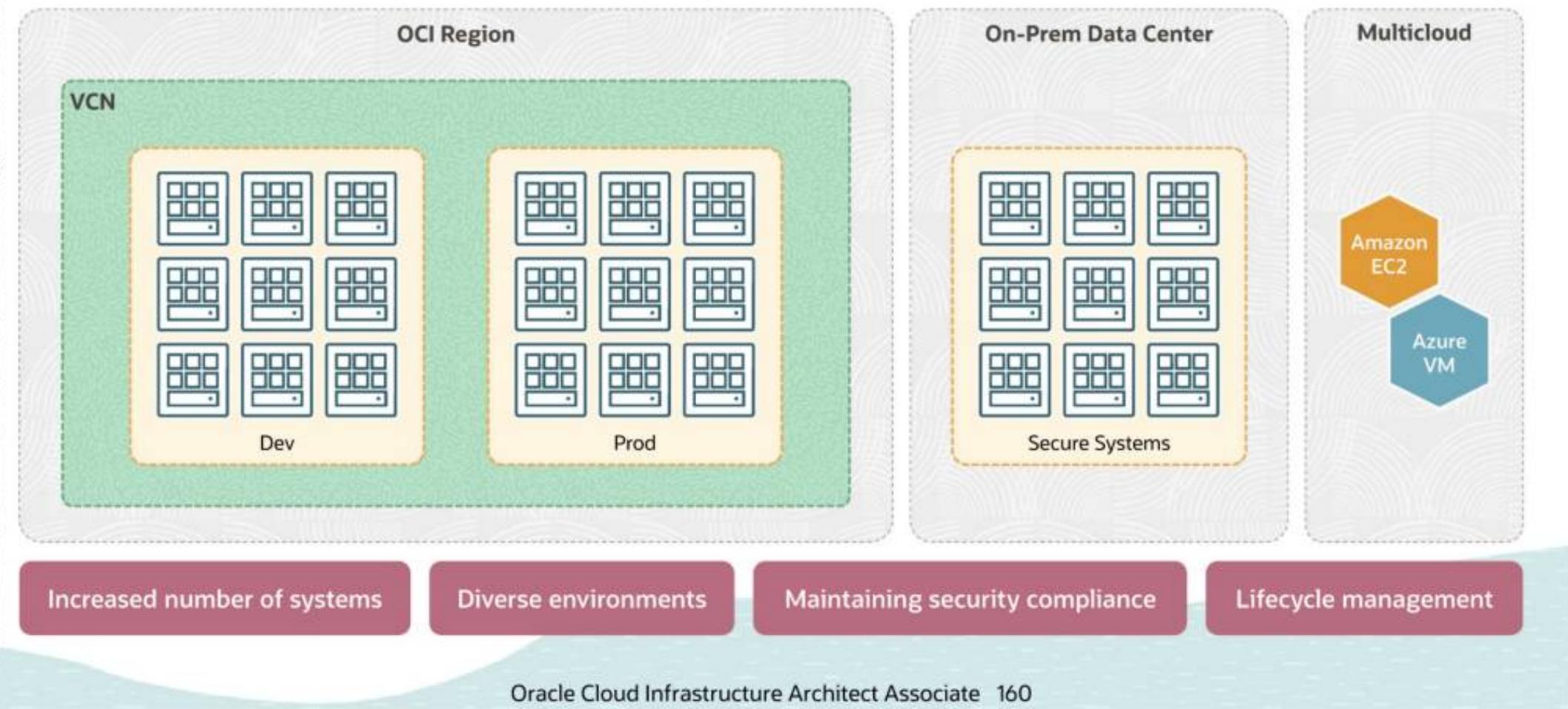
Understanding **Challenges** of IT Administrator



IT Administrator



Understanding **Challenges** of IT Administrator



Managing the OS: Challenges

Compliance & availability



- Ensure security compliance through consistent OS management.
- Maintain high availability with regular administration.
- Optimize performance through ongoing monitoring and updates.

Labor intensive & inefficient processes



- Manual administration is labor-intensive and time-consuming.
- In-house tools demand specialized expertise and independent management.

Complexity



- OS patching is error-prone and complex to manage across lifecycles.
- Scaling patch management is challenging for large, distributed deployments.

Need to improve productivity



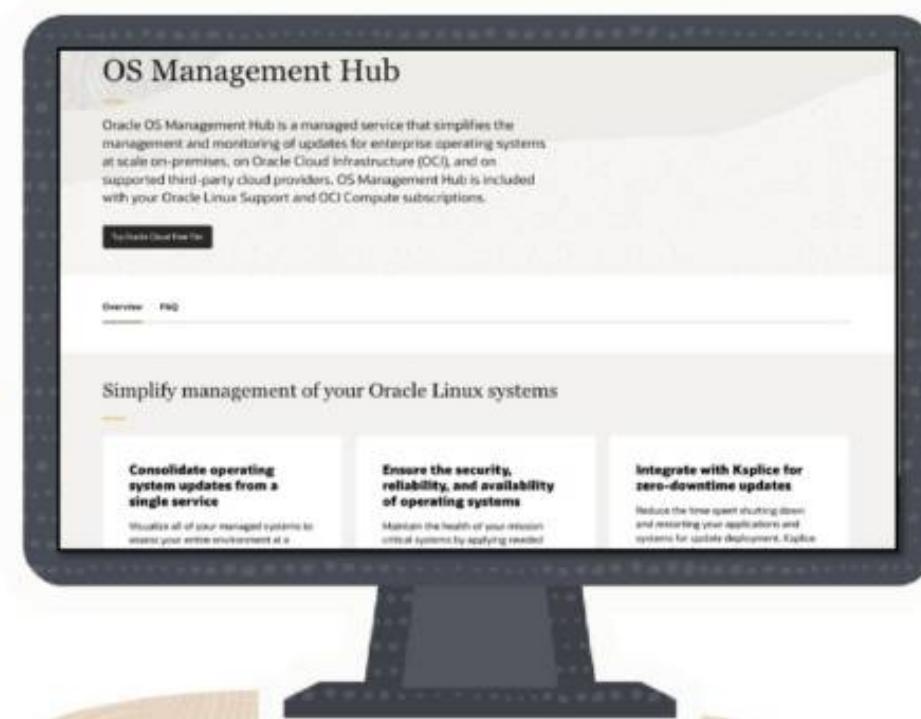
- Organizations aim to improve productivity and efficiency.
- Focus on prioritizing tasks critical to business over routine operations.

Oracle OS Management Hub

Centralized OS management



Gain control of updates over your entire environment, reducing administration and improving efficiency.



Enhanced security and compliance



Provide dashboard for compliance monitoring, patch statuses, and vulnerability reports.

Zero-downtime updates

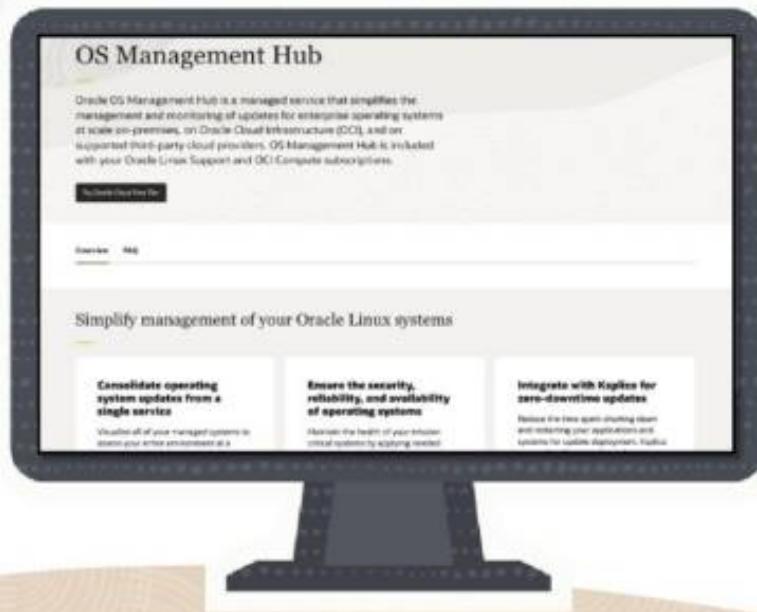


Reduce downtime with Ksplice integration, applying Oracle Linux updates without rebooting systems.



Manage systems across OCI, third-party clouds, and on-premises with a unified OS environment view.

Managed across environments



Oracle OS Management Hub



On-premises

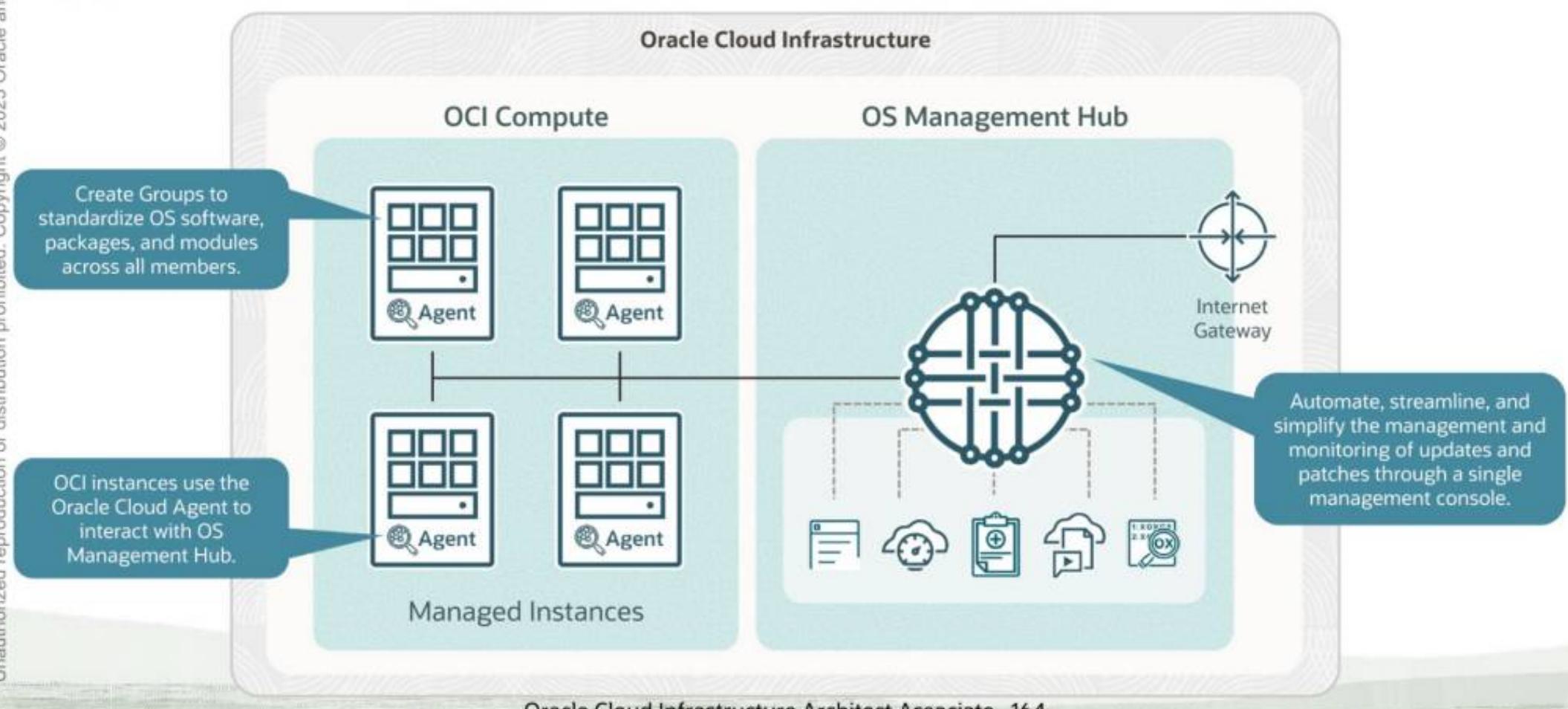


OCI

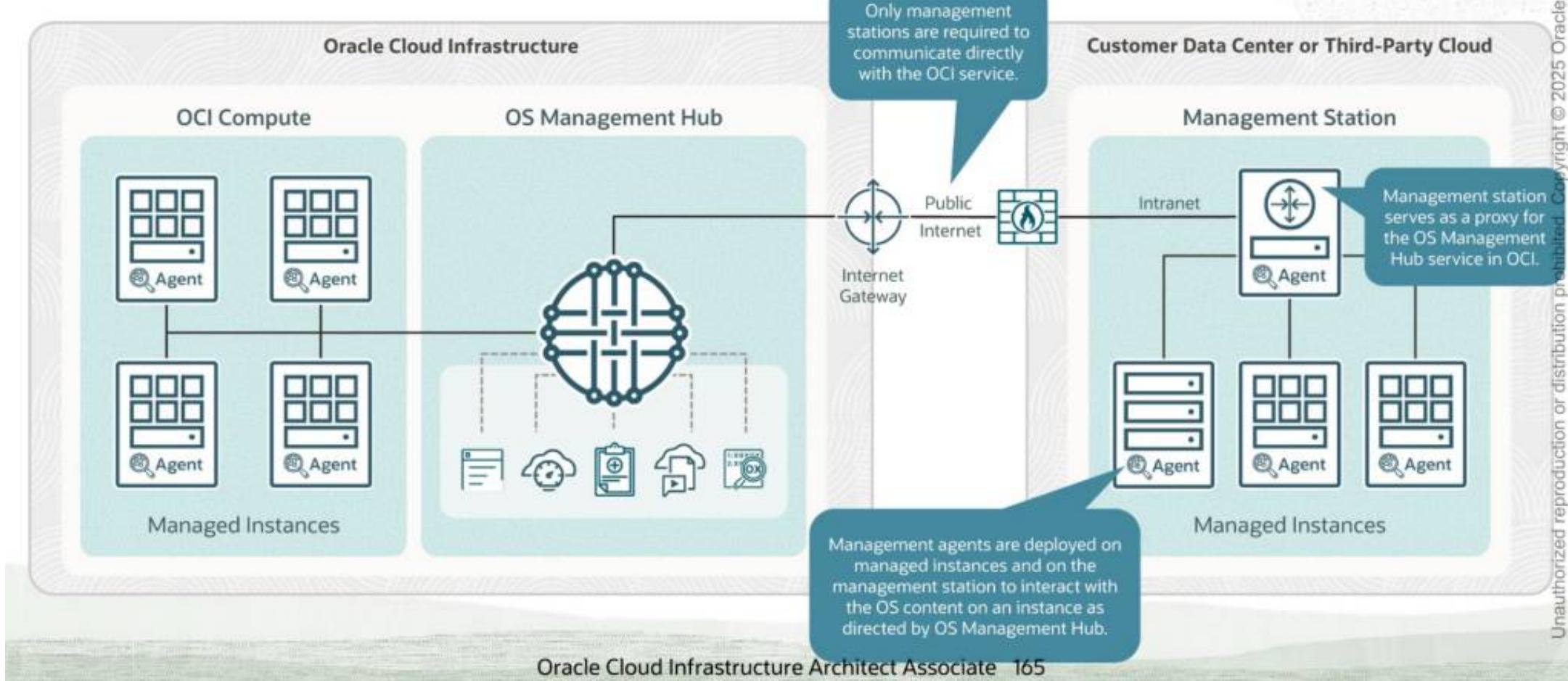


Third-party cloud

OSMH Service Architecture



OSMH Service Architecture



OSMH Dashboard

The screenshot displays the Oracle OS Management Hub (OSMH) Dashboard. At the top, there's a navigation bar with the Oracle Cloud logo, a search bar, and account information for "US East (Ashburn)".

The main content area is titled "Overview" and features a "Welcome to OS Management Hub" message. Below this are three primary reports:

- Security updates report:** Shows 14 out of 21 instances have security updates available. The donut chart indicates 32% (Green) and 67% (Yellow).
- Bug updates report:** Shows 8 out of 21 instances have bug updates available. The donut chart indicates 32% (Green) and 67% (Yellow).
- Instance activity report:** Shows 3 out of 21 instances are not communicating with the service. The donut chart indicates 96% (Green), 3% (Yellow), and 1% (Red).

Below these reports are three "More actions" cards:

- Select vendor software sources:** Use software sources to provide OS content to instances. Includes a "Discover vendor software sources" button.
- Setup management station:** Create a management station to distribute content to instances in your private data center or supported third-party cloud environment. Includes a "Create management station" button.
- Create a profile:** Create profiles to define the content assigned to instances at registration. Includes a "Create a profile" button.

At the bottom, there are two resource sections:

- Training Videos:** Includes a "Discover 22 min" link and a "Training Deck" button.
- Documentation:** Includes a "Get started" link and a "60 documentation" button.

The left sidebar contains a navigation menu with the following items:

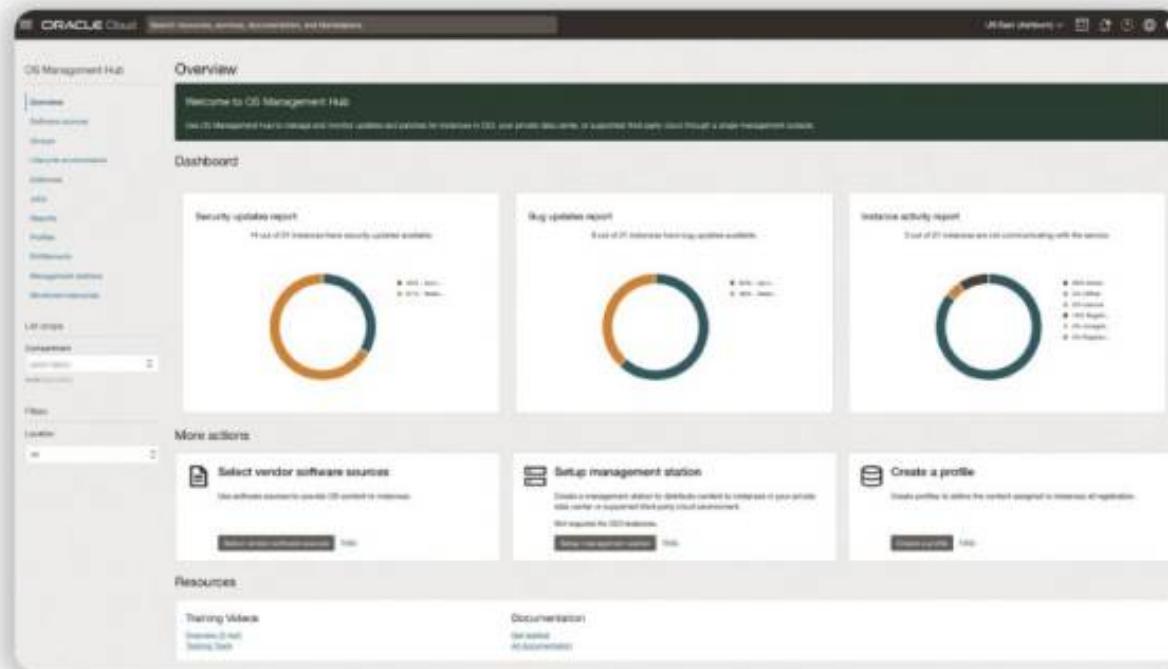
- OS Management Hub:
 - Overview
 - Software sources
 - Regions
 - Lifecycle environments
 - Instances
 - Jobs
 - Reports
 - Metrics
 - Environments
 - Management stations
 - Monitored resources
- Unit scope:
 - Compute instance
 - Compute instance
- Filters
- Locators

OSMH Dashboard

Overview dashboard

Keep an eye on your managed environment:

- Out-of-compliance patching statuses
- Number of available security and bug updates
- Instances communicating with the service



Real-time reports

Monitor whether an instance is up-to-date:

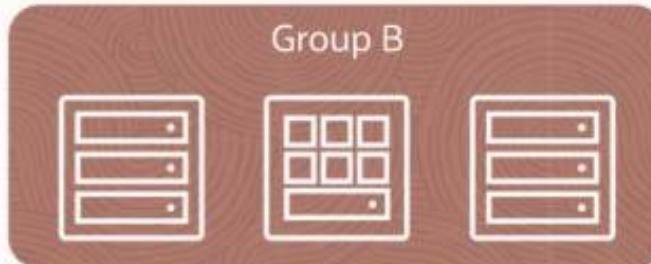
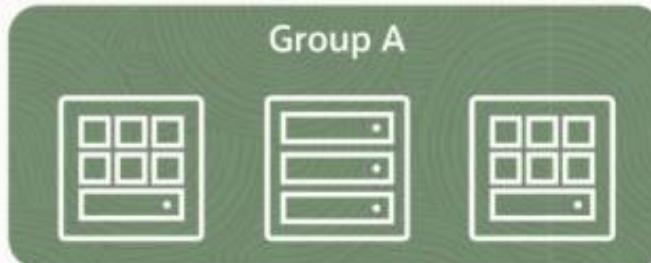
- Drill into linked security advisory information
- Run available updates directly from the Reports view
- Download reports in CSV, JSON, or XML formats

OSMH: Simplify and Automate Patch Updates

Efficient instance and group management through a single console

Align OS content across
a collection of instances

Perform fleet management operations



▶ Check for and apply updates.

▶ Install and remove packages.*

▶ Run all or any available security, Ksplice (kernel and user space)*, bug, enhancement, and other updates.

▶ Run update jobs immediately, on a one-time or recurring schedule.

OSMH: Benefits



Improve security and reliability

- Stay up to date with security and bug fixes.
- Ensure security compliance.



Lower costs

- Management as a service reduces administrative overhead, operational, and capital expenditures.



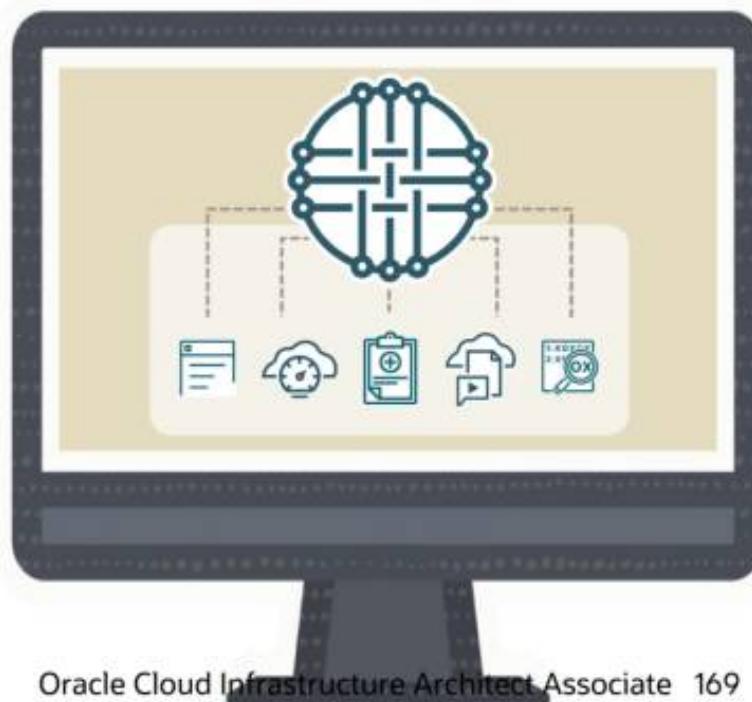
Save time, increase efficiency

- Automate manual processes; flexible job scheduling.
- Automated operations reduce human errors.



Reduce management complexity

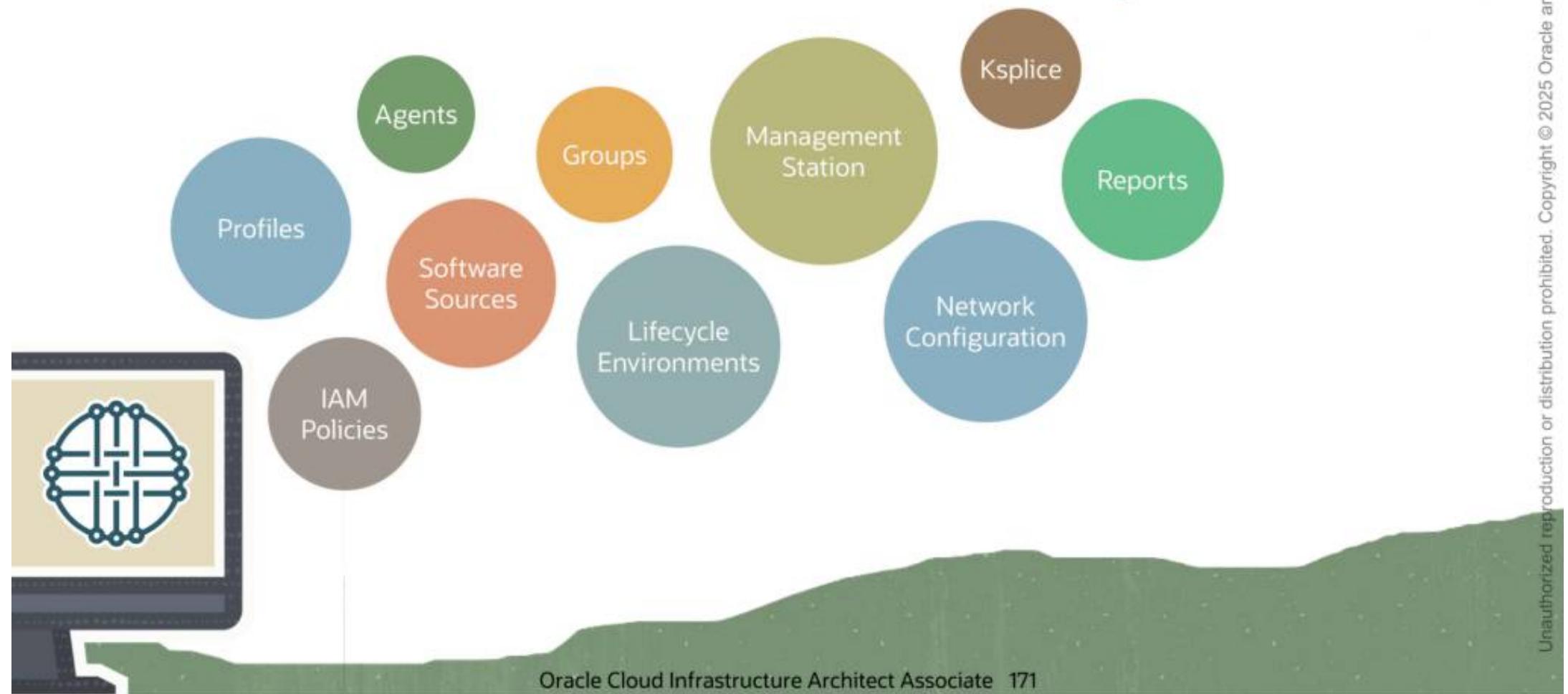
- Gain centralized, simplified, and integrated OS management.
- Maintain consistency of patch lifecycle environments.



Oracle Cloud Infrastructure

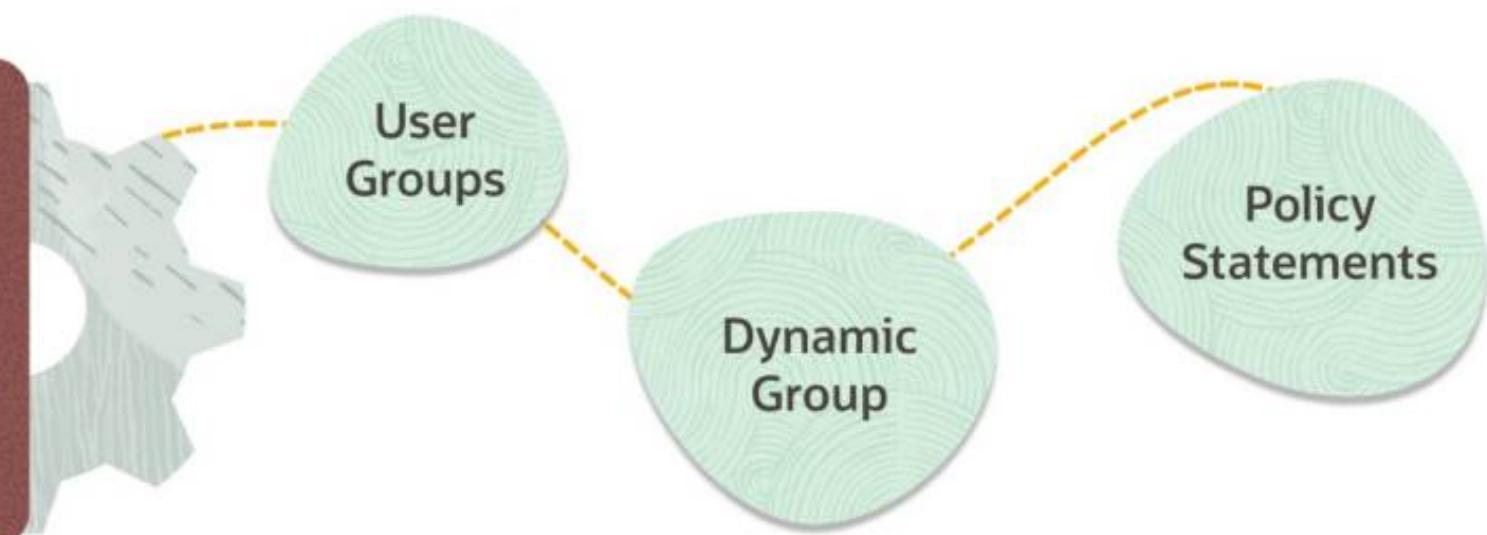
Oracle OS Management Hub (OSMH) Components

OSMH Components



OSMH: OCI IAM Policies

Setting up
OCI IAM Policies
to enable
OS Management Hub



OSMH: OCI IAM Policies

User Groups



OSMH: OCI IAM Policies

User Groups

Dynamic Group

Rule for OCI instances

A rule statement that includes each compartment (and subcompartment) that will contain instances

```
ANY {instance.compartment.id='<compartment_ocid>',  
     instance.compartment.id='<subcompartment_ocid>'}
```

Rule for non-OCI instances

Separate rule statement for each compartment that will contain a Management Agent used by an instance

```
ALL {resource.type='managementagent',  
      resource.compartment.id='<compartment_ocid>'}
```

```
ALL {resource.type='managementagent',  
      resource.compartment.id='<subcompartment_ocid>'}
```

OSMH: OCI IAM Policies

User Groups

Dynamic Group

Policies

Policy for dynamic group

Allows the service agent on the managed instances to interact with OS Management Hub

Allow dynamic-group <osmh_dyn_grp> to {OSMH_MANAGED_INSTANCE_ACCESS} in tenancy where request.principal.id = target.managed-instance.id

Policy for user access

Allows the admin user group to manage all OS Management Hub resources in the tenancy

Allow group <osmh-admins> to manage osmh-family in tenancy
Allow group <osmh-admins> to manage management-agents in tenancy
Allow group <osmh-admins> to manage management-agent-install-keys in tenancy

OSMH: OCI IAM Policies



User Groups

Dynamic Group

Policies

Policy for user access

Allows the admin user group to manage all OS Management Hub resources in a compartment and read profiles and software sources in the root compartment

Allow group <osmh-admins> to read osmh-profiles in tenancy
where target.profile.compartment.id = '<tenancy-ocid>'

Allow group <osmh-admins> to read osmh-software-sources in tenancy
where target.softwareSource.compartment.id = '<tenancy-ocid>'

Allow group <osmh-admins> to manage osmh-family in compartment <compartment>

Allow group <osmh-admins> to manage management-agents in compartment
<compartment>

Allow group <osmh-admins> to manage management-agent-install-keys in compartment
<compartment>

Supported OS Platforms



On-premises
(Private data center)

Oracle Linux 7

Oracle Linux 8

Oracle Linux 9



Oracle Cloud Infrastructure

Oracle Linux 6

Oracle Linux 7

Microsoft Windows Server 2016*

Microsoft Windows Server 2019*

Microsoft Windows Server 2022*



Third-party cloud
(Azure, AWS)

Oracle Linux 7

Oracle Linux 8

Oracle Linux 9

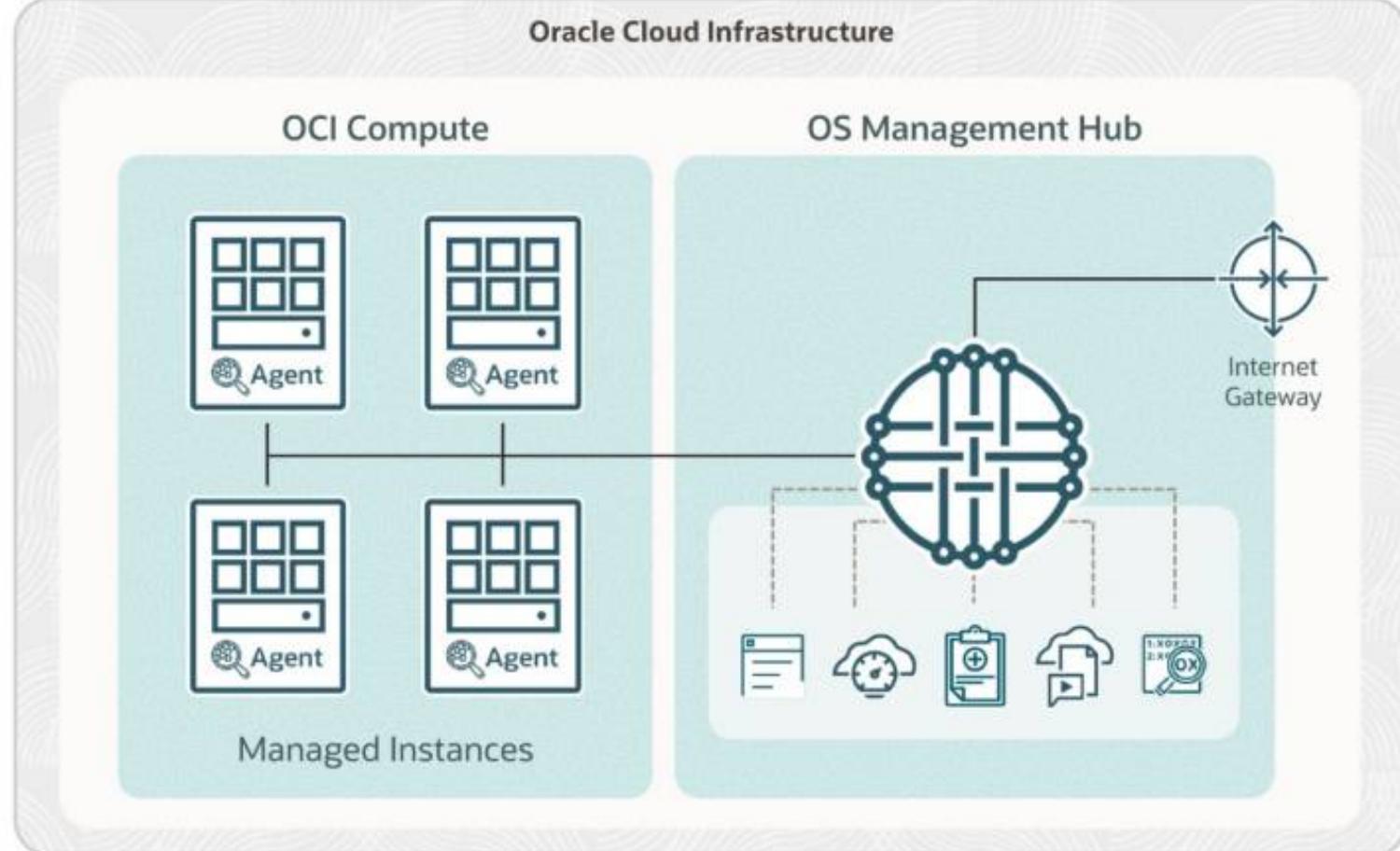
*Standard, Datacenter



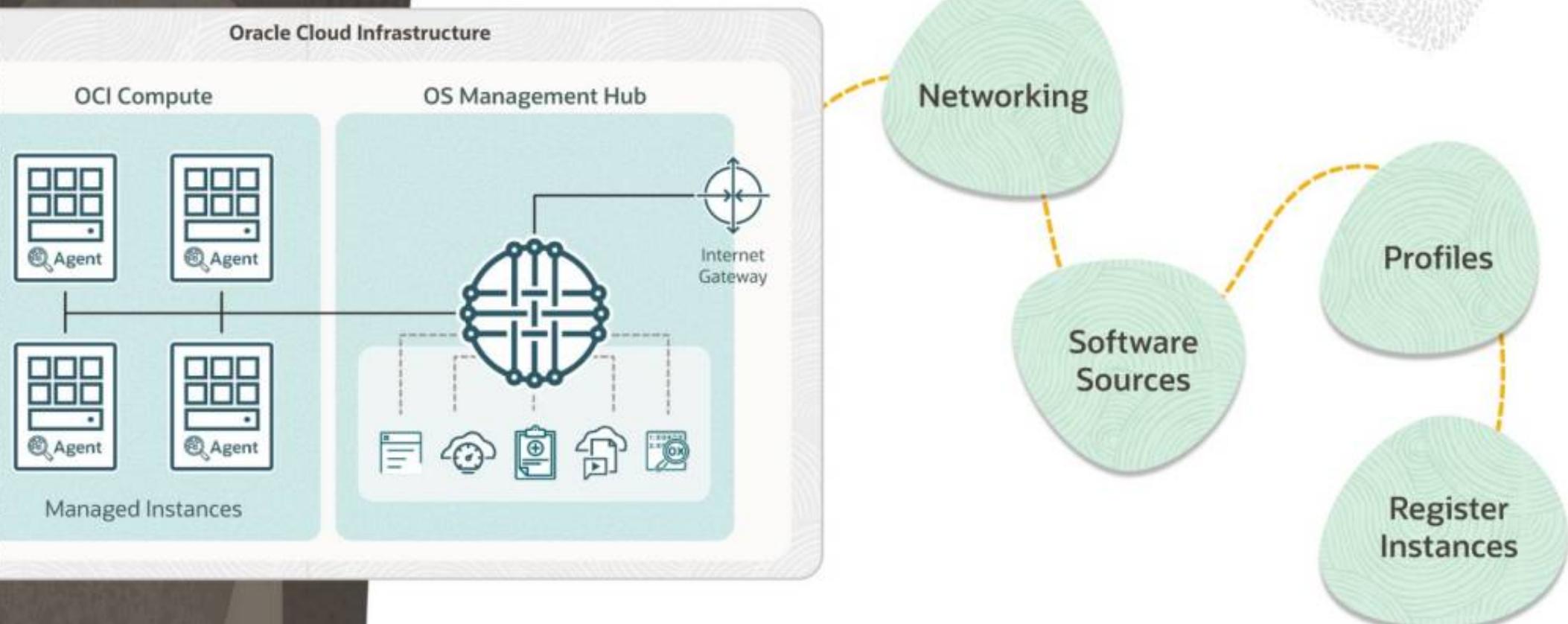
Oracle Cloud Infrastructure

Oracle OS Management Hub (OSMH) for OCI Instances

OSMH Example: OCI Instances



OSMH Example: OCI Instances



OSMH Example: OCI Instances

Networking

Oracle Linux

Virtual cloud network requirements:

- **Private Subnet:**
 - Use a service gateway with *All <region> Services in Oracle Services Network* CIDR label.
 - OR attach to a **NAT gateway**.
- **Public Subnet:**
 - Attach to an **Internet Gateway**.



OSMH Example: OCI Instances

Networking

Microsoft Windows Instances

Virtual cloud network requirements:

- Ensure security lists or network rules are configured for access to the Windows update server.



OSMH Example: OCI Instances

Networking

Software Sources

Software Sources

- Software sources are basically collections of packages.
- They allow administrators to control which packages can be installed on instances.
- Administrators do not have to manually configure the repositories on every instance.



OSMH Example: OCI Instances

Networking

Software Sources

Software Sources: Types

Vendor Software Source

- Repository of OS vendor-provided content
- Foundation for content available to instances managed by OS Management Hub
- At least one vendor source required before registering instances



OSMH Example: OCI Instances

Networking

Software Sources

Software Sources: Types

Custom Software Source

- User-created software repository with curated content
- Built upon vendor software sources as a base
- Filters used to refine the package and module selection
- Can be attached to instances and groups



OSMH Example: OCI Instances

Networking

Software Sources



Software Sources: Types

Versioned Custom Software Source

- Immutable—content cannot be changed after creation
- Used to manage content for lifecycle environments
- Cannot be directly attached to an instance or group
- Does not automatically resolve package dependencies



OSMH Example: OCI Instances

Networking

Software Sources

Profiles

Profiles

Profiles ensure consistent instance registration by defining associations that are applied at the time of registration.



Software
Sources

Lifecycle
Stage
Membership

Group
Membership

Impact

Location
Specificity

OSMH Example: OCI Instances

Networking

Software Sources

Profiles

Register Instances



Register New Instance

Registering an instance with the **OS Management Hub** allows you to efficiently manage your instances, ensuring they stay updated and secure.



Step 1

Create Instance

Step 2

Enable
OS Management Hub
Agent Plugin

Step 3

Select Profile



OSMH Example: OCI Instances

Networking

Software Sources

Profiles

Register Instances

Register Existing Instance

Registering existing instance with the **OS Management Hub** allows you to efficiently manage your instances, ensuring they stay updated and secure.



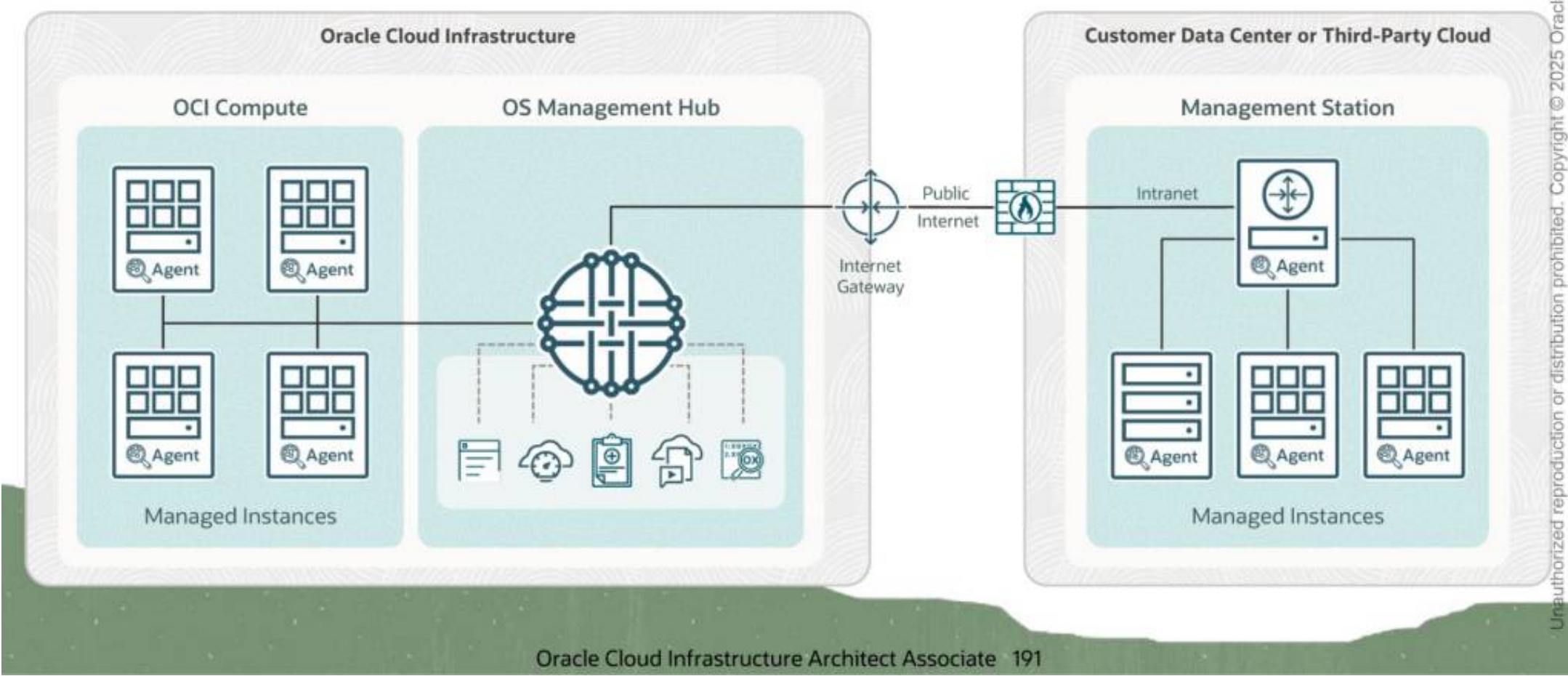
Ensure Oracle Cloud Agent is installed and is version **1.40.0 or later**.

```
sudo yum install -y oracle-cloud-agent
```

Oracle Cloud Infrastructure

Oracle OS Management Hub (OSMH) Management Station

OSMH: Management Station



Management Station



Oracle Cloud Infrastructure Architect Associate 192



Centralized Management

Manage OS updates and patches for multiple instances from a single point.



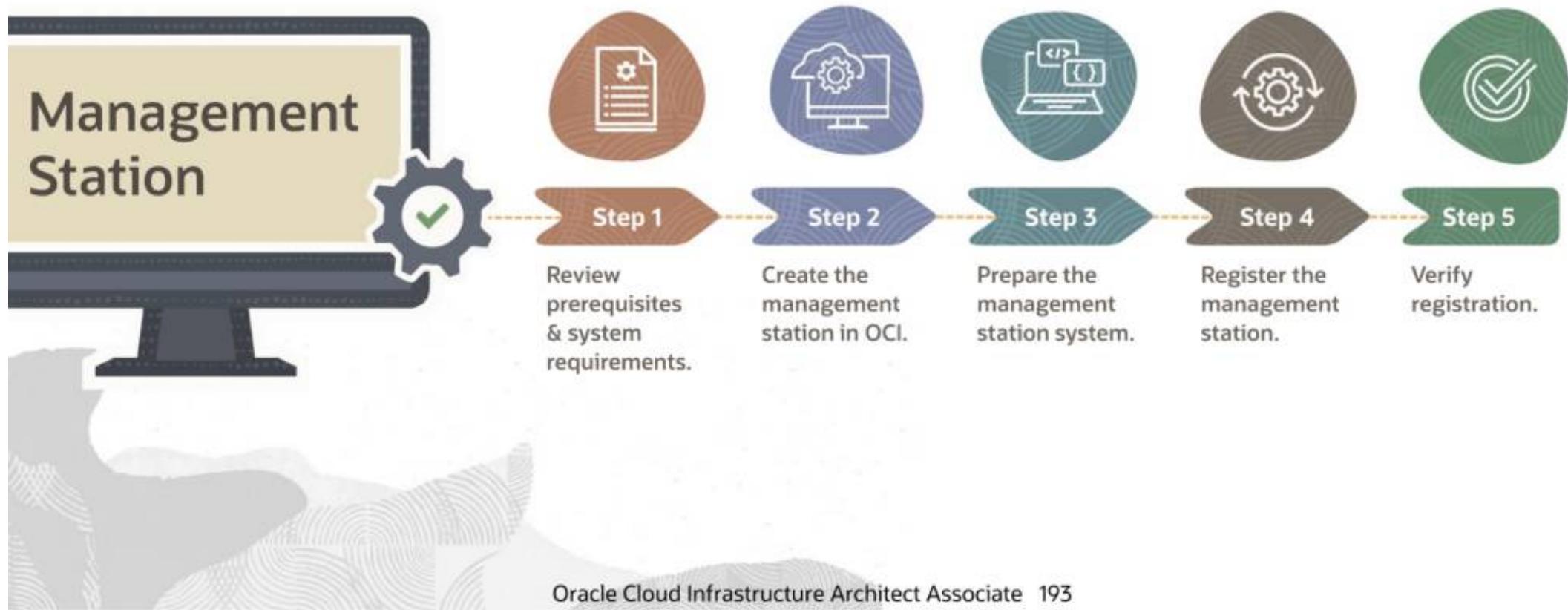
Reduced Bandwidth

Download OS content once to the management station and distribute it locally, saving bandwidth.



Offline Updates

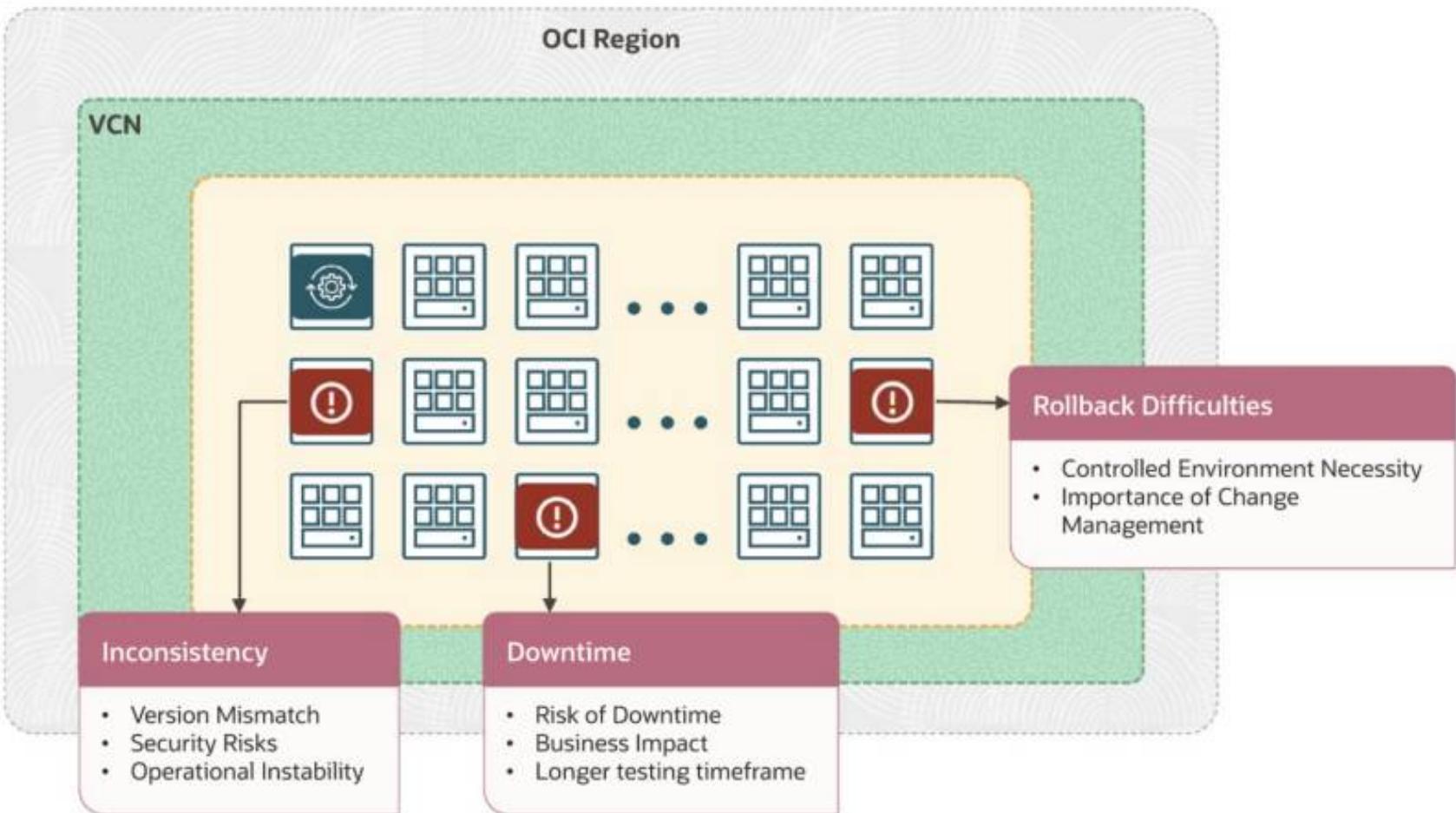
Update systems without direct internet connectivity, enhancing security.



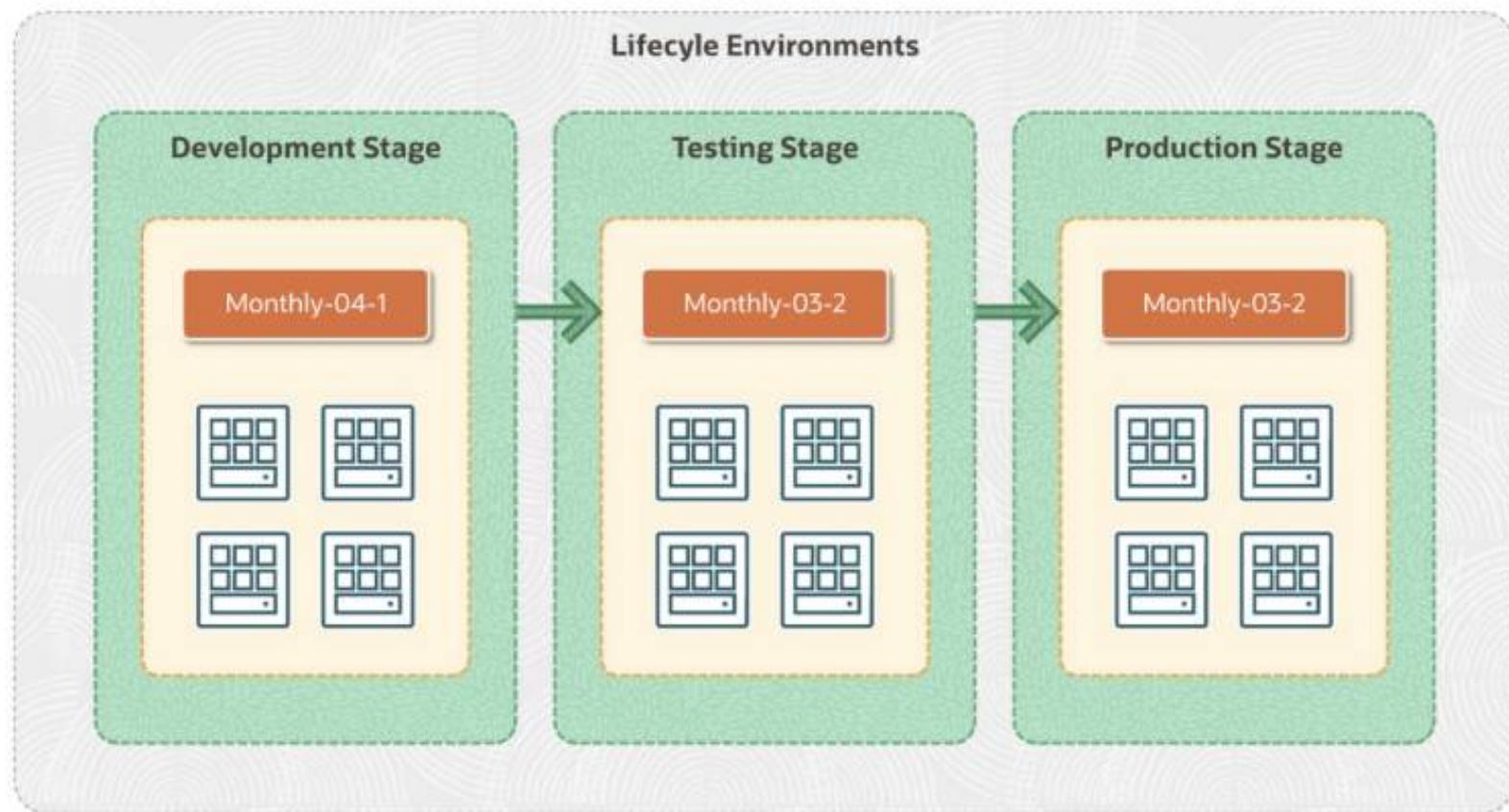
Oracle Cloud Infrastructure

Oracle OS Management Hub (OSMH) Lifecycle Environments

Scenario



Lifecycle Environments



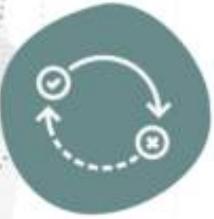
Lifecycle Environments

Benefits



Consistency and Integrity

All instances within a stage receive the same versioned content, ensuring consistency across the environment.



Controlled Rollouts

The staged promotion process allows for gradual rollouts, minimizing disruption and providing time to address any unforeseen issues that might arise.



Reduced Risk

Potential issues are identified and addressed early in the development and testing stages, significantly reducing the risk of problems in production.



Simplified Management

Automated instance attachment, content promotion, and software source management streamline OS updates, making them more efficient and less prone to errors.

Oracle Cloud Infrastructure

Demo: Run Command

Oracle Cloud Infrastructure

Run Command

— Compute

Run Command

Scripts can be uploaded in the Console (up to 4k).

Windows scripts run as a batch file.

Linux scripts run in a bash shell by default.

Works on any platform image (except Ubuntu)

No SSH required

Script results can be sent to object storage.

Example Scenarios



Oracle Cloud Infrastructure
Instance Console Connection

—
Compute

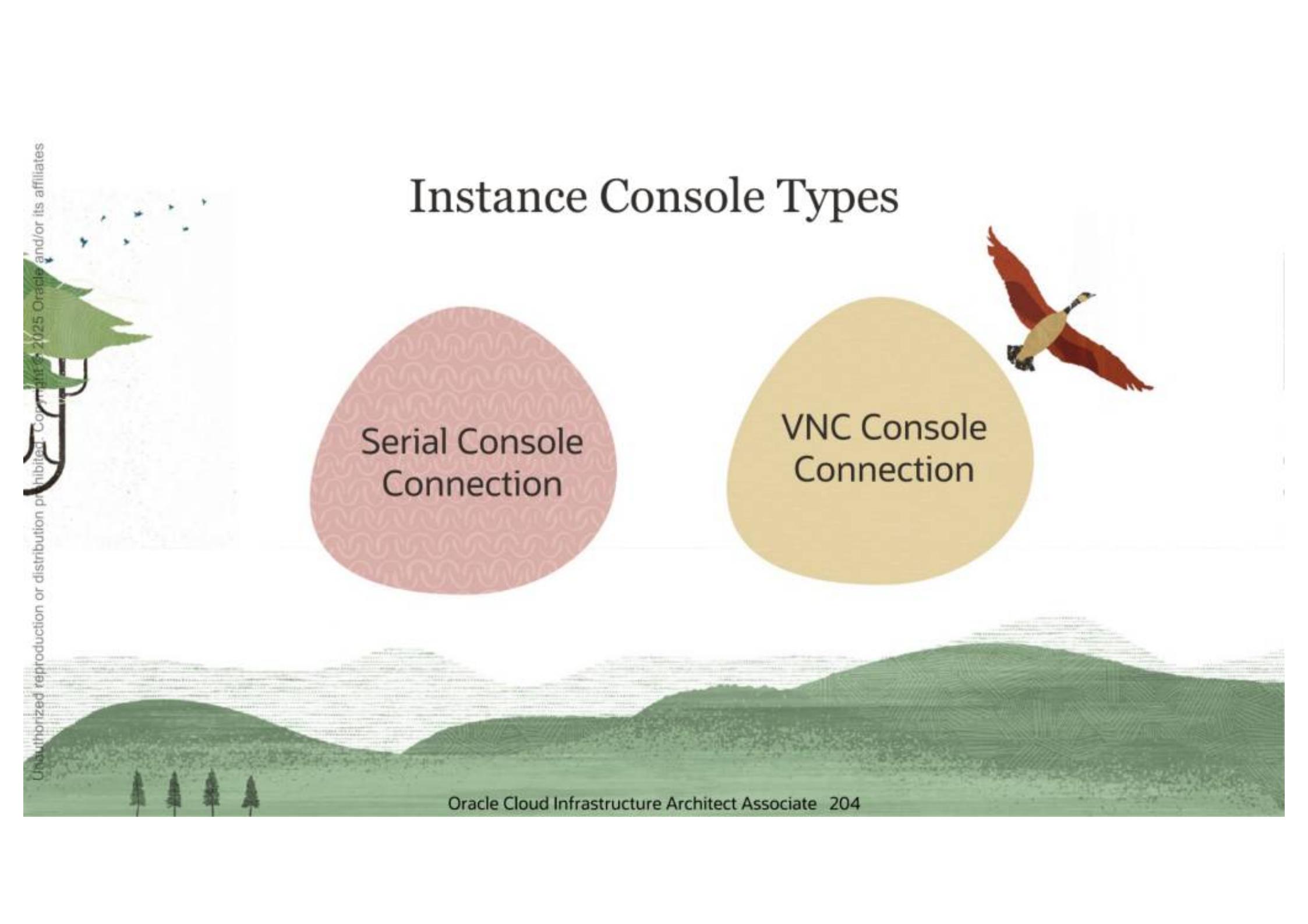
Instance Console Connections

Remotely troubleshoot malfunctioning instances.

The screenshot shows the 'Console connection' section of the Oracle Cloud Infrastructure console. On the left, there's a sidebar with various resources like Metrics, Attached block volumes, Attached VMs, Boot volume, and a 'Console connection' section which is currently selected. Under 'Console connection', there are buttons for 'Launch Cloud Shell connection' (which is highlighted in blue) and 'Create local connection'. Below these buttons is a table with two columns: 'State' and 'Fingerprint of the server host key'. The state is 'Active' and the fingerprint is 'ca96XU'. There are 'Show' and 'Copy' buttons next to the fingerprint. To the right of the table is a 'Fingerprint of your public key' section with 'EditYDA', 'Show', and 'Copy' buttons. At the bottom of the page, there's a terminal window showing the output of a 'journalctl -b' command, which includes messages about starting serial getty, reaching target, and running cloud-init.

State	Fingerprint of the server host key
Active	ca96XU Show Copy

```
[ 1.564183] cloud-init[2027]: Cloud-init v. 21.1-7.0.2.el8_5.4 running 'modules:config' at Mon, 25 Apr 2022 16:52:35 +0000. Up 18.28 seconds.  
[ 1.564183] cloud-init[2027]: Starting user runtime directory /run/user/0...  
[ 1.564183] cloud-init[2027]: Starting user manager for uid 0...  
[ 1.564183] cloud-init[2027]: Started Session c1 of user root.  
[ 1.564183] cloud-init[2027]: Started Apply the settings specified in cloud-config.
```



Instance Console Types

Serial Console
Connection

VNC Console
Connection

Use Cases

An imported or customized image that does not complete a successful boot

A previously working instance that stops responding after maintenance

Oracle Cloud Infrastructure

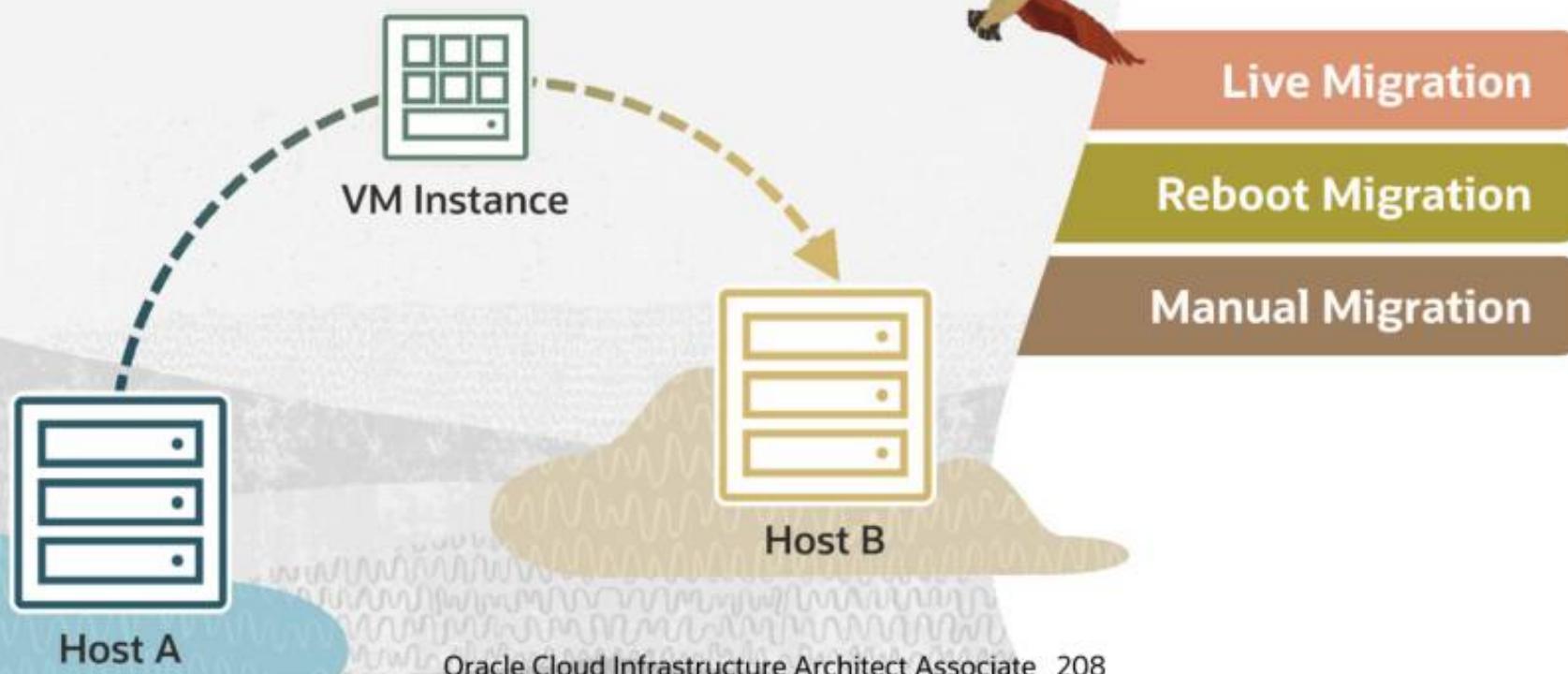
Demo: Console Connection

Oracle Cloud Infrastructure

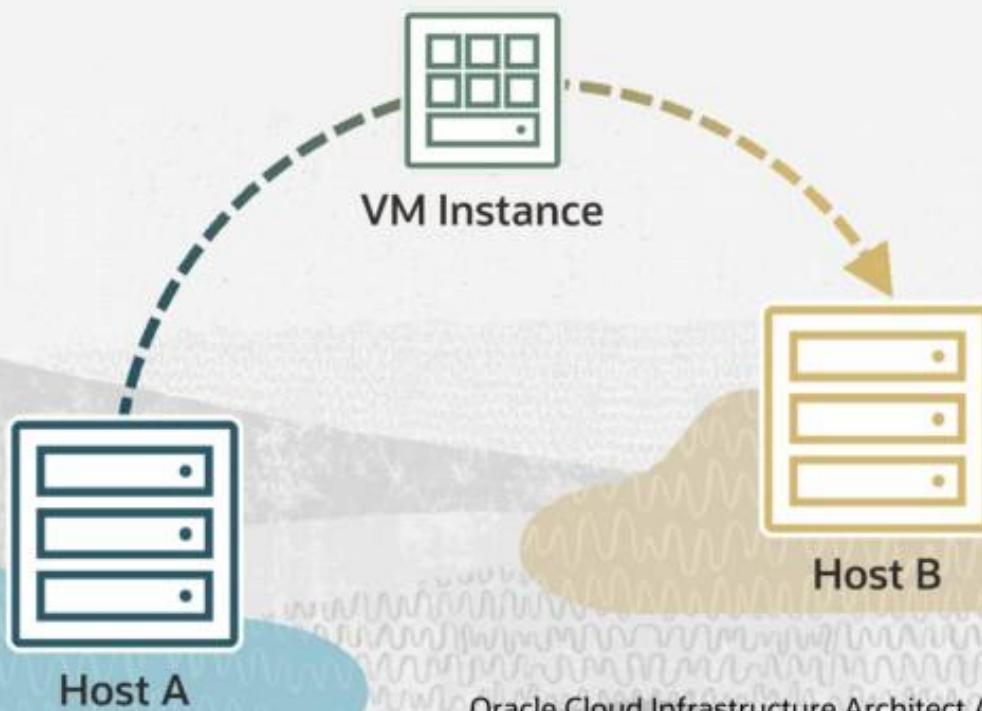
Infrastructure Maintenance

— **Compute**

Relocating a VM Instance



Live Migration



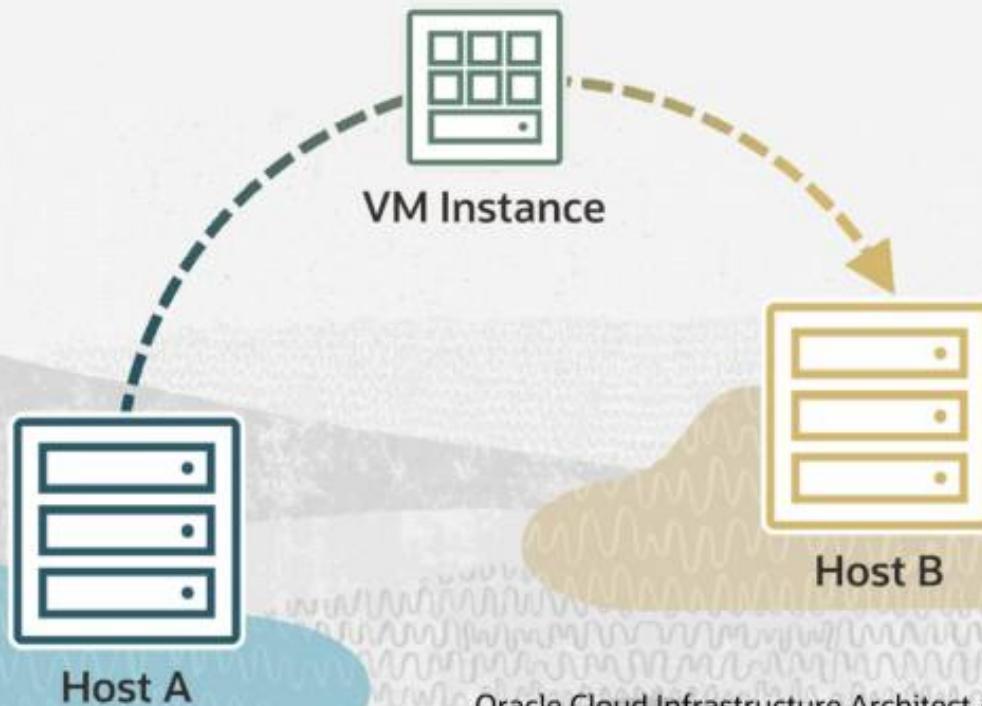
Live Migration

VM instance migrated with minimal disruption

Emits infrastructure maintenance event

Not all shapes supported

Reboot Migration

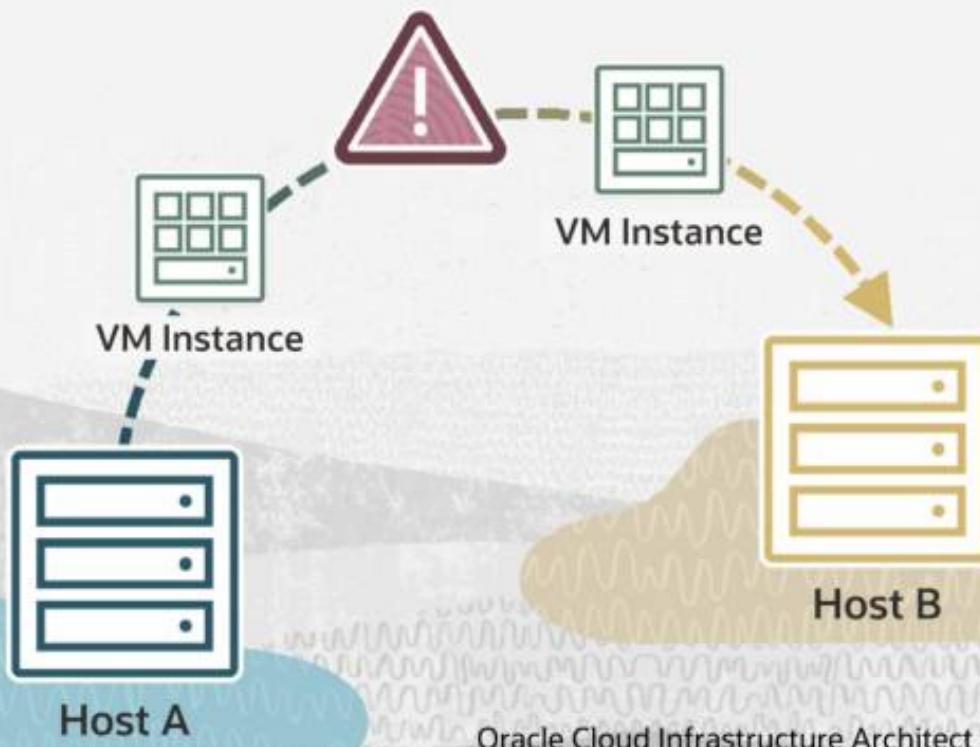


Reboot Migration

Short downtime

Can proactively reboot before the maintenance due date

Manual Migration

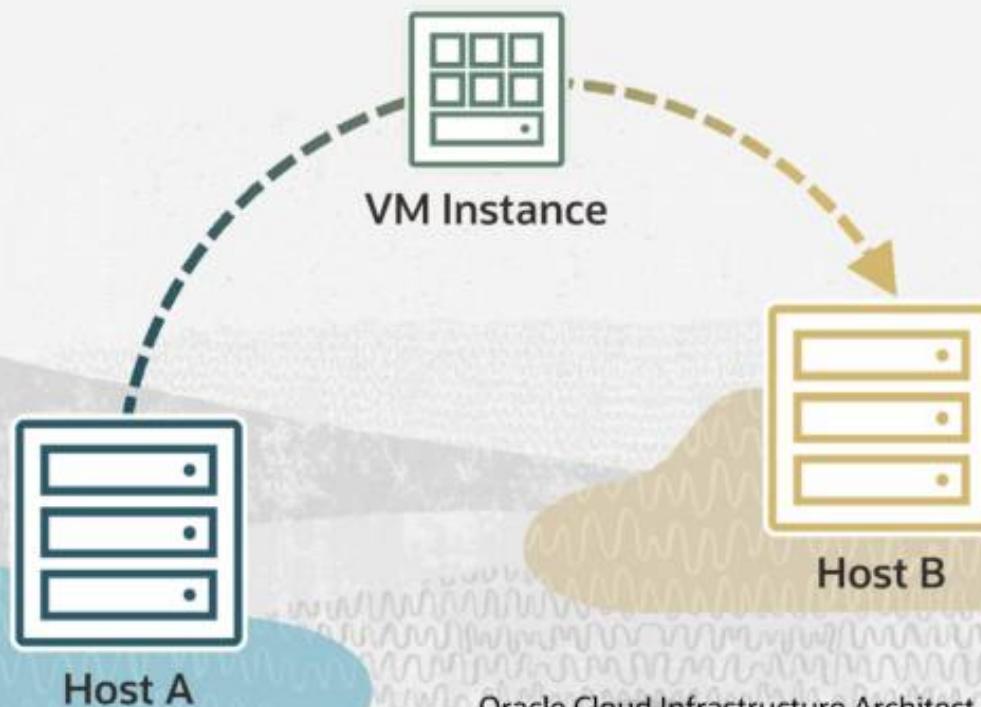


Manual Migration

For instances without a date in the **Reboot Maintenance Field**.

The instance needs to be terminated (do not forget to preserve the boot volume) and recreated.

VM Recovery Due to Infrastructure Failure



VM Recovery Due to Infrastructure Failure

Similar to reboot migration for Standard VM instances

Dense I/O VM instances are recovered by rebooting the instance on the same physical host

Oracle Cloud Infrastructure Shielded Instances

— **Compute**

Shielded Instances



Harden the firmware security.

Defend against malicious boot level software.

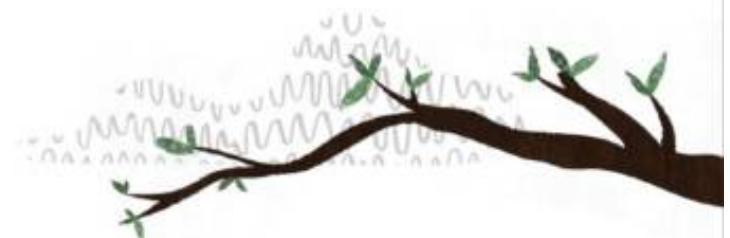


Image and Shape → Show advanced options

Create compute instance

Secure Boot

Secure Boot is a Unified Extensible Firmware Interface (UEFI) feature that prevents unauthorized boot loaders and operating systems from booting.

Measured Boot

Measured Boot enhances boot security by taking and storing measurements of boot components, such as bootloaders, drivers, and operating systems. Bare metal instances do not support Measured Boot.

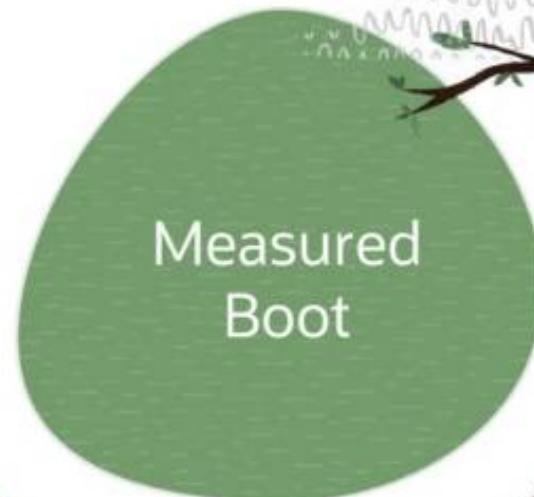
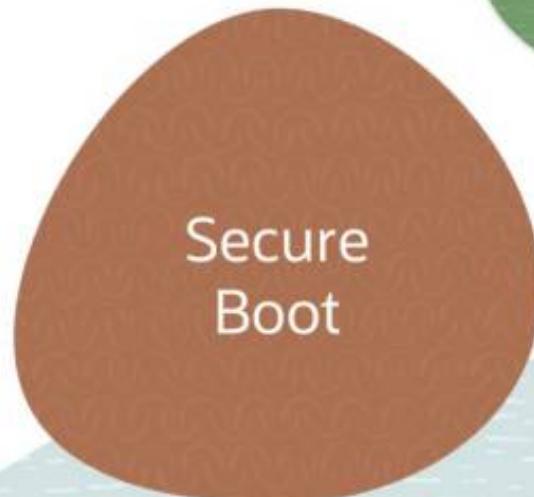
Trusted Platform Module

The Trusted Platform Module (TPM) is used to securely store boot measurements.

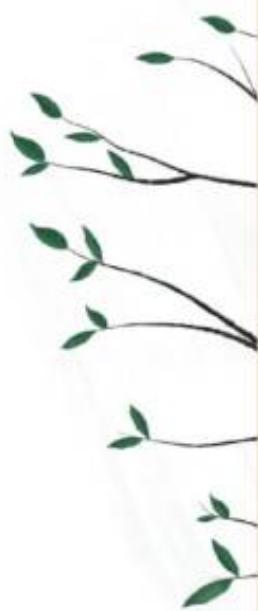
Shielded Instances



**Measured Boot is
not available on
Bare Metal instances.**



Shielded Instances



Secure Boot

- › Unified Extensible Firmware Interface feature
- › Ensures every component in the boot process has a valid signature

Measured Boot

- › Enhances boot security
- › Track boot measurements



Shielded Instances



Trusted Platform Modules (TPM)

- › Specialized security chip used by Measured Boot to store boot measurements
- › When you enable Measured Boot, TPM is automatically enabled (on VM instances).
- › Measurements taken by Measured Boot are stored in Platform Configuration Registers (PCRs) inside the TPM.

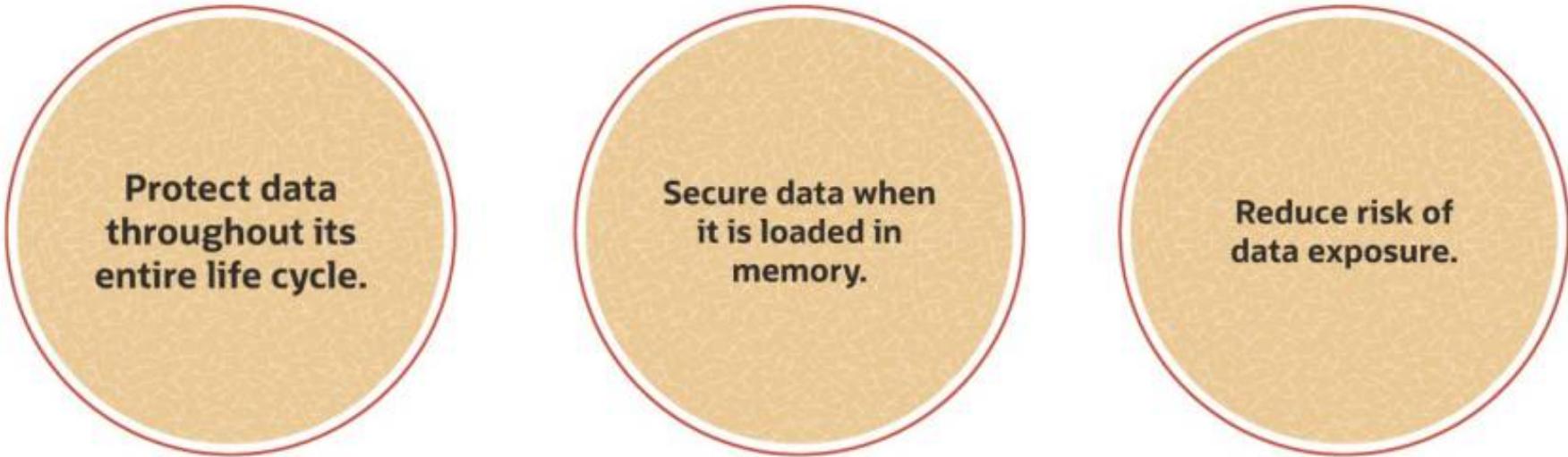
Oracle Cloud Infrastructure

Demo: Create a Shielded Instance

Oracle Cloud Infrastructure Confidential Computing

— **Compute**

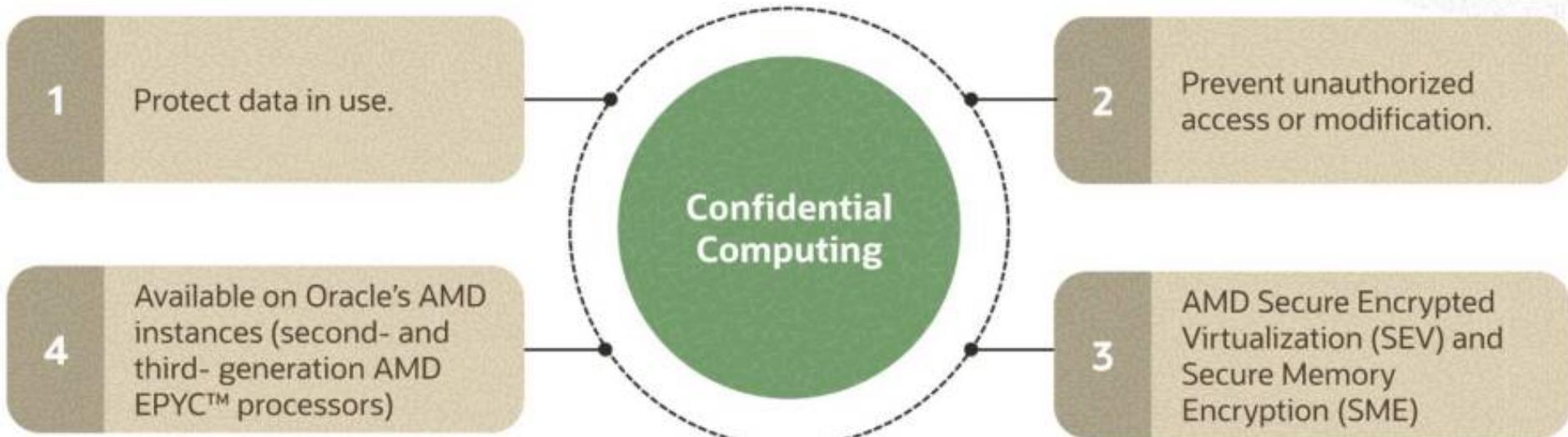
Why Confidential Computing?



- Protect data throughout its entire life cycle.

- Secure data when it is loaded in memory.

- Reduce risk of data exposure.



Supported Shapes

VM.Standard.E4.Flex (on Oracle Linux 7.x or 8.x platform images)

VM.Standard.E3.Flex (on Oracle Linux 7.x or 8.x platform images)

BM.DenseIO.E4.128 (on any platform image)

BM.Standard.E4.128 (on any platform image)

BM.Standard.E3.128 (on any platform image)

Benefits

Improves isolation

No change to application

Minimal performance impact

Object Storage - Basics

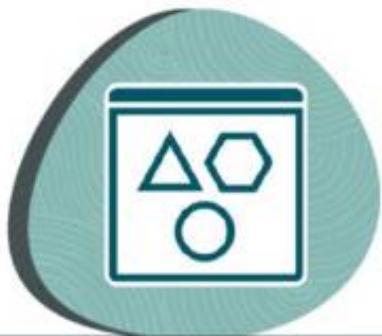
Oracle Cloud Infrastructure

Overview of Object Storage

Object Storage

Oracle Cloud Infrastructure Storage Services

	Local NVMe	Block Volume	File Storage	Object Storage	Archive Storage
Type	NVMe SSD-based temporary storage	NVMe SSD-based block storage	NFSv3 compatible file system	Highly durable Object storage	Long-term archival and backup
Durability	IP addresses, Non-persistent; survives reboots	Durable (multiple copies in an AD)	Durable (multiple copies in an AD)	Highly durable (multiple copies in a region)	Highly durable (multiple copies in a region)
Capacity	Terabytes+	Petabytes+	Fully Elastic	Unlimited	Unlimited
Unit Size	51.2 TB for BM, 6.4-25.6 TB for VM	50 GB - 32 TB/vol. 32 vols/instance	Up to 8 Exabyte	10 TiB/object	10 TiB/object
Use cases	Big Data, OLTP, high performance workloads	Apps that require SAN like features (Oracle DB, Exchange)	Apps that require shared file system (E-Business Suite, HPC)	Unstructured data incl. logs, images, videos	Long-term archival and backups (Oracle DB backups)



OCI Object Storage

- Highly Durable and Scalable
- Secure and Cost Efficient
- Highly reliable
- Internet scale and high performance storage platform
- Store unlimited amount of data
- Designed for unstructured data
- Regional Service
- Access data from anywhere
- Supports private access from OCI resources in a VCN
- Three Storage Tiers



OCI Object Storage Use Cases



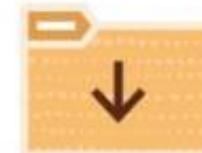
Content Repository



Unstructured and
semi-structured data



Big Data/Spark/
Hadoop/Data Analytics



Archive/Backup

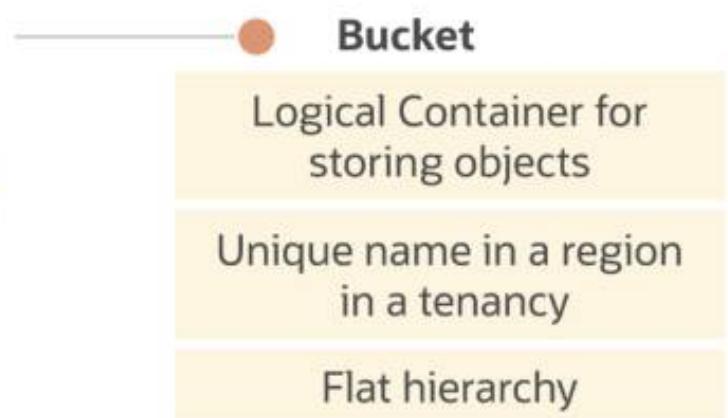
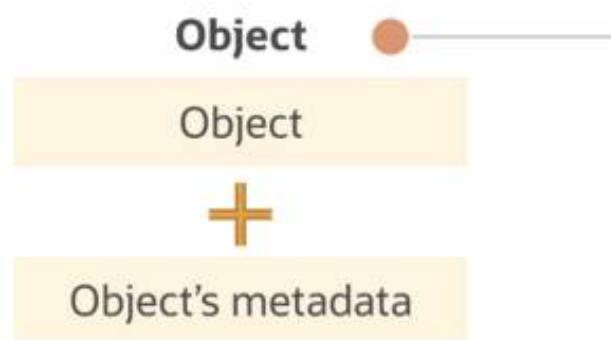
Oracle Cloud Infrastructure

Object Storage Resources

Object Storage



Object Storage Resources



Namespace

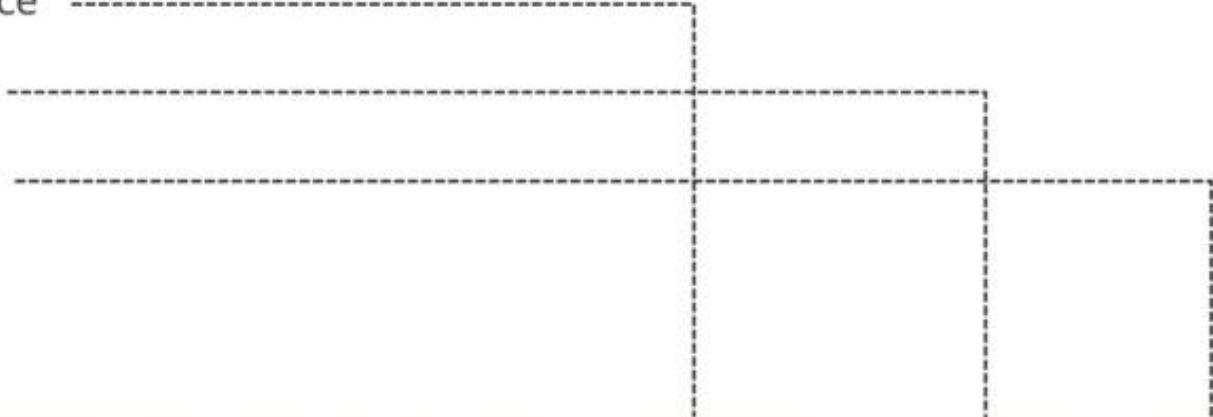
Top-level container for all buckets/objects

Namespace name is unique to a tenant

Object Storage Endpoint



- Namespace
- Bucket
- Object



<https://objectstorage.us-sanjose-1.oraclecloud.com/n/ociarchassociate/b/training/o/oci.jpg>

Prefixes

- Simulate a directory structure by adding a prefix string
- Includes one or more forward slashes (/) to an object name
- Example : training/oci/oci.jpg

The screenshot shows a web-based interface for managing objects in an OCI storage bucket. At the top, there are buttons for 'Upload' and 'More Actions', a toggle switch for 'Show Deleted Objects', and a search bar labeled 'Search by prefix'. Below this is a table with columns: 'Name/Version ID', 'Last Modified', 'Size', and 'Storage Tier'. The table lists two entries: a folder named 'training' and a file named 'oci.jpg'. The 'oci.jpg' entry is selected, as indicated by a checked checkbox in the first column. The table also includes a header row with column names.

	Name/Version ID	Last Modified	Size	Storage Tier
<input type="checkbox"/>	training	-	-	-
<input checked="" type="checkbox"/>	oci	-	-	-
	oci.jpg	Wed, Apr 20, 2022, 16:28:36 UTC	10.49 KiB	Standard

Oracle Cloud Infrastructure

Object Storage Characteristics

Object Storage

Object Storage Characteristics

- Strong Consistency - Serves most recent copy of the data
- Durability - Eleven 9s durability, Data Integrity
- Security - Encryption, Integrated with IAM service
- Unlimited Data Storage - Each object can be maximum 10 TiB

Oracle Cloud Infrastructure

Demo: Create a Bucket - Console, Cloudshell, OCI CLI

Oracle Cloud Infrastructure

Demo: Upload and Access the Object & Bucket Visibility

Oracle Cloud Infrastructure

Multipart Uploads

Object Storage

Multipart Uploads

- Upload data in parallel
- Faster and Efficient
- Retry upload of object parts and not the entire object
- Object Size > 100 MiB → Use Multipart Uploads
- Upper size limit of an object part → 50 GiB
- Flexibility to pause uploads and resume later



Multipart Uploads (Using Console)

Delete uncommitted or failed multipart uploads

Create Lifecycle Rule Help

Name
ociarchassdemorule

Target

Latest Version of Objects

Create a lifecycle rule that applies to the **latest** version of either:

- All objects in the bucket
- Objects that match the object name filters that you specify

Previous Versions of Objects

Create a lifecycle rule that applies to the **previous** versions of either:

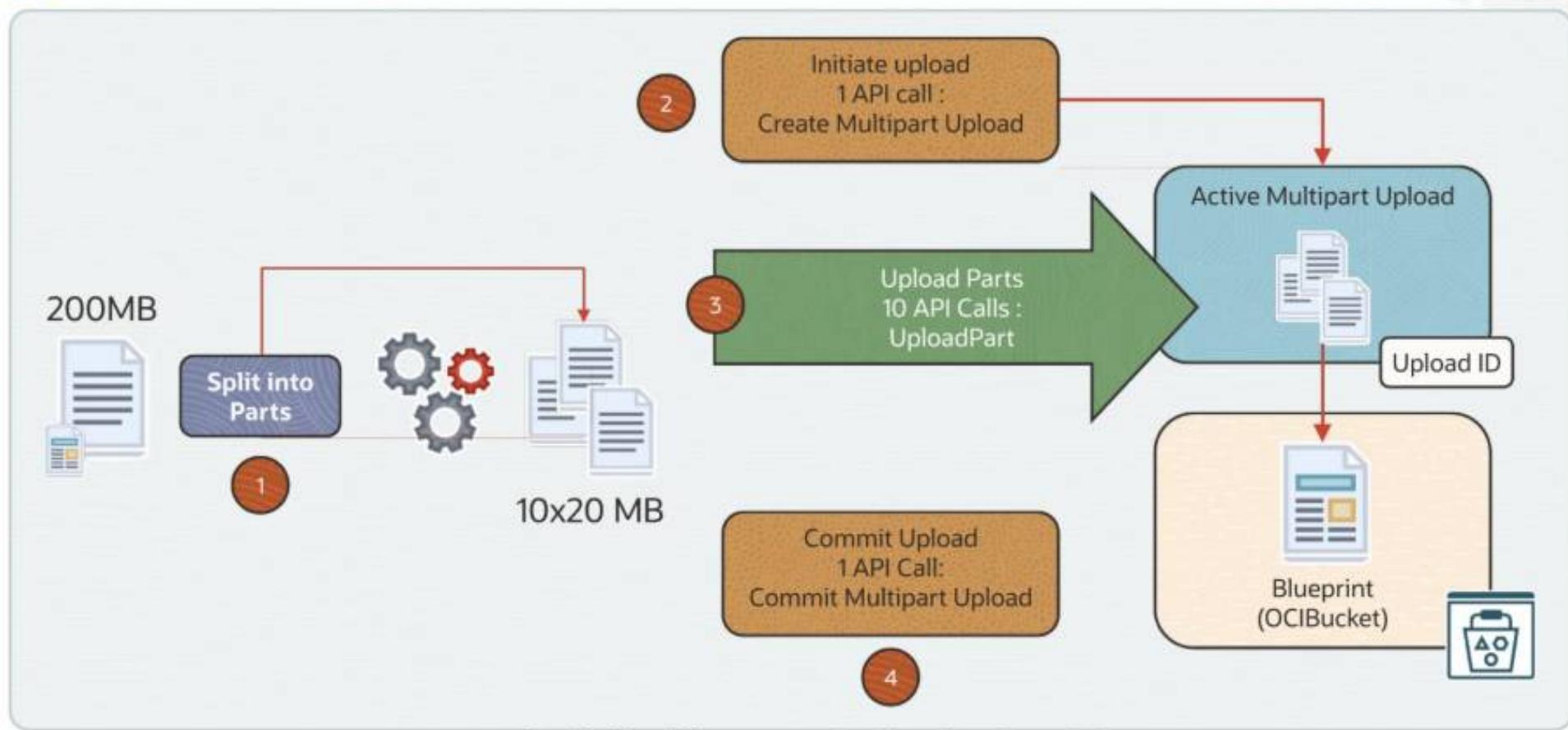
- All objects in the bucket
- Objects that match the object name filters that you specify

Uncommitted Multipart Uploads

Create a lifecycle rule that deletes uncommitted or failed multipart uploads.

✓

Multipart Uploads (Using Multipart Upload API)



Multipart Uploads (Using CLI)



- No need to split the objects into parts
- Specify the part size
- No need to commit after upload

```
oci os object put --bucket-name cloud --file
demovideo.mp4 --name demovideotwo.mp4 --
part-size 3 --parallel-upload-count 5
```

Oracle Cloud Infrastructure

Demo: Multipart Uploads

Oracle Cloud Infrastructure

Managing Buckets and Objects

—
Object Storage

Managing Buckets and Objects



- Bucket names and object names are case-sensitive
- Cannot nest buckets
- Can store objects that are upto 10 TiB
- Can't edit or append data to an object
- Enable object versioning to retain previous object versions
- Pre-authenticated requests

Managing Buckets and Objects



- Retention Rules
- Replication Policy
- Security Zones : Buckets must be private
- Object Copy
- Object Lifecycle Management

Oracle Cloud Infrastructure Object Storage Tiers

Object Storage

Object Storage Tiers

- Maximize access performance
- Minimize storage costs
- Two options during bucket creation:
 - Standard Storage tier bucket
 - Archive Storage tier bucket
- Can explicitly assign storage tier to the object

The image shows two screenshots of the Oracle Cloud Infrastructure (OCI) console. The top screenshot is titled 'Create Bucket' and shows a form for creating a new bucket. It includes fields for 'Bucket Name' (set to 'samvitbucket') and 'Default Storage Tier' (with 'Standard' selected, indicated by a red box). A note below states: 'The default storage tier for a bucket can only be specified during creation. Once set, you cannot change the storage tier in which a bucket resides.' A link 'about storage tiers' is provided. The bottom screenshot is titled 'Update Storage Tier' and shows a dropdown menu for changing the storage tier of an existing object. The 'Standard' option is currently selected. Other options in the dropdown are 'Infrequent Access' and 'Archive'. A 'Help' link is also present.

Object Storage Tiers

Standard Storage Tier (Hot)

- Default storage tier
- Quick, immediate and frequent access
- Higher storage costs compared to other tiers
- Content repository
- Data repository

Infrequent Access Storage Tier (Cool)

- Infrequently accessed data
- Must be immediately available
- Storage costs are lower than the Standard Storage Tier
- The minimum storage retention period is 31 Days
- Data retrieval fees
- Backup of on-premises data

Archive Storage Tier (Cold)

- Seldom or rarely accessed data
- Lowest storage costs
- The minimum storage retention period is 90 days
- Must be restored before they are available for access
- Restore time: 1 hour
- Compliance and audit mandates

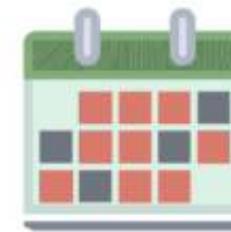
Oracle Cloud Infrastructure

Auto-Tiering

— Object Storage



Object Storage Tiers



Standard Storage Tier

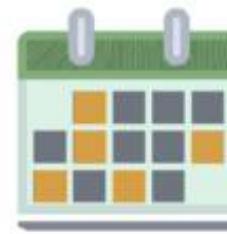
Fast, immediate, and frequent access

Instantaneous retrieval with no cost

No retention period



Object Storage Tiers



Infrequent Access Storage Tier

Ideal for data that you access infrequently

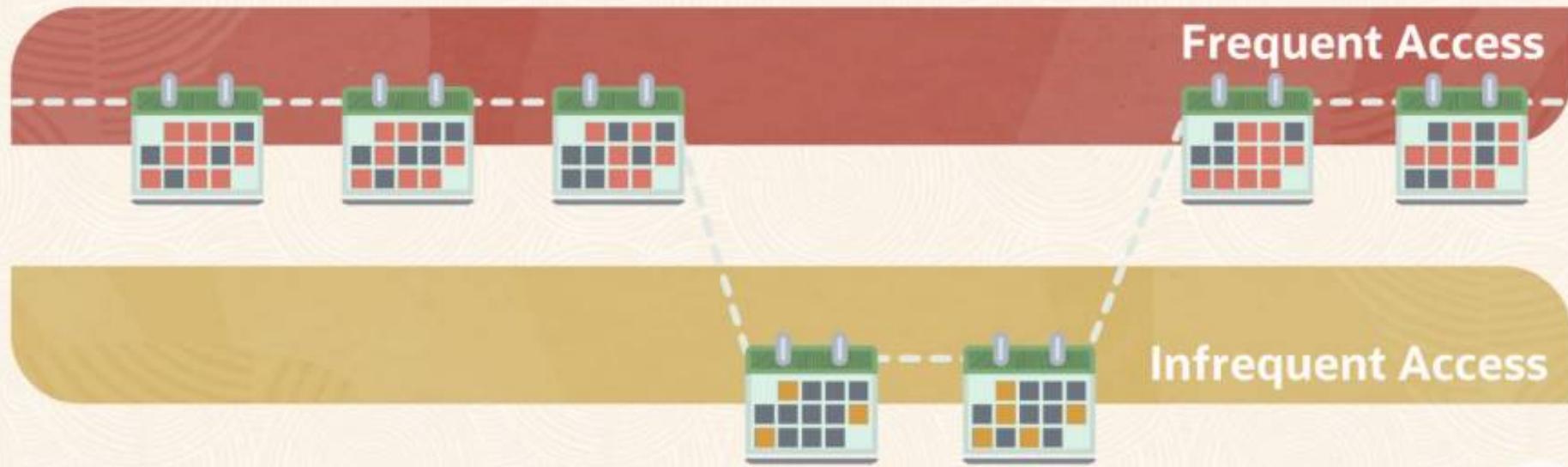
Storage costs lower than the Standard Storage Tier

Minimum storage retention period requirement for Infrequent Access: 31 days

Data Retrieval fees apply



Cool



OCI Object Storage Auto-tiering

Enabled at bucket level

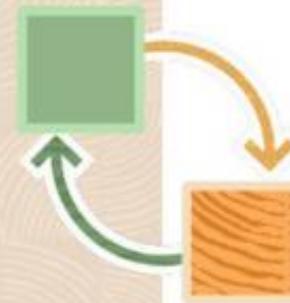
Tiering allows to maximize performance and minimize costs

Auto-tiering transitions objects based on access patterns

Objects are moved to the Standard tier without incurring any retrieval and storage fees are prorated

Auto-tiering possible scenarios

New application
data storage that
has no established
access patterns



Data storage that has
changing access
patterns

Oracle Cloud Infrastructure

Demo: Update Storage Tier (Manually, Auto-Tiering)

Oracle Cloud Infrastructure

Object Lifecycle Management

—
Object Storage

Lifecycle Policy Rules

Automated action based on defined rules

Reduce storage costs and save time

Supported Lifecycle action: Move to Infrequent Access, Move to Archive and Delete

Supported Resources: Objects, Object versions, Uncommitted or failed multipart uploads

Object name prefix and pattern matching condition



Lifecycle Policy Rules

Rule priority: Delete takes priority

Auto-Tiering enabled: Cannot create a rule to move to IFA

Single lifecycle policy consisting up to 1000 rules

Only Delete rules supported for Archive Storage bucket

What happens to the data uploaded to the bucket before policy creation?



Object Name Filters

Two types:

- Prefix matching
 - Exact matching of left-most characters of an object name
 - Does not support wildcard characters
 - Example: training/oci/ can be a prefix for training/oci/os.jpg

- Pattern matching
 - Matches on the entire object name
 - Supports wildcard characters
 - Example: *.jpg can match oci.jpg & training/oci/test.jpg



Object Name Filters – Rule Precedence



Pattern Exclusions



Pattern Inclusions



Prefix Inclusions

Object Name Filters (Optional)

Use object name filters to specify which objects the Lifecycle rule applies to. You can choose objects using prefixes and pattern matching. If no name filter is specified, the rule applies to all objects in the bucket. [Learn more about using object name filters](#)

You can add object filters in any order. Object Lifecycle Management takes care of the evaluation precedence.

Filter Type

Include by prefix

Include by prefix

Include by pattern

Exclude by pattern

Filter Value

documents/

Special characters are matched exactly when 'Include by prefix' is selected.

+ Add Another Filter

Lifecycle Policy Rules



Create Lifecycle Rule

Name

Target

Latest Version of Objects Create a lifecycle rule that applies to the latest version of either: <ul style="list-style-type: none">All objects in the bucketObjects that match the object name filters that you specify	Previous Versions of Objects Create a lifecycle rule that applies to the previous versions of either: <ul style="list-style-type: none">All objects in the bucketObjects that match the object name filters that you specify	Uncommitted Multipart Uploads Create a lifecycle rule that deletes uncommitted or failed multipart uploads.
--	--	---

Lifecycle Action

Number of Days

Object Name Filters (Optional)
Use object name filters to specify which objects the lifecycle rule applies to. You can choose objects using prefixes and pattern matching. If no name filter is specified, the rule applies to all objects in the bucket. [Learn more about using object name filters](#)
You can add object filters in any order. Object Lifecycle Management takes care of the evaluation precedence.



Transition Data



With Object Lifecycle Management you can transition the data to the lower-cost tier.

Move Standard -> Archive tier after 30 days

Automatically delete archived objects after 180 days



Oracle Cloud Infrastructure

Demo: Update Storage Tier (Lifecycle Management)

Expert Tip

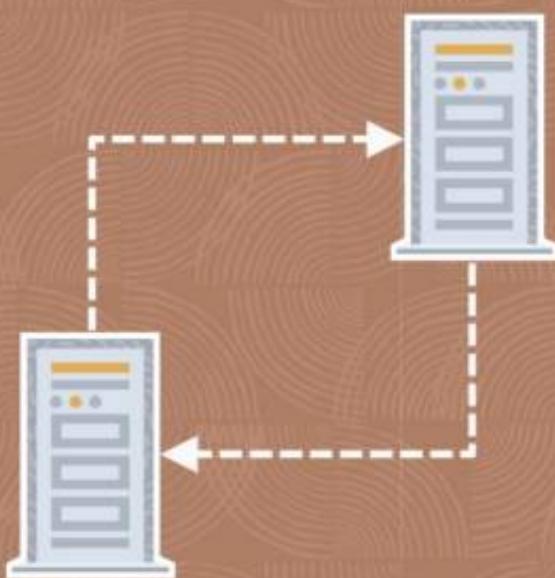
Object Storage - Advanced

Oracle Cloud Infrastructure

Object Storage Replication

—
Object Storage

Object Storage Replication



Replicate objects in one bucket to another in same or different region

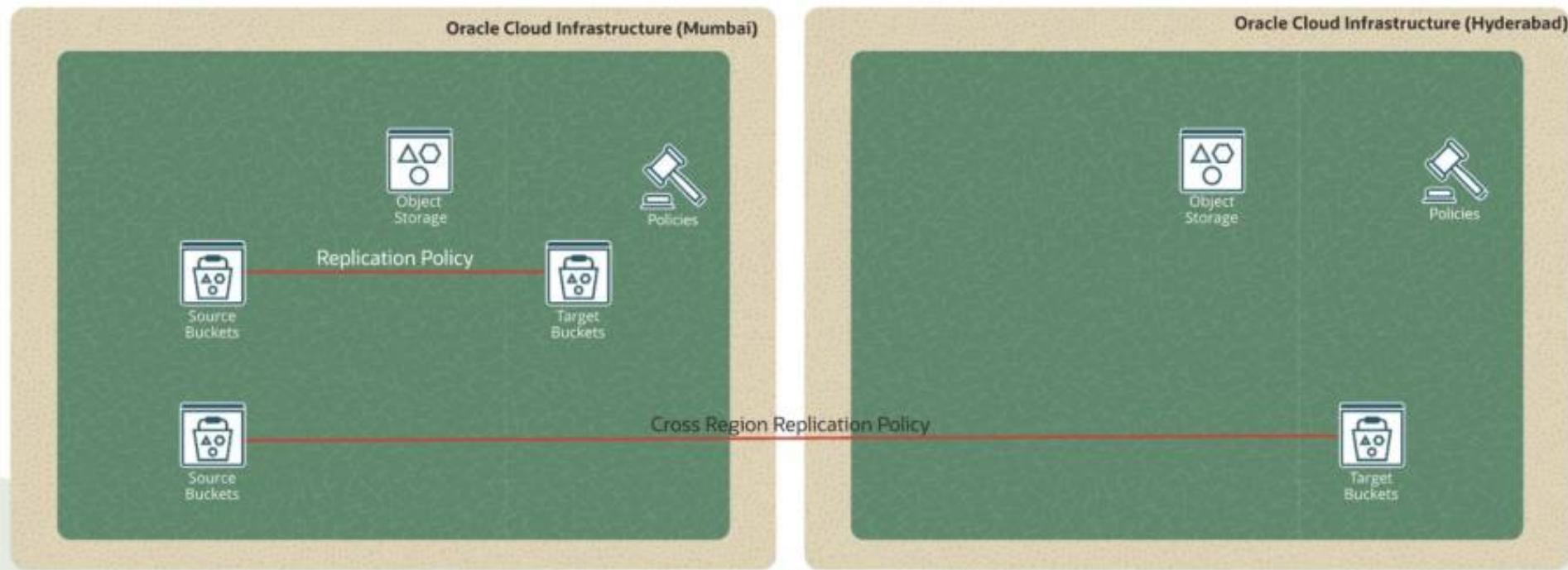
Destination bucket becomes read-only after creation of policy

Asynchronous replication

Objects uploaded to a source bucket before policy creation are not replicated

Objects deleted from source bucket is automatically deleted from the destination bucket

Object Storage Replication



Benefits



Aids in DR efforts

Data Redundancy Compliance

Protection from regional outages

Maintain objects closer to end users

Replication Policy

Create Replication Policy

[Help](#)

Name

Destination Region



Destination Bucket in Pro-Demo [\(Change Compartment\)](#)



Replication overwrites any object in the destination bucket that has the same name as an object in the source bucket. Objects uploaded to a source bucket before policy creation are not replicated.

Limitations



Destination bucket needs to be manually created before creating replication policy

A source or destination bucket can be in the Standard (Object Storage) or Archive Storage tier

Maximum of one source for each replication destination bucket

Chained replication not supported

After policy creation, destination bucket is read-only. You can only update its objects in the source bucket

Cannot delete a replication destination bucket unless replication is stopped

Demo: Replication Policy

Oracle Cloud Infrastructure Object Versioning

Object Storage



Enabled at bucket level

Can be enabled/suspended at any time

Provides data protection against accidental updates & deletes

Charged for latest object versions and previous versions

Object Versioning Status

Disabled

- Object is overwritten
(Upload an object with same name)
- Deletion is permanent(not recoverable)

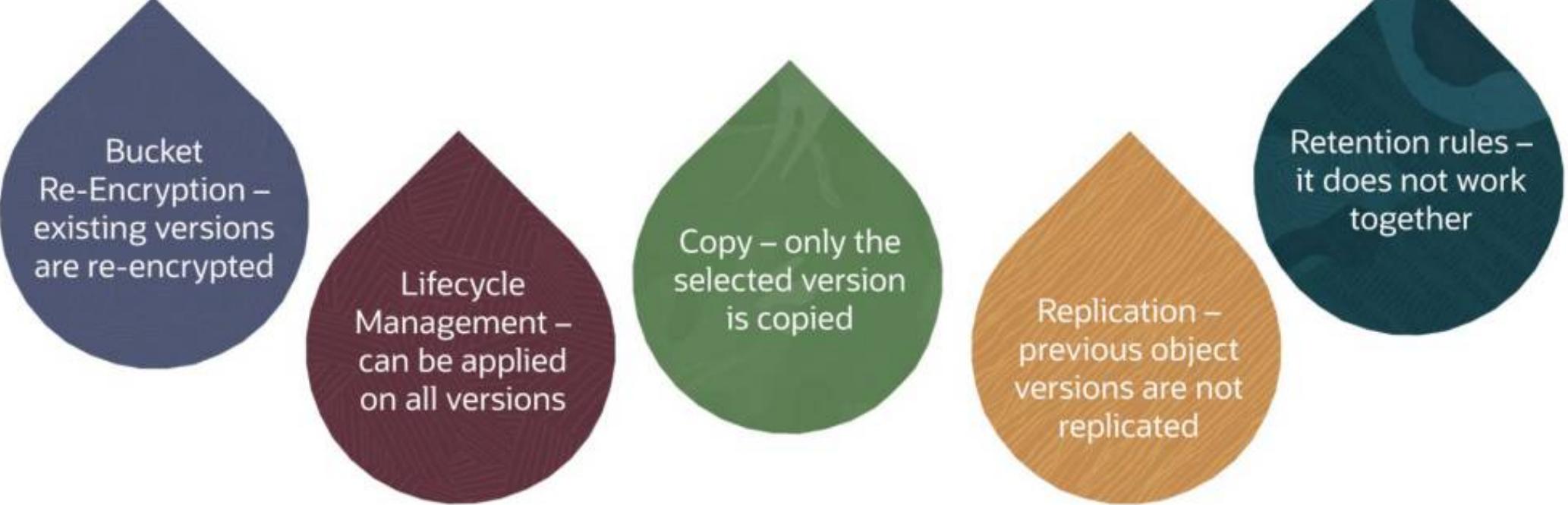
Enabled

- Existing object becomes a previous version
- Newly uploaded object becomes the latest version
- A version of deleted object is retained

Suspended

- Upload and delete behavior is the same as Disabled
- Versions created before suspension are retained
- Re-enable versioning at any time

Versioning integration with other features



Bucket Re-Encryption – existing versions are re-encrypted

Lifecycle Management – can be applied on all versions

Copy – only the selected version is copied

Replication – previous object versions are not replicated

Retention rules – it does not work together

Oracle Cloud Infrastructure

Demo: Object Versioning

Oracle Cloud Infrastructure

Demo: Replication Policy with Versioning

Oracle Cloud Infrastructure Retention Rules

Object Storage



Data Retention



Retention Rule Types



Time-Bound



Indefinite



Retention Rule Lock

Irreversible operation

Tenancy administrator
cannot delete a locked rule

Mandatory 14-day delay before a
rule is locked

Rule can only be deleted by
deleting the bucket

Create Retention Rule

Time-Bound Object modification is prevented for the retention duration you specify

Indefinite Object modification is prevented until you delete the retention rule.

Retention Duration

The retention duration that you specify is applied to each object individually, and is based on the object's Last Modified timestamp.

Retention Time Amount: 1

Retention Time Unit: Days

Enable Retention Rule Lock ⓘ

ⓘ When a rule is locked, only an increase in the retention duration is allowed and the rule can only be deleted by deleting the bucket. A bucket must be empty to be deleted.

Scheduled Lock Time: May 5, 2022 06:39 UTC

Retention Duration for Time Bound Rules

Retention rules are created for a bucket

Duration of a rule is applied to each object in the bucket individually, based on the object's Last Modified timestamp.

Bucket: oci

Two Objects : ocitest (last modified 14 months ago)

ocidemo (last modified 3 months ago)

Retention Rule → Duration : 1 year

Prevents modification or deletion of ocidemo for the next 9 months

Allows modification or deletion of ocitest



Use Cases



Regulatory Compliance



Data Governance



Legal Hold

Retention rules integration with other features

Bucket Re-Encryption –
not affected

Lifecycle Management –
can update the storage tier of objects

Replication – Can only create retention
rules on a replication source bucket

Versioning – only works on with
disabled/suspended status

Oracle Cloud Infrastructure

Demo: Retention Rules - Time Bound and Indefinite

Oracle Cloud Infrastructure

Object Copy

Object Storage

Object Copy

Copy objects to other buckets in the same or different regions

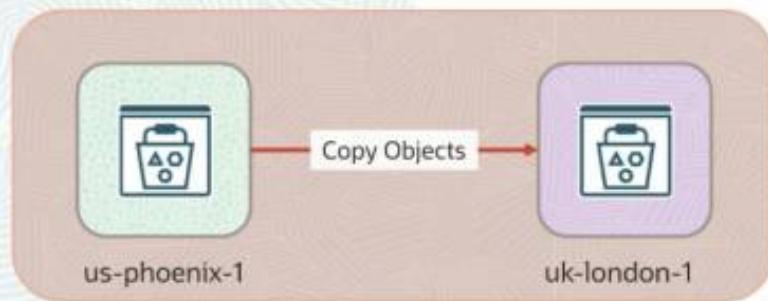
Asynchronous Operation

Cannot be directly copied from Archive storage

Does not automatically create buckets

Copy Object Overwrite Rules:

- Overwrite destination object
- Do not overwrite any destination object
- Overwrite destination object only if it matches the specified ETag
- Copy object only if the source matches the specified ETag



Object Copy



Copy Object

Destination Namespace [?](#)

ociarchassociate

Destination Region

India West (Mumbai)

Destination Bucket

demobuket

Destination bucket must already exist

Destination Object Name (Optional)

training/oci/oci.jpg

Destination Storage Tier (Optional)

Standard

Overwrite Rule

ETag matching rules allow you to control the copying or overwriting of objects based on their ETag values.

[Learn more about ETag matching in cross-region copy](#)

- Overwrite destination object
- Do not overwrite any destination object
- Overwrite destination object only if it matches the specified ETag
- Copy object only if the source matches the specified ETag

[?](#) Policy statements for copying across tenancies

Make sure you that have the correct policy statements added in both the **source** and the **destination** tenancies. If you do not have the permissions to add the policies, ask your administrator to add them. [Learn more](#)

[Copy Object](#)

[Cancel](#)



Oracle Cloud Infrastructure

Demo: Object Copy

Oracle Cloud Infrastructure

Object Storage Logging

Object Storage



Logging

Send read access and write access events to OCI Logging service

Open source Fluentd format

Integrates with OCI Logging analytics

Enabled per bucket

Enabling Logging

Resources

Logs

Category	Status	Log Name	Log Group	Enable Log
read	Active	OSLoggingDemo_read	OSLoggingDemo	<input checked="" type="checkbox"/> Enabled
write	Active	OSLoggingDemo_write	OSLoggingDemo	<input checked="" type="checkbox"/> Enabled

Showing 2 Items

Logs

Oracle Cloud Infrastructure

Demo: Object Storage Logging

Oracle Cloud Infrastructure
Securing Object Storage
—
Object Storage

Initial Security Tasks

- Use IAM Policies to grant access to users and resources
- Restrict access to requests that originate from an allowed IP Address using network source
- Prevent Deletion of Buckets and Objects
- Encrypt resources using a custom key
- Secure Network access to resources
- Create a Security Zone



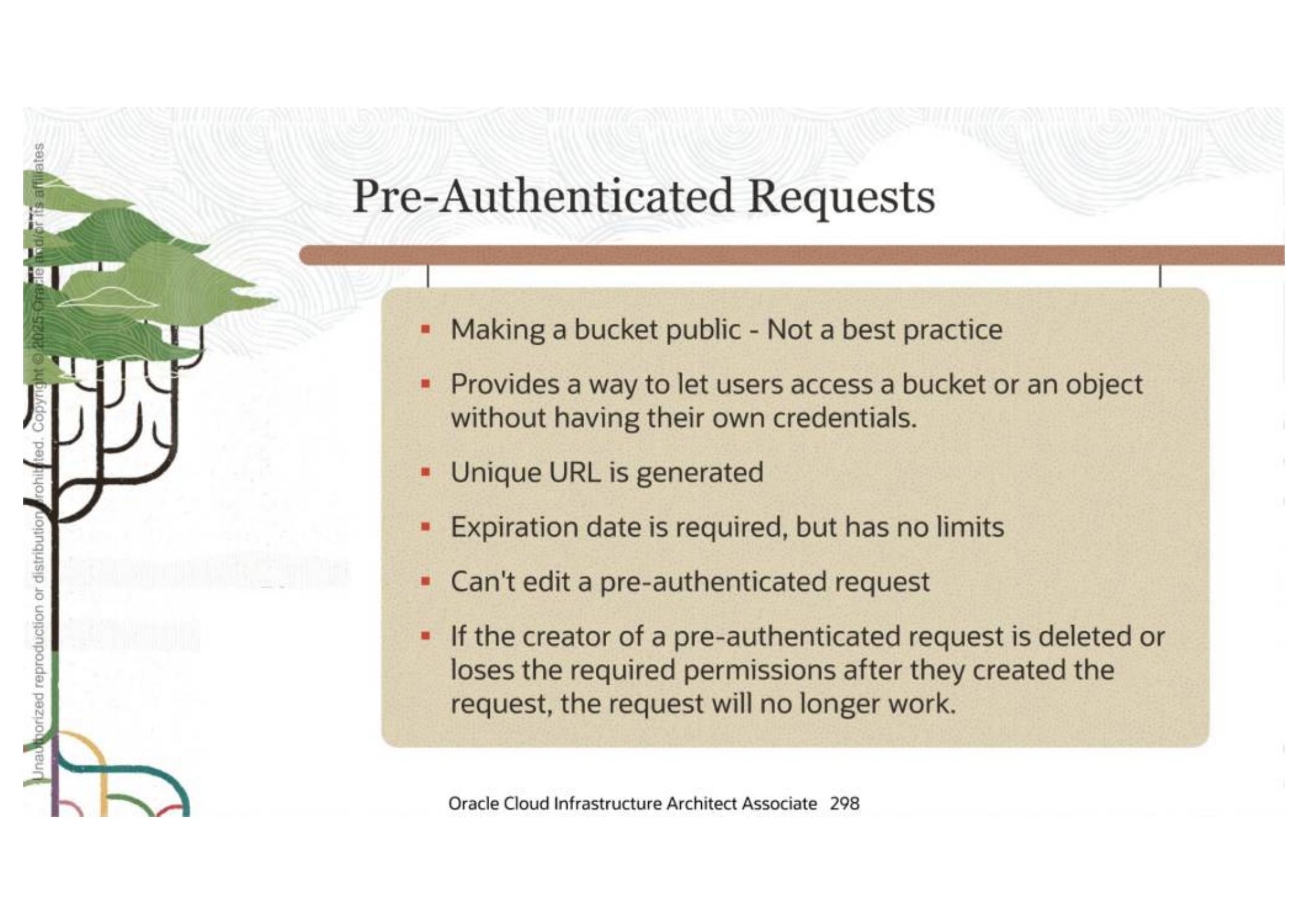
Routine Security Tasks

- Rotate encryption keys
- Perform a security audit
- Use object versioning to minimize data loss due to malicious deletes
- Provide BUCKET_DELETE & OBJECT_DELETE permission to a minimum set of IAM Users/Groups
- Ensure the integrity of data when it is moved or copied to different locations
- Configure Retention rules

Oracle Cloud Infrastructure

Pre-Authenticated Requests

—
Object Storage



Pre-Authenticated Requests

- Making a bucket public - Not a best practice
- Provides a way to let users access a bucket or an object without having their own credentials.
- Unique URL is generated
- Expiration date is required, but has no limits
- Can't edit a pre-authenticated request
- If the creator of a pre-authenticated request is deleted or loses the required permissions after they created the request, the request will no longer work.

Pre-Authenticated Requests



Create Pre-Authenticated Request

[Help](#)

Name

par-ociarchassociatedemo

Pre-Authenticated Request Target

Bucket

Create a pre-authenticated request that applies to all objects in the bucket.

Object

Create a pre-authenticated request that applies to a specific object.

Objects with prefix

Create a pre-authenticated request that applies to all objects with a specific prefix.

Object Name

oci.jpg

Access Type

- Permit object reads
- Permit object writes
- Permit object reads and writes

Expiration

Apr 28, 2022 07:20 UTC

[Create Pre-Authenticated Request](#)[Cancel](#)

Oracle Cloud Infrastructure

Demo: Create a Pre-authenticated request

Oracle Cloud Infrastructure

Demo: Create a Bucket with Customer Managed Key

Oracle Cloud Infrastructure

Demo: Re-encrypt an Object

Oracle Cloud Infrastructure

Demo: Create automation based on object state changes

Block Storage - Basics

Oracle Cloud Infrastructure

Overview of Block Volume

Block Storage

OCI Storage

	Local NVMe	Block Volume	File Storage	Object Storage	Archive Storage
Type	NVMe SSD-based temporary storage	NVMe SSD-based block storage	NFSv3 compatible file system	Highly durable Object storage	Long-term archival and backup
Durability	IP addresses, Non-persistent; survives reboots	Durable (multiple copies in an AD)	Durable (multiple copies in an AD)	Highly durable (multiple copies in a region)	Highly durable (multiple copies in a region)
Capacity	Terabytes+	Petabytes+	Fully Elastic	Unlimited	Unlimited
Unit Size	51.2 TB for BM, 6.4-25.6 TB for VM	50 GB - 32 TB/vol. 32 vols/instance	Up to 8 Exabyte	10 TB/object	10 TB/object
Use cases	Big Data, OLTP, high performance workloads	Apps that require SAN like features (Oracle DB, Exchange)	Apps that require shared file system (E-Business Suite, HPC)	Unstructured data incl. logs, images, videos	Long-term archival and backups (Oracle DB backups)



Block Volume Features and Use Cases

Provides durable and high performance storage

Store data beyond the lifespan of the compute instance

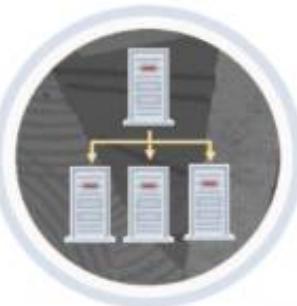
Create, attach, connect, and move volumes as needed

Typical scenarios:
Persistent storage
Expand a compute instance's storage
Instance scaling

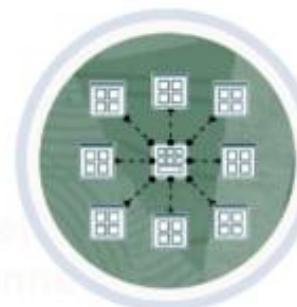
Block Volume Features



Elastic Capacity
(50 GB to 32 TB)



Stored redundantly across
multiple storage servers with
built-in repair mechanisms



Up to 32 volumes
per instance



By default, encrypted at
rest; option to enable
in-transit encryption for
PV volume attachments



Local NVMe SSD Devices



Some compute instance shapes (such as BM.DenseIO2.52) include locally attached NVMe devices

Extremely low latency

High performance

Ideal for Big Data, OLTP

Customer's responsibility to protect and manage the durability of data

```
[opc@nvme ~]$ lsblk
NAME   MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
nvme0n1 259:0   0  5.8T  0 disk
nvme1n1 259:3   0  5.8T  0 disk
nvme2n1 259:1   0  5.8T  0 disk
nvme3n1 259:2   0  5.8T  0 disk
nvme4n1 259:5   0  5.8T  0 disk
nvme5n1 259:6   0  5.8T  0 disk
nvme6n1 259:4   0  5.8T  0 disk
nvme7n1 259:7   0  5.8T  0 disk
sda     8:0      0 46.6G  0 disk
└─sda2   8:2      0    8G  0 part [SWAP]
└─sda3   8:3      0 38.4G  0 part /
└─sda1   8:1      0  200M  0 part /boot/efi
```

Oracle Cloud Infrastructure

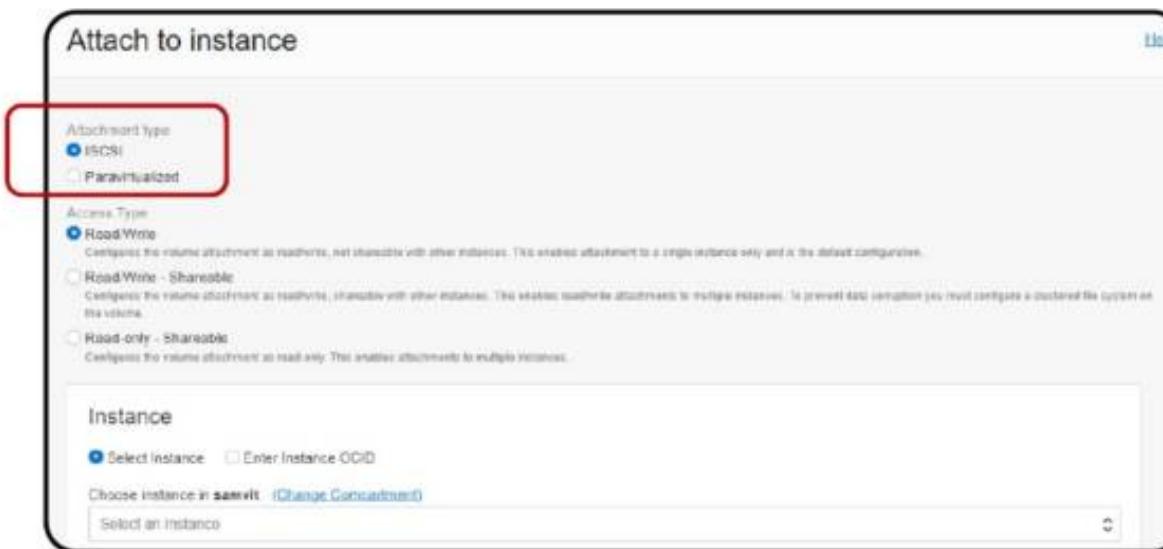
Volume Attachment Types

— **Block Storage**

Volume Attachment Types

Ways to attach block volume to an instance:

- iSCSI
- Paravirtualized



iSCSI Versus Paravirtualized



iSCSI:

- Uses the internal storage stack in the guest OS and network hardware virtualization
- Does not use hypervisor in the attachment process

Paravirtualized:

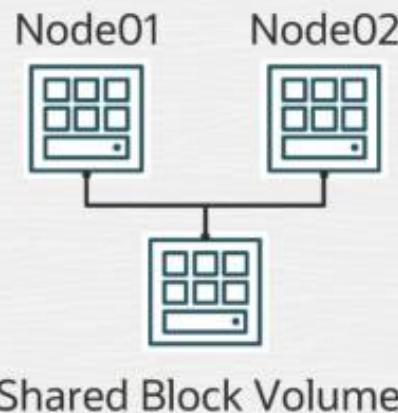
- Light virtualization technique
- Hypervisor APIs used by VM to access remote storage
- More efficient than full virtualization



Oracle Cloud Infrastructure

Volume Access Types

Block Storage



Access Type

Allows multiple instances to connect to the same volume

Read/Write access type

Read/Write Shareable and
Read-only Shareable access types

Configure a clustered file system
to prevent data corruption.

A shared volume can
connect up to eight instances.

Read/Write – Shareable

Access Type

Read/Write

Configures the volume attachment as read/write, not shareable with other instances. This enables attachment to a single instance only and is the default configuration.

Read/Write - Shareable

Configures the volume attachment as read/write, shareable with other instances. This enables read/write attachments to multiple instances. To prevent data corruption you must configure a clustered file system on the volume.

Read-only - Shareable

Configures the volume attachment as read-only. This enables attachments to multiple instances.



To prevent data corruption resulting from uncontrolled read/write operations with shared volume attachments, you must install and configure a clustered file system before you use the volume. The Block Volume service does not provide coordination for concurrent write operations to a shared volume.

See [Configuring Multiple Attachments for Read/Write Access](#) for more information.



I understand that data might become corrupted if the volume is used before a clustered file system is installed and configured.

Oracle Cloud Infrastructure Boot Volumes

Block Storage

Boot Volumes



- **Boot volumes:**
 - Provide remote boot disks
 - Are encrypted by default
 - Enable faster performance and lower launch times
- Create a manual backup, assign a backup policy, or create a clone of boot volumes.
- Change the volume performance to Balanced or Higher performance.

Custom Boot Volumes

You have the option of specifying a custom boot volume size.

Boot volume

A [boot volume](#) is a detachable device that contains the image used to boot the compute instance.

Specify a custom boot volume size

Volume performance varies with volume size. Default boot volume size: 46.6 GB. When you specify a custom boot volume size, service limits apply.

Boot volume size (GB)

200

Integer between 50 GB and 32,768 GB (32 TB). Must be larger than the default boot volume size for the selected image.

Boot volume

A [boot volume](#) is a detachable device that contains the image used to boot the compute instance.

Specify a custom boot volume size

Volume performance varies with volume size. Default boot volume size: 47.0 GB. When you specify a custom boot volume size, service limits apply.

Boot volume size (GB)

200

Integer between 50 GB and 32,768 GB (32 TB). Must be larger than the default boot volume size for the selected image.

For Linux, the default boot volume size is 46.6 GB.

For Windows, the default boot volume size is 47 GB.

Troubleshooting

Attach a boot volume to an instance as a block volume for troubleshooting.

Detach a boot volume from its associated compute instance to attach it to a different instance.

Oracle Cloud Infrastructure

Demo: Block Volume Creation

Oracle Cloud Infrastructure

Demo: Attach Block Volume to Instance - iSCSI attachment

Oracle Cloud Infrastructure

Demo: Attach Block Volume to Instance - Paravirtualized attachment

Oracle Cloud Infrastructure

Demo: Configure Multiple Instance Volume Attachments - Part 1

Oracle Cloud Infrastructure

Demo: Configure Multiple Instance Volume Attachments - Part 2

Oracle Cloud Infrastructure Block Volume Performance

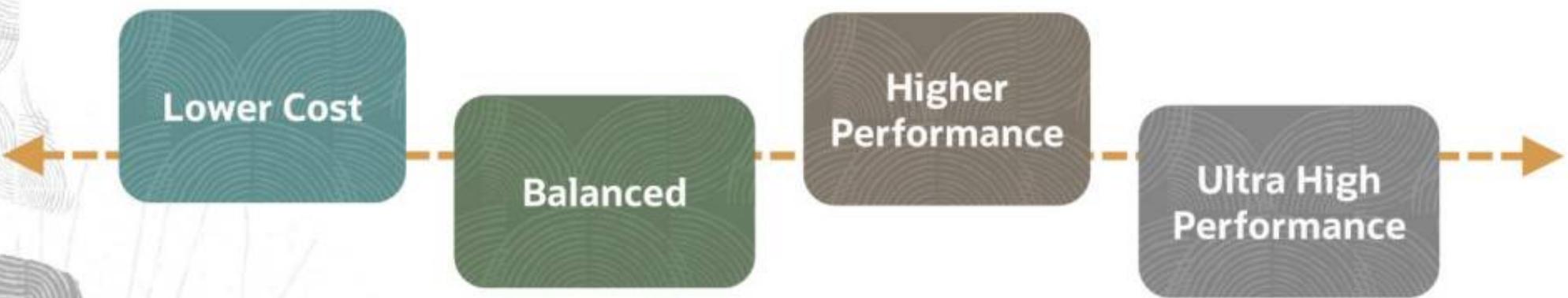
Block Storage

Block Volume Performance

- NVMe-based storage infrastructure
- Flexible and elastic performance
- Configured for “Balanced” performance level, by default
- Configure using slider or VPU control



Performance Levels



Performance Levels: Lower Cost

- Throughput intensive workloads with large sequential I/O
- 2 IOPS/GB, 3000 Max IOPS per Volume
- 240 KBPS/GB, 480 Max MBPS per Volume
- Only storage cost
- No additional VPU cost
- Available only for block volumes (not boot volumes)
- Streaming, log processing

Performance Levels: Balanced

- Default Performance Level
- 60 IOPS/GB, 25000 Max IOPS per volume
- 480 KBPS/GB, 480 Max MBPS per volume
- 10 VPUs per GB/month
- Provides good balance between performance and cost savings
- Available for both block and boot volumes

Performance Levels: Higher Performance

- Recommended for workloads with high I/O requirements
- 75 IOPS/GB, 50000 Max IOPS per volume
- 600 KBPS/GB, 680 Max MBPS per volume
- 20 VPUs per GB/month
- Available for both block and boot volumes

Performance Levels: Ultra High Performance

- Recommended for most demanding, I/O intensive workloads
- (90-225) IOPS/GB, 300,000 Max IOPS per volume
- (720-1800) KBPS/GB, 2680 Max MBPS per volume
- 30-120 VPUs per GB/month
- Available only for block volumes

Oracle Cloud Infrastructure

Dynamic Performance Scaling

—
Block Storage

Dynamic Performance Scaling with Autotuning

Two Types:

Performance Based Autotuning

Detached Volume Autotuning

Service adjusts the performance level automatically to optimize performance.



Performance Based Autotuning

Specify:

- Default performance setting (VPUs/GB)
- Maximum performance level (VPUs/GB)

Performance Metrics

- Volume throttled operations
- Volume guaranteed VPUs/GB
- Volume guaranteed IOPS
- Volume guaranteed throughput

Detached Volume Autotuning

- Adjust the volume's performance level to the optimal level based on the attached state of the volume.
- **Volume Detached**
 - Performance level adjusted to Lower Cost
- **Volume Attached**
 - Performance level adjusted to default VPUs/GB
 - Performance Based Autotuning (Enabled) → Further dynamically scale performance

Block Storage - Advanced

Oracle Cloud Infrastructure

Resizing a Volume

Block Storage

Expand volume size without detaching the volume from an instance.

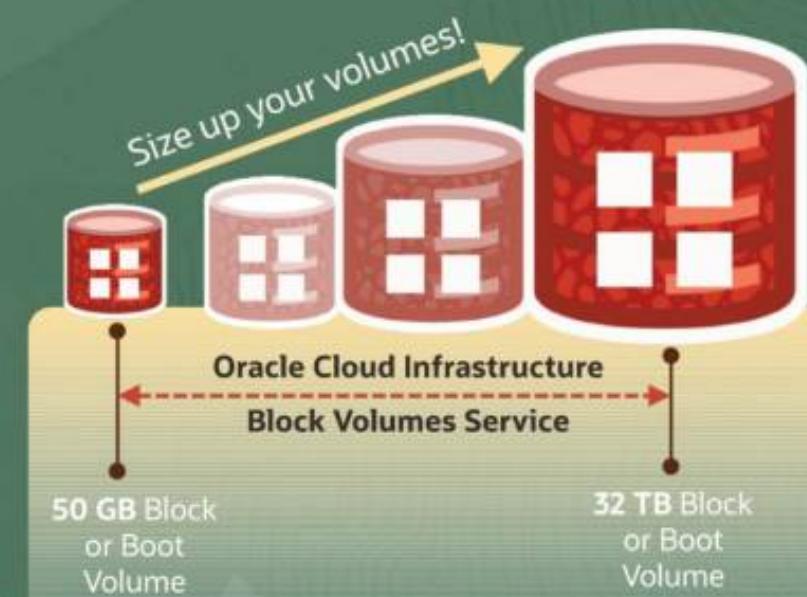
You can only increase the size of the volume; can't decrease.

After resizing, the first backup on the resized volume is a full backup.

Avoid impact on your application/workloads.

Disable cross-region replication before resizing the volume.

Block and Boot Volumes Online Resize



Edit volume

Name

ociarchassdemobv

Volume Size and Performance

Volume Size (in GB)

1024

Size must be an integer between the current size (1,024 GB) and 32,768 GB (32 TB). Volume performance varies with volume size.

ⓘ After the volume is provisioned, for the volume resize to take effect, you need to extend the partition. [Learn More](#)

Target Volume Performance

VPU ⓘ

Balanced

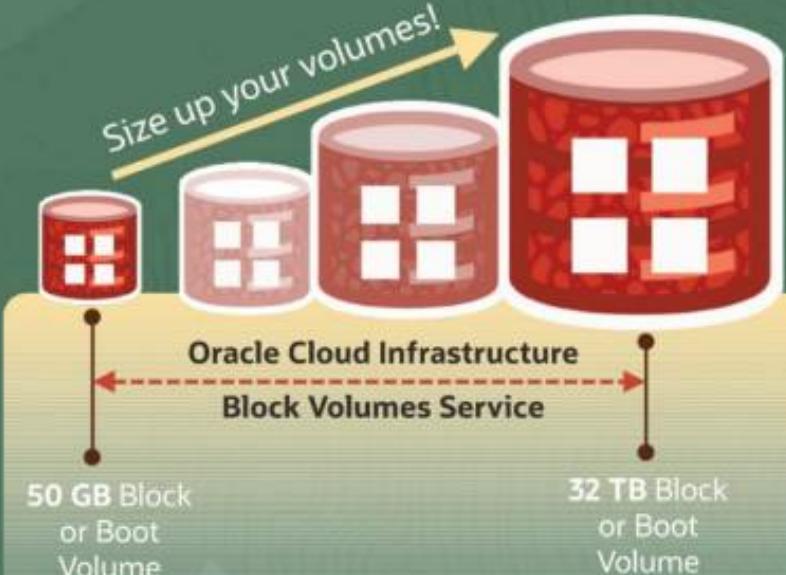
10

0

120

Resizing

Size up your volumes!



Three offline options to increase size

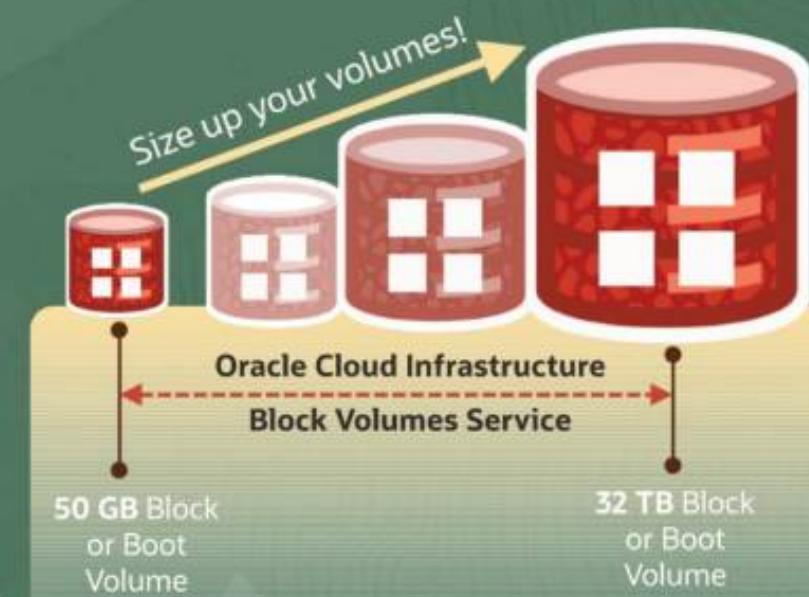
Expand an existing detached volume.

Restore from a volume backup to a larger volume.

Clone an existing volume to a new, larger volume.

You can only increase the size of the volume. **You cannot decrease the size.**

Block and Boot Volumes Offline Resize



Oracle Cloud Infrastructure

Demo: Volume Resize and Extend Partition

Oracle Cloud Infrastructure

Block Volume Backups

Block Storage



Backup and Restoration

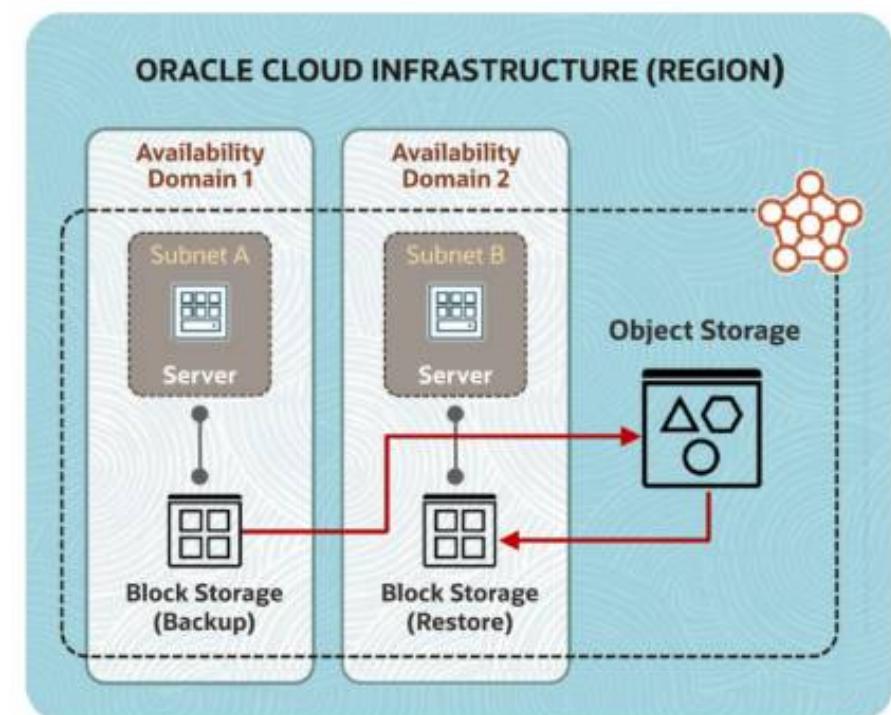


Point-in-time snapshot of a block volume

Encrypted and stored in OCI Object Storage

Can be restored as new volumes to any Availability Domain in the same region

Source volume's tags are automatically included with the backup.



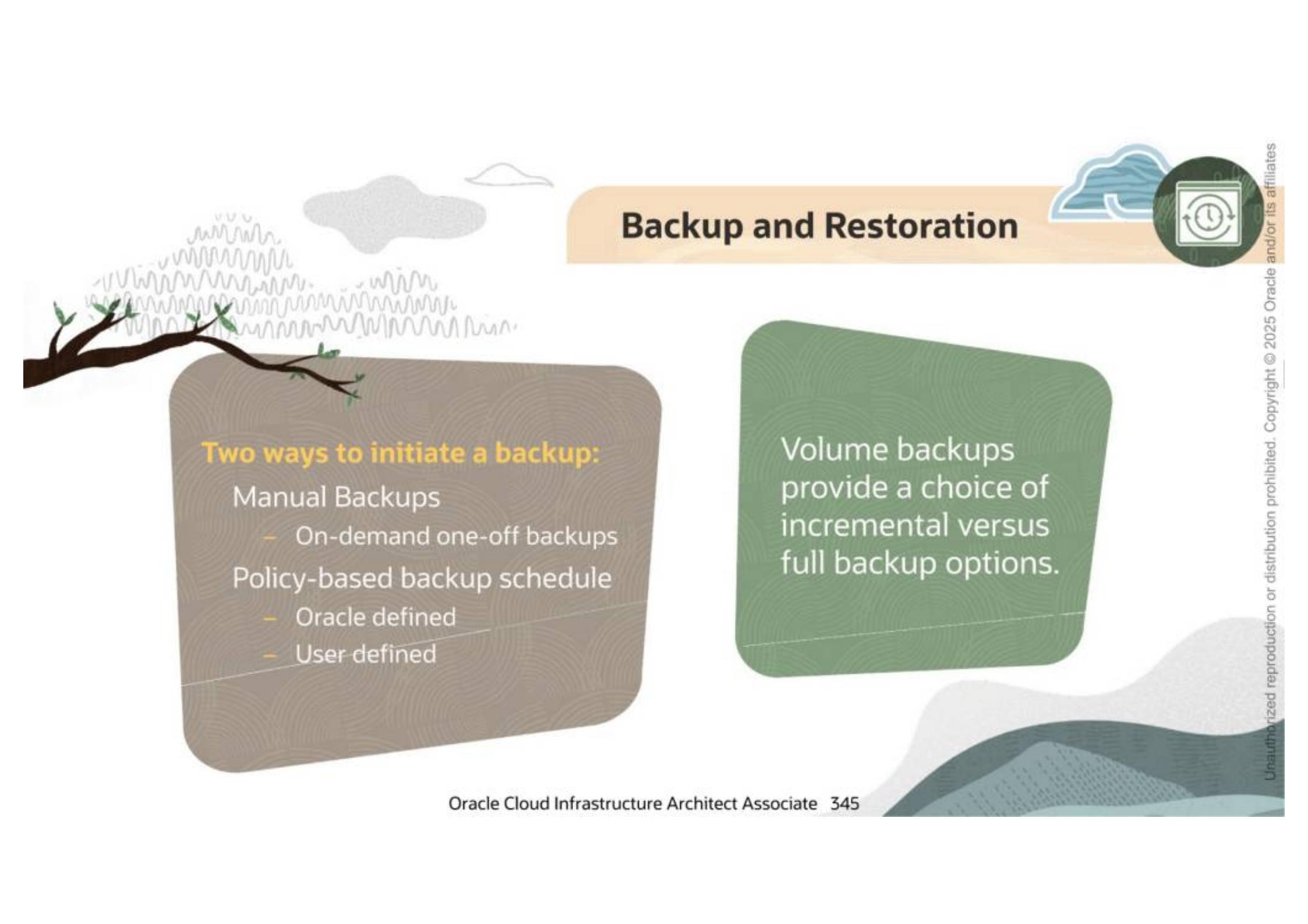


Backup and Restoration

You can copy block volume backups to other regions → Disaster Recovery and business continuity.

After a volume has been resized, the first backup will be a full backup.

You can take a backup of a volume when it is attached to or detached from an instance.



Backup and Restoration



Two ways to initiate a backup:

Manual Backups

- On-demand one-off backups

Policy-based backup schedule

- Oracle defined
- User defined

Volume backups provide a choice of incremental versus full backup options.

Backup and Restoration

Automated policy-based capability

Bronze

Silver (+ Bronze)

Gold (+Silver + Bronze)

Backup options

Customized, user-defined backup policy

Schedules, full or incremental, retention time

Oracle Cloud Infrastructure

Demo: Create a Block Volume Backup

Oracle Cloud Infrastructure

Demo: Create a Backup Policy and define schedule

Oracle Cloud Infrastructure

Demo: Restore a Block Volume Backup

Oracle Cloud Infrastructure

Demo: Copy Block Volume Backup to another region

Oracle Cloud Infrastructure

Block Volume Clones

Block Storage

Block Volume Clones

- ▶ Make a copy of an existing block or boot volume
- ▶ Point-in-time direct disk-to-disk copy of the source volume
- ▶ All data (in the source volume during clone creation) copied to the clone
- ▶ Subsequent changes to the data not copied
- ▶ Occurs immediately
- ▶ Attach and use the cloned volume as a regular volume

Block Volume Clones

Can be created only in the same Availability Domain (AD)

▶ Number of clones created simultaneously:

- **If the source volume is attached:**
You can create one clone at a time.
- **If the source volume is detached:**
You can create up to 10 clones from the same source volume simultaneously.

Oracle Cloud Infrastructure

Demo: Create a Block Volume Clone

Oracle Cloud Infrastructure

Block Volume Backup Versus Clone Operation

Block Storage

Backup Versus Clone



	Volume Backup	Volume Clone
Description	Point-in-time backup of data	Single point-in-time copy of a volume
Speed	Slower (minutes or hours)	Faster (seconds)
Cost	Lower cost	Higher cost
Storage Location	Object Storage	Block volume
Retention Policy	Manual backups don't expire. Policy-based backups do expire.	No expiration

Backup Versus Clone

	Volume Backup	Volume Clone
Volume Groups	Supported	Supported
Use Case	Supports business continuity requirements; meets compliance regulatory requirements	Rapidly duplicates an existing environment Example: To test configuration changes without impacting production environment

Oracle Cloud Infrastructure

Cross Region Replication

— **Block Storage**

Cross Region Replication

Enables you to perform ongoing automatic replication of volumes to other regions

Supports both boot and block volumes

Asynchronous replication

Gives you the current version of the data

Initial synchronization

No down time or impact on source volumes

Cross Region Replication

Cannot resize a volume with cross-region replication enabled

Not supported for volumes encrypted with customer-managed vault encryption keys

To create a new volume from a volume replica, activate the replica.

Cost considerations:

- Replica billed using the Lower Cost option regardless of volume type in source region
- Network costs for replication between regions

Cross Region Replication

Depending on the source region, the target region is provided.

UK West (Newport)

- UK South (London)

US East (Ashburn)

- Brazil East (Sao Paulo)
- Netherlands Northwest (Amsterdam)
- UK South (London)
- US West (Phoenix)

US West (Phoenix)

- US East (Ashburn)
- US West (San Jose)

US West (San Jose)

- US West (Phoenix)

Disaster Recovery
Migration
Business Expansion

Use Cases





Enabling Volume Replication

Make sure that the target region is subscribed

Access the volume details and edit its properties

Enable the replication, select the target region and Availability Domain (if applicable)

Cross Region Replication

Enables asynchronous cross region volume replication. [Learn more](#)

ON OFF

Cross Region Replication

Enables asynchronous cross region volume replication. [Learn more](#)

ON OFF

REGION

US East (Ashburn)

AVAILABILITY DOMAIN

Select an AD
GrCh:US-ASHBURN-AD-1
GrCh:US-ASHBURN-AD-2
GrCh:US-ASHBURN-AD-3

NAME

Block_Volume01

Oracle Cloud Infrastructure

Demo: Cross Region Replication

Oracle Cloud Infrastructure Volume Groups

Block Storage

Volume Groups

- Group together multiple volumes in a group
- Includes both boot and block volumes
- Create Volume Group Backups and Clones
- Add up to 32 volumes up to a maximum size limit of 128 TB
 - Each volume can only be in one volume group.
 - When a volume group is deleted, the individual volumes are not deleted.

Volume Groups

Typical Enterprise Application Storage Architecture



VMs with
Web Tier



VMs with
Application Tier



Bare Metal Compute
with Database Tier



1 TB block
volumes



2 TB block
volumes



32 TB block
volume

Create volume group backups and clones:

- Policy-based backups also available

Coordinated snapshot across all volumes:

- Use case: Enterprise app lifecycle management

Available with no additional charge

Oracle Cloud Infrastructure

Demo: Volume Groups

Oracle Cloud Infrastructure

Demo: Volume Groups Cross Region Replication

Oracle Cloud Infrastructure

Cross Availability Domain Replication

—
Block Storage



Cross Availability Domain Replication



Replicate to another availability domain within the same region.

This functionality supports boot volumes, block volumes, and volume groups.

Cost considerations:

- Replica billed using the Lower Cost option
- Network costs for replication between availability domains within the same region are not billed



Cross Availability Domain Replication



You cannot resize a volume with cross-availability domain replication enabled.

This capability is not supported for volumes encrypted with customer-managed vault encryption keys.

To create a new volume from a volume replica, activate the replica.

There is no down time or impact on source volumes.

Enabling Cross Availability Domain Replication

umentation, and Marketplace

US East (Ashburn) ▾

Create block volume

Cross Region Replication

Enables asynchronous cross region volume replication. [Learn more](#)

ON OFF

REGION i

US East (Ashburn)

AVAILABILITY DOMAIN

dKYS:US-ASHBURN-AD-2

NAME

testvolume

Encryption

Encrypt using Oracle-managed keys

Leaves all encryption-related matters to Oracle.

Encrypt using customer-managed keys

Requires you to have access to a valid Key Management key.

Create Block Volume Cancel

Oracle Cloud Infrastructure

Demo: Cross Availability Domain Replication

Oracle Cloud Infrastructure

Demo: Block Volume Encryption

File Storage - Basics

Oracle Cloud Infrastructure

Overview of File Storage

File Storage

Oracle Cloud Infrastructure Storage Services

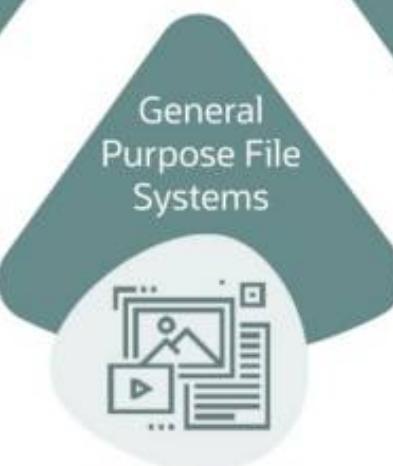
	Local NVMe	Block Volume	File Storage	Object Storage	Archive Storage
Type	NVMe SSD-based temporary storage	NVMe SSD-based block storage	NFSv3 compatible file system	Highly durable Object storage	Long-term archival and backup
Durability	IP addresses, nonpersistent; survives reboots	Durable (multiple copies in an AD)	Durable (multiple copies in an AD)	Highly durable (multiple copies in a region)	Highly durable (multiple copies in a region)
Capacity	Terabytes+	Petabytes+	Fully elastic	Unlimited	Unlimited
Unit Size	51.2 TB for BM, 6.4-25.6 TB for VM	50 GB - 32 TB/vol. 32 vols/instance	Up to 8 exabyte	10 TB/object	10 TB/object
Use Cases	Big Data, OLTP, high performance workloads	Apps that require SAN-like features (Oracle DB, Exchange)	Apps that require shared file system (E-Business Suite, HPC)	Unstructured data incl. logs, images, videos	Long-term archival and backups (Oracle DB backups)

File Storage

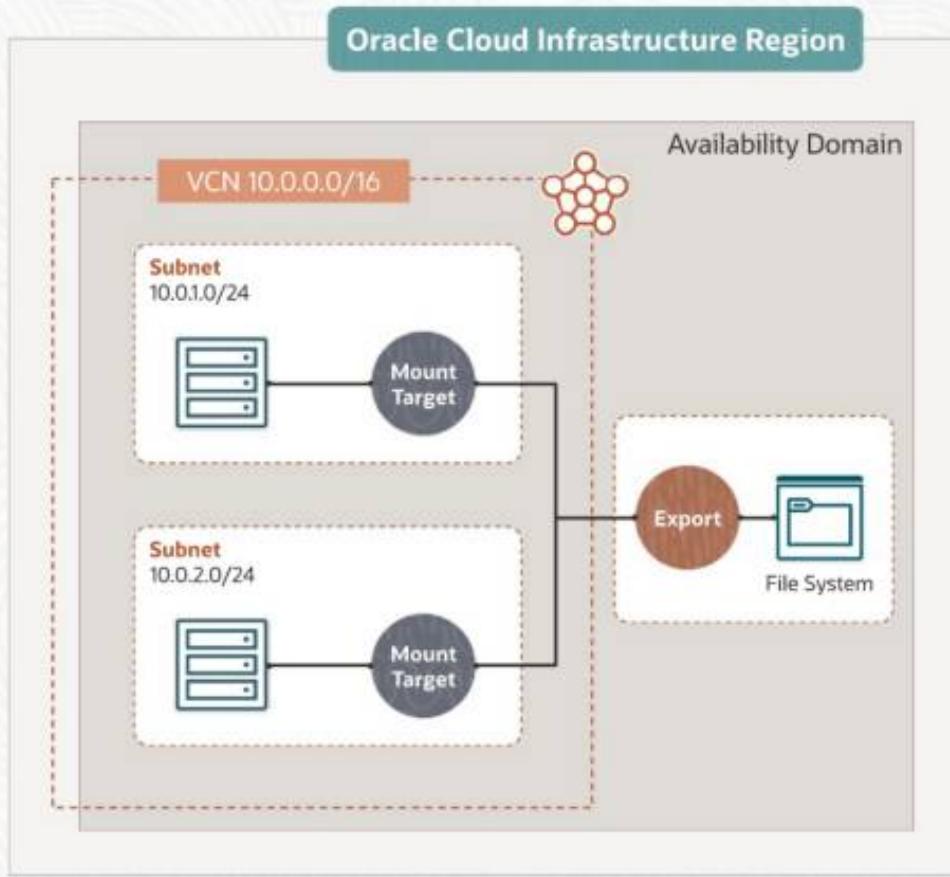


- ▶ Durable, scalable, and secure enterprise-grade network file system
- ▶ Connect to the file system from any bare metal, virtual machine in VCN
- ▶ Access the file system from outside the VCN by using VCN peering, FastConnect, and IPSec VPN
- ▶ Fully managed
- ▶ Does not require upfront provisioning
- ▶ Supports NFSv3 protocol and Network Lock Manager for file locking

File Storage Use Cases



OCI File Storage Service Features



Shared file system storage for compute instances

Supports NFS v.3 distributed file system

Data protection: Snapshots (10,000 snapshots per file system)

Security: Data-at-rest and in-transit encryption for all file systems and metadata

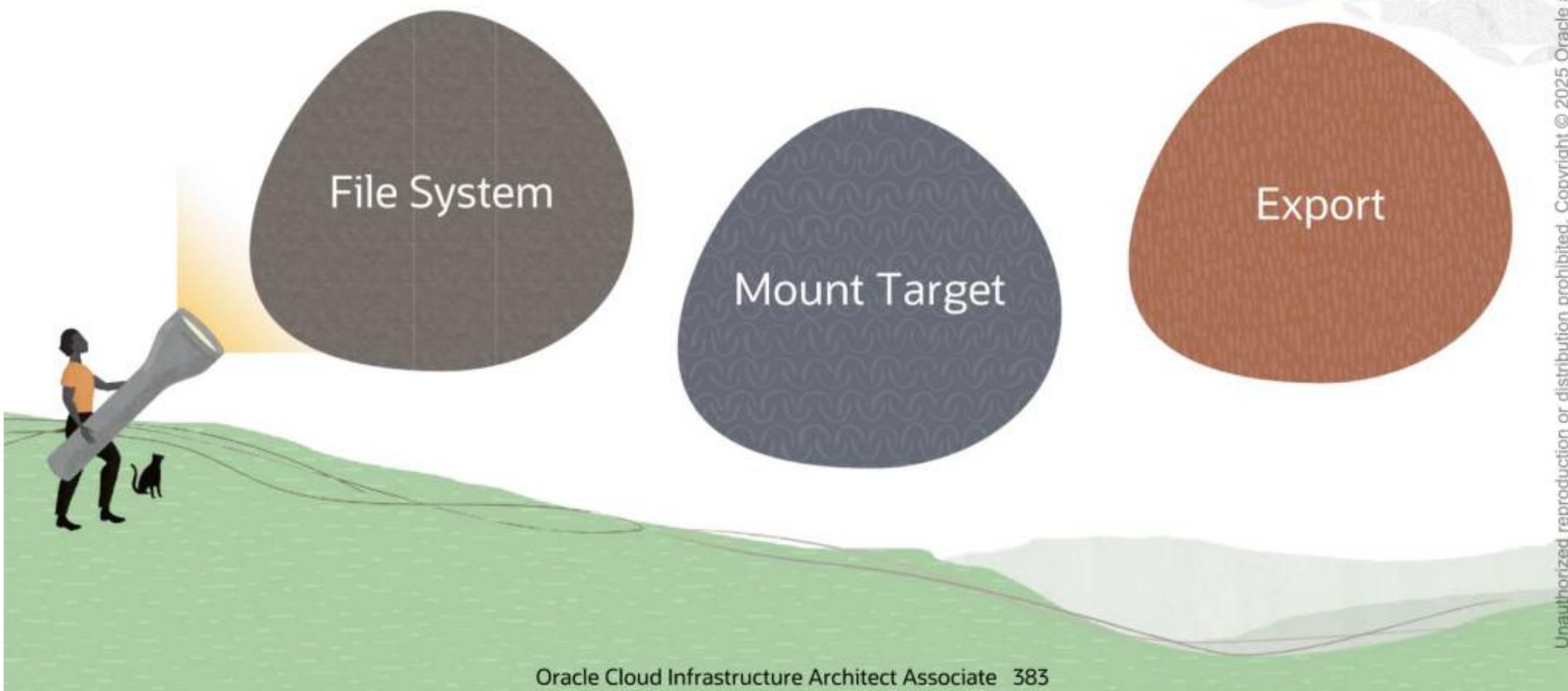


Oracle Cloud Infrastructure

File Storage Concepts

File Storage

File Storage Concepts



File Storage Concepts

NFS endpoint

Lives in a subnet

Provides the IP address/DNS name; used in the mount command

File systems exported through mount targets

Same mount target can be reused for multiple file systems



File Storage Concepts

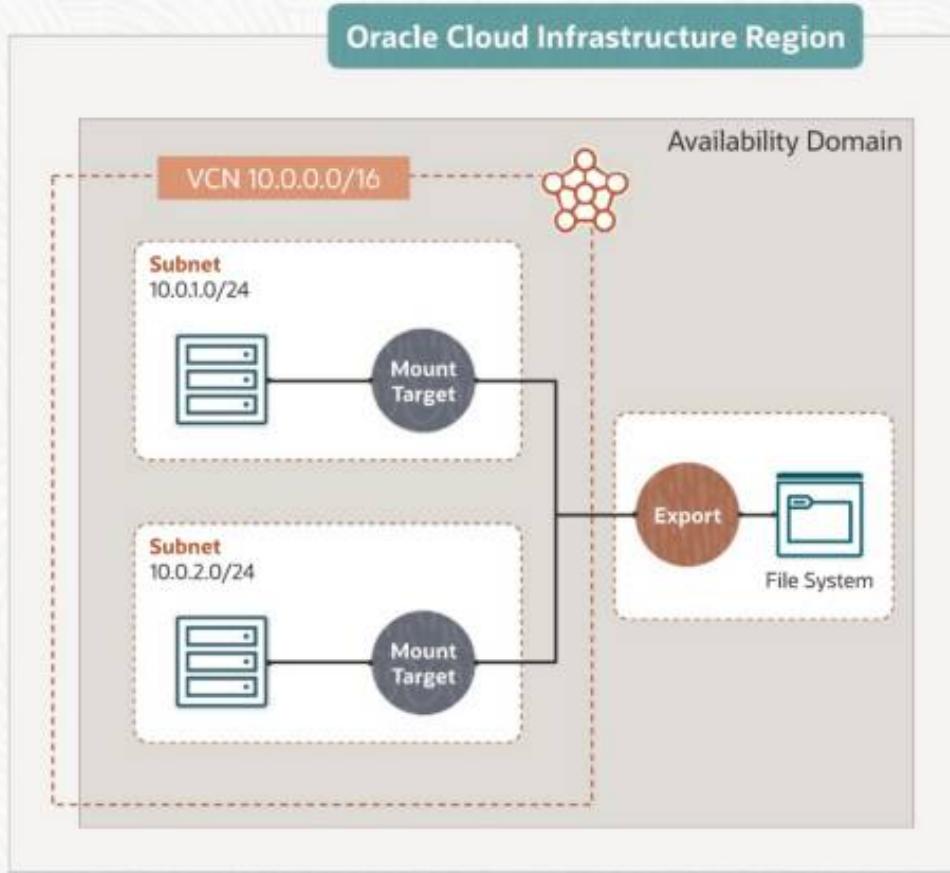
Exports control how NFS clients access file systems when they connect to a mount target.

Export Set: Collection of one or more exports

Export Path: Uniquely identifies the file system within the mount target

Export Options: Set of parameters that specify the level of access granted to NFS clients





File System: Storage where files exist

Export: NFS Control Layer

Mount Target: Endpoint used by clients to connect to the file system

Mounting a File System

- Check SL and NSG for access rules.
- Launch the OCI instance.
- Install nfs-utils or nfs-common.
- Create a directory.
- Check mount targets in the OCI console.
- Copy the mount commands and run on the client.

```
opc@node01:~$ sudo yum install nfs-utils  
opc@node01:~$ sudo mkdir -p /mnt/nfs  
opc@node01:~$ sudo mount 10.0.0.3:/fss-shared /mnt/nfs
```

Oracle Cloud Infrastructure

Demo: Create and Mount a File System

Oracle Cloud Infrastructure

NFS Export Options

File Storage

NFS Export Options

Edit NFS Export Options

Help

NFS export options control how clients can access your file system. [Learn more.](#)

Source	Ports	Access	Squash	Squash UID	Squash GID	⋮
0.0.0.0/0	Any	Read/Write	None	Not used	Not used	+ Another Option

Control client access to the file system

Set of parameters within the export

Specifies the level of access granted to NFS clients when they connect to a mount target

NFS Export Options

Edit NFS Export Options

NFS export options control how clients can access your file system. [Learn more](#).

Source	Ports	Access
10.0.0.0/24	Any	Read/Write

Edit NFS Export Options

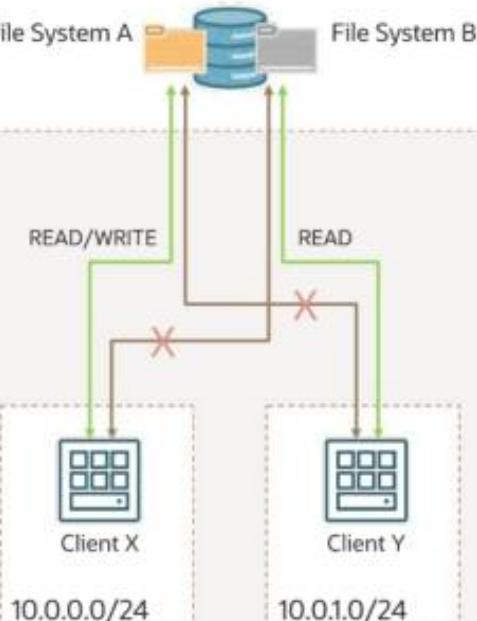
NFS export options control how clients can access your file system. [Learn more](#).

Source	Ports	Access
10.0.1.0/24	Any	Read Only

10.0.2.0/24

Mount Target Subnet

File System A File System B



VCN, 10.0.0.0/16



NFS Export Options

The File Storage service applies the first set of options that matches the client source IP address.

Source	Ports	Access	Squash	Squash UID	Squash GID
10.0.0.0/16	Any	Read Only	None	Not used	Not used
10.0.0.8	Any	Read/Write	None	Not used	Not used



Clients who connect from IP address 10.0.0.8 have read-only access in the file system.

Source:
IP address or
CIDR block of
NFS client

Access:
Read-only or
read/write

Ports:
Privileged or Any

Squash:
All, root, or none

Options to control
export access



Oracle Cloud Infrastructure

Demo: NFS Export Options

Oracle Cloud Infrastructure

File System Paths

File Storage

File Storage Service: Paths



Export Paths

Mount Point
Paths

File System
Paths



Export Paths



Exports

Create Export Delete

<input type="checkbox"/>	Export Path	State	Mount Target	Created
<input type="checkbox"/>	/oci/export	● Active	mttarget	Fri, Apr 22, 2022, 09:20:48 UTC
0 Selected				



Export Paths

Uniquely identify the file system within the mount target

Can associate up to 100 file systems behind a single mount target

Unrelated to any path within the file system or the client instance

Used by the instance to mount the file system

Cannot be edited after export is created

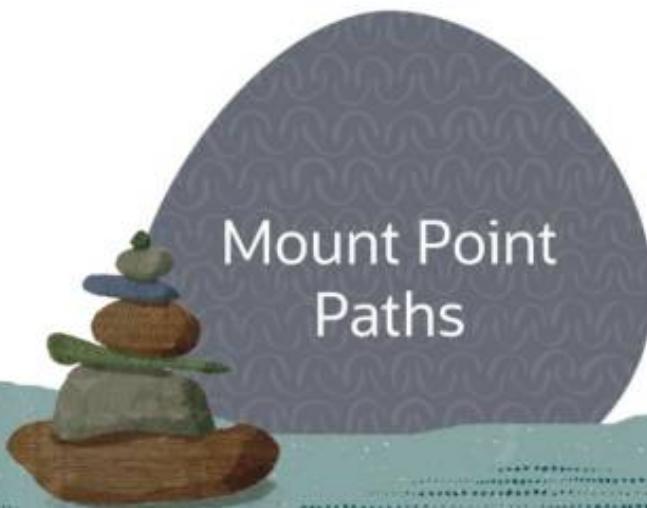
Mount Point Paths



Paths within a client instance to a locally accessible directory on which the file system is mounted

```
sudo mount 10.0.0.6:/FileSystem1 /mnt/mountpointA
```

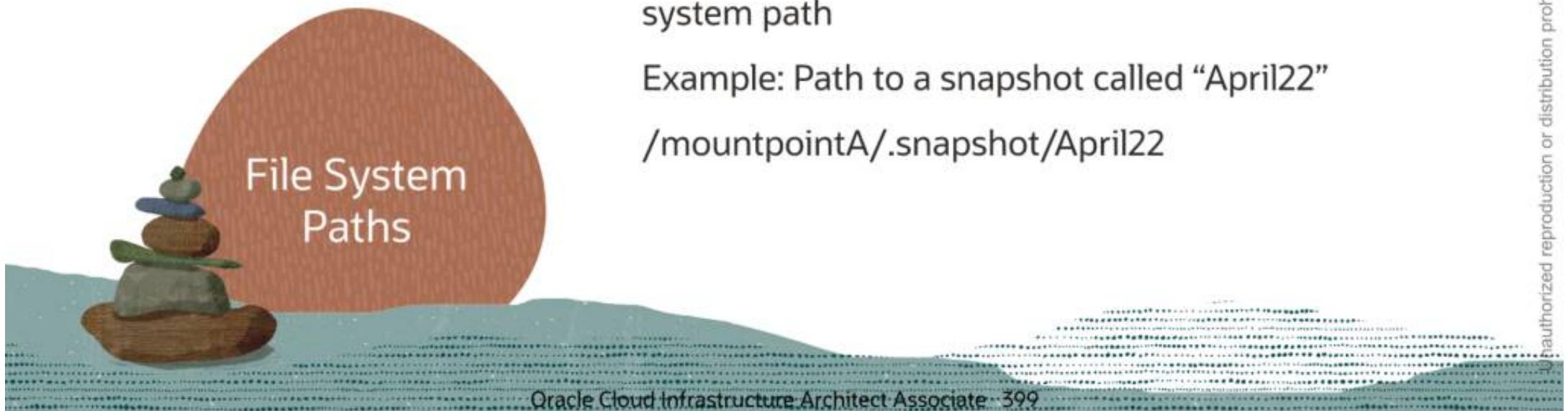
Mount Point Path



File System Paths



Paths to directories within the file system
Contain the contents of the file system
Create the directory structure within the file system path
Example: Path to a snapshot called “April22”
`/mountpointA/.snapshot/April22`



File System Paths

File Storage - Advanced

Oracle Cloud Infrastructure

File System Snapshots

File Storage

File System Snapshots

- Provide data protection of the file system
- Consistent, point-in-time
- Accessible under the root directory of the file system at .snapshot/name
- Consume no additional storage (when it is taken)



Snapshots

<input type="checkbox"/>	Name	State	Created
<input type="checkbox"/>	22AprilSnapshot	● Active	Fri, Apr 22, 2022, 10:47:16 UTC

0 Selected

```
[opc@demoinst ~]$ sudo mkdir -p /mnt/ocifsexport
[opc@demoinst ~]$ sudo mount 10.0.0.55:/ocifsexport /mnt/ocifsexport
[opc@demoinst ~]$ cd /mnt/ocifsexport/.snapshot/
[opc@demoinst .snapshot]$ ls
22AprilSnapshot
[opc@demoinst .snapshot]$
```



Oracle Cloud Infrastructure

Demo: Create a Snapshot and Perform Restoration

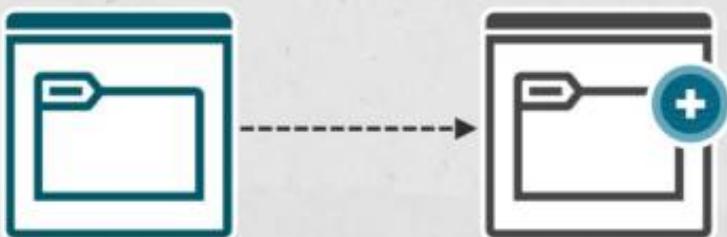
Oracle Cloud Infrastructure

File System Cloning

File Storage

File System Cloning

New file system that is created based on a snapshot of an existing file system



At the point of creation:

Data included in the clone is identical to the data in the snapshot.

After creation:

Data changes in the clone aren't included in the original file system.

Data changes to the original file system aren't included in the clone.

File System Cloning

The screenshot shows the Oracle Cloud Infrastructure (OCI) File Storage interface. On the left, there is a large green circle icon with a white letter 'S' and the word 'ACTIVE' below it. To its right is a card for a snapshot named '22AprilSnapshot'. The 'Clone' button in this card is highlighted with a red box. Below the snapshot card is a table of snapshot information, including OCID, Created date, and Utilization. On the right, there is a card for a file system named 'clonedfilesystem'. The 'Delete' button in this card is highlighted with a red box. The file system card displays various details such as OCID, Created date, Utilization, Availability Domain, Compartment, and Encryption Key. A red box highlights the 'Hydration: In Progress' status in the file system card's details section.

File Storage » File Systems » File System Details » Snapshot Details

22AprilSnapshot

ACTIVE

Clone Add Tags Delete

Snapshot Information Tags

OCID: ...zaaaaa Show Copy
Created: Fri, Apr 22, 2022, 11:21:46 UTC
Utilization: 0 B ⓘ
Availability Domain: dKYS:PHX-AD-1
Compartment: intoraderchil (root)/samvit/Pro-Demo
Encryption Key: Oracle-managed key Edit

clonedfilesystem

Rename Move Resource Add Tags Delete

File System Information Tags

OCID: ...qwljs Show Copy
Created: Fri, Apr 22, 2022, 10:47:16 UTC
Utilization: 0 B ⓘ
Availability Domain: dKYS:PHX-AD-1
Compartment: intoraderchil (root)/samvit/Pro-Demo
Encryption Key: Oracle-managed key Edit

Hydration: In Progress ⓘ
Source Snapshot: [22AprilSnapshot](#) ⓘ
Parent File System: [ociarcassfilesystem](#) ⓘ
Clone Root: False ⓘ
Descendants: False ⓘ

File System Cloning Concepts

Source Snapshot

The snapshot used
to create a clone

Parent File System

The file system that contains
the source snapshot

File System Cloning Concepts

Hydration

Process of copying metadata from the source to the clone. The clone is immediately available on creation and can be used for regular operations while hydration is in progress.

Clone Tree

A group of clones that descend from the same root file system.

Oracle Cloud Infrastructure

Demo: Clone a File System

Oracle Cloud Infrastructure

Demo: Encrypt using Customer Managed Keys

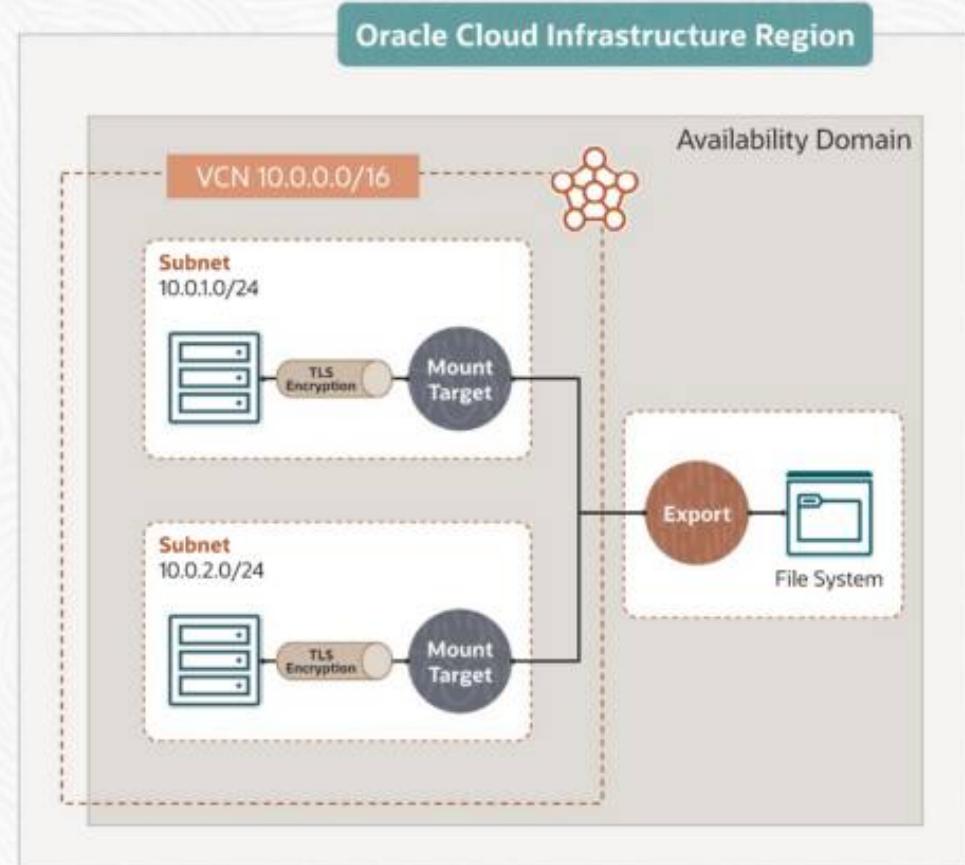
Oracle Cloud Infrastructure

In-Transit Encryption

File Storage

In-Transit Encryption

- Secure data between instances and mounted file systems using TLS v.1.2
- Download and install a package `oci-fss-utils` on the instance.
- Use the in-transit encryption command to mount the file system.



```
$ sudo mount -t oci-fss 10.x.x.x:/fs-export-path /mnt/yourmountpoint
```

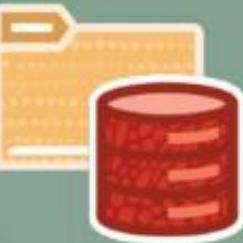
Oracle Cloud Infrastructure

Demo: Set up In-transit encryption

Oracle Cloud Infrastructure

File System Replication

File Storage



File System Replication



Asynchronous replication

Replication of source file system to target file system:

- Within a region
- Across regions

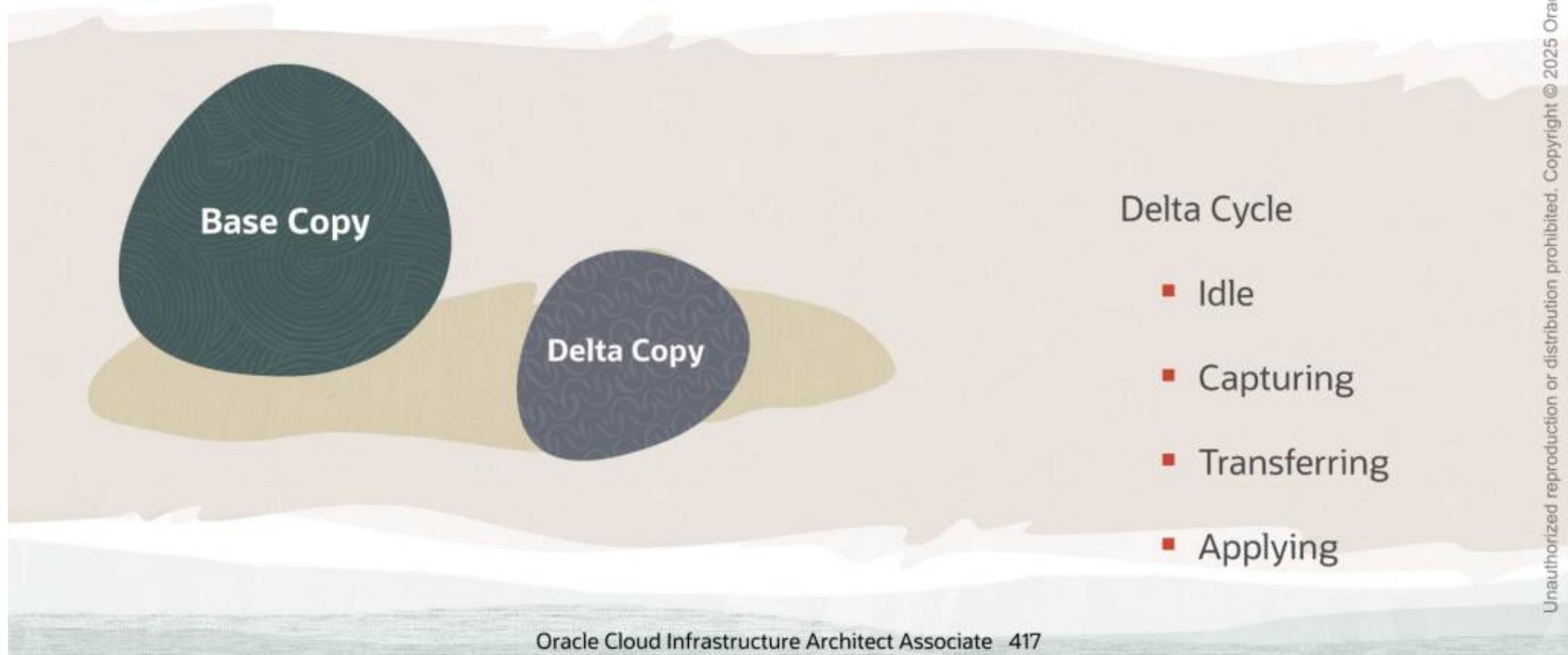
Consistent file system replicas

Replication to multiple target regions

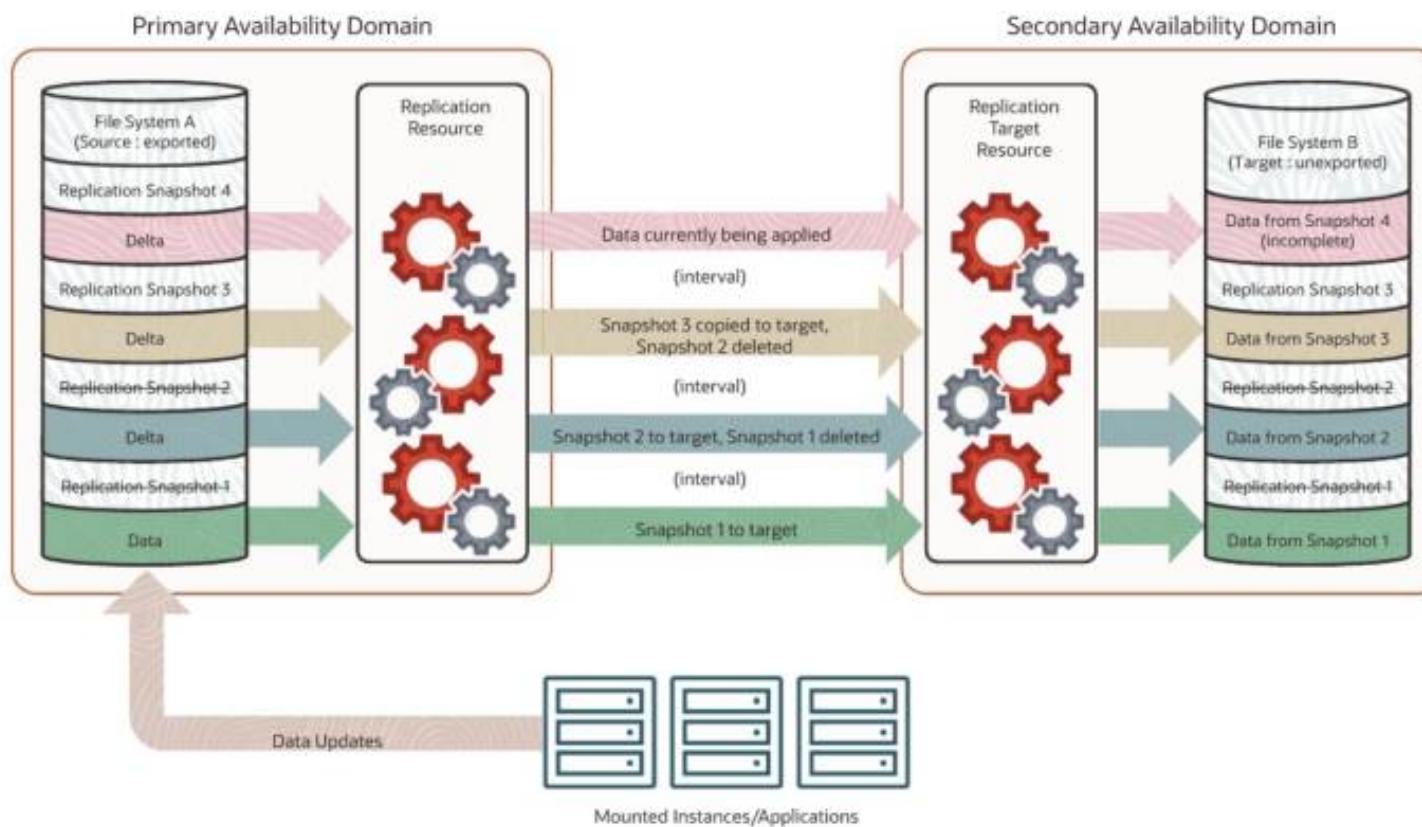
File System Replication Concepts



File System Replication Concepts



Replication Process





File System Replication: Use Cases

- Disaster Recovery
- Data Migration
- Data Redundancy Compliance

Oracle Cloud Infrastructure

Demo: File Storage Replication

Oracle Cloud Infrastructure

File Storage Security

File Storage

Security Layers



Security layer...	Uses these...	To control actions:
IAM Service	Users and policies	Creating instances (NFS clients) and FSS VCNs; creating, listing, and associating file systems and mount targets
Network Security	IP addresses, CIDR blocks, security lists, network security groups	Connecting the NFS client instance to the mount target
NFS Export Options	File system exports, IP addresses, UNIX users	Privileged source port connection, reading and writing files, and limiting root user access on a per-file system basis
UNIX Security	UNIX users, file mode bits	Mounting file systems, reading the writing files

Oracle Cloud Infrastructure

File System Usage and Metering

File Storage

File System Usage and Metering

- Reports metered file system utilization
- Updates hourly
- Can use df and du commands to see usage
- Utilization size reported by du can be much larger than the meteredBytes value
- df reports the same value as meteredBytes

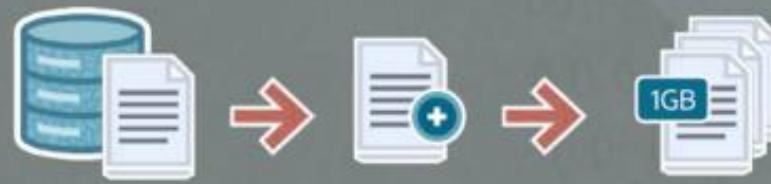
Snapshot Metered Utilization

Initially consume no additional usage

Reference the original data instead of duplicating it

Included in the reporting meteredBytes value of the file system

Example:



Testfilesystem



Add file1



Total size = 1 GB



After hourly update cycle,
total meteredBytes = 1 GB



Create snapshot



After hourly update cycle,
total meteredBytes = 1 GB

Clone Metered Utilization

Clone references the parent file system's data.

Clone is metered for all its metadata and incremental changes made.

Example:



testfilesystem

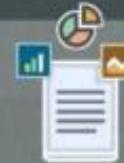


Create a clone "testclone"

Before any data is altered:



testfilesystem
metered for its data



metadata



testclone metered only for its metadata

Clone Metered Utilization

Clone references the parent file system's data.

Clone is metered for all its metadata and incremental changes made.

Example:



testfilesystem

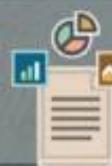


Create a clone "testclone"

After you create a 2GB file in testclone:



testfilesystem is metered for the data it shares with testclone



testclone is metered for its metadata



2 GB
changed data

Expert Tip
